Федеральное агентство по рыболовству
Федеральное государственное бюджетное образовательное учреждение высшего образования
«Астраханский государственный технический университет»

Институт рыбного хозяйства биологии и природопользования

Кафедра «Иностранные языки и РК»

Методические указания
для практических занятий
по дисциплине
по дисциплине «Иностранный язык в профессиональной сфере»

для магистрантов по направлению:
18.04.01 «Химическая технология»
.

направленность подготовки:
Химическая технология топлива и газа

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Методические указания для практических занятий по дисциплине «Иностранный язык в профессиональной сфере» для магистрантов по направлению: 18.04.01 «Химическая технология» / АГТУ; О.В. Федорова. – Астрахань, 2024. – 63 с.

Приведены методические указания для практических занятий по дисциплине «Иностранный язык в профессиональной сфере», которые позволяют студентам самостоятельно выполнять задания с использованием билингвальных словарей и специальной справочной литературы по грамматике. Для выполнения заданий достаточно изучить и понять основные теоретические сведения, содержащиеся в учебной литературе, прилагаемой в списке учебно-методического и информационного обеспечения дисциплины.

Цель методических указаний: оказание помощи обучающимся в выполнении практической работы по дисциплине «Иностранный язык в профессиональной сфере».

Методические указания содержат задания, позволяющие обучающимся овладеть специальной лексикой, а также развить умения и навыки говорения, чтения, письма и перевода англоязычного материала в области ветеринарно-санитарной экспертизы. Задания, приведенные в данных методических указаниях, нацелены на формирование следующей компетенции:

УК-4 – способен применять современные коммуникативные технологии, в том числе на иностранном(ых) языке(ах), для академического и профессионального взаимодействия.

Описание практической работы содержит: тему, задания, требования к выполнению конкретного задания по данной теме, порядок выполнения задания, формы контроля, требования к оформлению заданий. Для получения дополнительной, более подробной информации по изучаемым вопросам приведены рекомендуемые источники.

Методические указания для практических занятий предназначены для магистров, обучающихся по направлению 18.04.01 «Химическая технология». Они полностью соответствуют требованиям ФГОС по дисциплине «Иностранный язык в профессиональной сфере».

Методические указания для практических занятий по дисциплине «Иностранный язык в профессиональной сфере» утверждены на заседании кафедры «Иностранные языки и речевая коммуникация» от 01 июля 2024 г., Протокол № 9.

Содержание

Введение

Методические рекомендации по выполнению практической работы по дисциплине «Иностранный язык в профессиональной сфере» предназначены для обучающихся по направлению 18.04.01 «Химическая технология», направленность подготовки: Химическая технология топлива и газа

Цель методических указаний: оказание помощи обучающимся в выполнении практической работы по дисциплине «Иностранный язык в профессиональной сфере».

Настоящие методические указания содержат работы, которые позволят обучающимся овладеть фундаментальными знаниями, профессиональными умениями и навыками деятельности направлены на формирование следующих компетенций:

УК-4– способен применять современные коммуникативные технологии, в том числе на иностранном(ых) языке(ах), для академического и профессионального взаимодействия.

В результате выполнения практических работ по дисциплине «Иностранный язык в профессиональной деятельности» обучающиеся должны:

- знать основные лексические единицы, грамматические явления, речевые клише и речевой этикет, используемые в типичных специальных и общекультурных ситуациях устного и письменного иноязычного общения в сферах деятельности, предусмотренных направлением подготовки обучающихся;

- уметь воспринимать устные и письменные иноязычные сообщения и понимать содержащуюся в них информацию, связанную с решением задач профессионального и повседневного характера; грамотно строить устные и письменные мотивированные сообщения на иностранном языке с целью передачи информации профессионального и повседневного содержания и реализации коммуникативных задач;

- владеть иностранным языком на уровне, достаточном для осуществления профессионального и межличностного общения в типичных ситуациях сферы деятельности, предусмотренных направлением подготовки обучающегося.

Описание практической работы содержит: тему, задания, требования к выполнению конкретного задания по данной теме, порядок выполнения задания, формы контроля, требования к оформлению заданий. Для получения дополнительной, более подробной информации по изучаемым вопросам приведены рекомендуемые источники.

1.Перечень видов практической работы по дисциплине

Раздел / Тема	Вид практической работы	Форма контроля	Требования к выполнению заданий
Раздел 1: *Нефтегазовая отрасль.* Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Технологические процессы в химической промышленности: инструменты и оборудование* **Тема:** Реферирование статей, составление аннотаций	Чтение и перевод текстов по темам; выполнение заданий по текстам; выполнение заданий по тестированию	Тест (УК-4.1) Опрос (УК-4.2) Письменное задание (УК-4.3)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом
Раздел 2: *Материалы, используемые в химической промышленности.* Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Основные продукты, получаемые в результате перегонки нефти.* **Тема:** *Взаимодействия в электролитных растворах. Ионные теории* **Тема:** Реферирование статей, составление аннотаций	Чтение и перевод текстов по темам; выполнение заданий по текстам; выполнение заданий по тестированию	Тест (УК-4.1) Опрос (УК-4.2) Письменное задание (УК-4.3)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом
Раздел 3: *Функции и применение химических объектов*. Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Происхождение и накопление углеводородов.* **Тема:** *Инновации в химической промышленности* **Тема:** Реферирование статей, составление аннотаций	Чтение и перевод текстов по темам; выполнение заданий по текстам; выполнение заданий по тестированию	Тест (УК-4.1) Опрос (УК-4.2) Письменное задание (УК-4.3)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом
Раздел 4: *Утилизация. Безопасность при работе в области химической промышленности. Оборудование по*	Чтение и перевод текстов по темам;	Тест (УК-4.1) Опрос (УК-4.2)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы

безопасности. Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Экологическая безопасность.* **Тема:***Промышленная и экономическая безопасность.* **Тема:** *Использование отработанных материалов* **Тема:** Реферирование статей, составление аннотаций	выполнение заданий по текстам; выполнение заданий по тестированию	Письменное задание (УК-4.3)	на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом
Раздел 5: *Переработка. Нефтеперерабатывающие предприятия.* Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Состав сырой нефти. Процесс переработки и перегонки бензина.* **Тема:** *Молекулы в газах и жидкостях. Молекулы в твердых веществах.* **Тема:** *Равновесие жидкость – пар. Зависимость температуры от равновесия пара.*	Чтение и перевод текстов по темам; выполнение заданий по текстам; выполнение заданий по тестированию	Тест (УК-4.1) Опрос (УК-4.2) Письменное задание (УК-4.3)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом
Раздел 6: *Система международного аудита нефти и газа.* Развитие навыков аналитического чтения и перевода английских текстов по темам: **Тема:** *Наиболее крупные категории запасов нефти и газа в соответствии с классификацией SPE.* **Тема:** *Взаимодействия в электролитных растворах.*	Чтение и перевод текстов по темам; выполнение заданий по текстам; выполнение заданий по тестированию	Тест (УК-4.1) Опрос (УК-4.2) Письменное задание (УК-4.3)	Привитие обучающимся навыков индивидуальной и коллективной работы с литературой с тем, чтобы на основе их анализа и обобщения они могли делать собственные выводы теоретического и практического характера, обосновывая их соответствующим образом

2. Тематика и задания для практической работы

Рекомендуемые источники (см. Список рекомендуемой литературы 1-9)

2.1 Чтение и перевод текстов. Выполнение упражнение по тесту. Устный опрос.

2.1.1 Чтение и перевод текстов.

Во время практических занятий важно умение работать с учебной и научной литературой. Необходимо научиться правильно ее читать, понимать и вести записи. Важно помнить, что рациональные навыки работы с книгой позволяют экономить время и повышают продуктивность.

Грамотная работа с книгой, журналом, пособием и т.п., особенно если речь идет об учебной и научной литературе, предполагает соблюдение ряда правил. Вначале следует ознакомиться с темой текста, т.е. прочитать заглавие. Это дает общую ориентировку, представление о структуре и вопросах, которые рассматриваются в тексте. Следующий этап - чтение. Первый раз целесообразно прочитать текст от начала до конца, чтобы получить цельное представление об изложенной информации. При повторном чтении происходит постепенное глубокое осмысление материала; выделение ключевых слов, основных идей, системы аргументов, наиболее ярких примеров и т.д. Непременным правилом чтения должно быть выяснение незнакомых слов, терминов, выражений, неизвестных имен, названий. С этой целью необходимо умение пользоваться словарем и другими справочными изданиями, а также ресурсами сети Интернет. Можно завести специальные тетради или блокноты. Чтения тестов и выполнение упражнений по текстам позволяют отработать навыки и умения вести поиск необходимой информации, обрабатывать и систематизировать ее.

Выделяют *четыре основные установки в чтении учебно-научного текста:*

- информационно-поисковая (задача - найти, выделить искомую информацию);
- усваивающая (усилия читателя направлены на то, чтобы как можно полнее осознать и запомнить как сами сведения, излагаемые автором, так и всю логику его рассуждений);
- аналитико-критическая (читатель стремится критически осмыслить материал, проанализировав его, определив свое отношение к нему);
- творческая (создает у читателя готовность в том или ином виде - как отправной пункт для своих рассуждений, как образ для действия по аналогии и т.п.; использовать суждения автора, ход его мыслей, результат наблюдения, разработанную методику, дополнить их, подвергнуть новой проверке).

Научная методика работы с литературой предусматривает также ведение записи прочитанного. Это позволяет привести в систему знания, полученные при чтении, сосредоточить внимание на главных положениях, зафиксировать, закрепить их в памяти, а при необходимости вновь обратиться к ним.

2.1.2 Выполнение упражнение по тесту.

На выполнения упражнений отводится определенное время. Время выполнения задания зависит от уровня его сложности и уровня подготовленности студента. Задание считается успешно выполненным в том случае, если оно выполнено полностью в отведенное для него время, а также в нем нет существенных грамматических и лексических ошибок.

Порядок выполнения задания:

Упражнения составлены с учетом материала практических занятий по каждой теме дисциплины (модуля). Для подготовки к выполнению упражнений необходимо изучить материал по каждой теме дисциплины, необходимо понять логику изложенного материала.

В процессе выполнения упражнений необходимо выполнить следующее:

• Прежде всего, следует внимательно изучить тип и структуру упражнения, оценить объем времени, выделяемого на его выполнение. Это поможет настроиться на работу.

• Лучше начинать выполнять те пункты, в правильности решения которых нет сомнений, пока не останавливаясь на тех, которые могут вызвать долгие раздумья. Это позволит успокоиться и сосредоточиться на выполнении более трудных вопросов.

• Очень важно всегда внимательно читать задания до конца, не пытаясь понять условия «,по первым словам,» или выполнив подобные задания в предыдущих тестированиях. Такая спешка нередко приводит к досадным ошибкам в самых легких вопросах.

• Если вы не знаете ответа на вопрос или не уверены в правильности, следует пропустить его и отметить, чтобы потом к нему вернуться.

• Психологи также советуют думать только о текущем задании. Как правило, задания в упражнениях не связаны друг с другом непосредственно, поэтому необходимо концентрироваться на данном вопросе и находить решения, подходящие именно к нему. Кроме того, выполнение этой рекомендации даст еще один психологический эффект – позволит забыть о неудаче в ответе на предыдущий вопрос, если таковая имела место.

• Многие задания можно быстрее решить, если не искать сразу правильный вариант ответа, а последовательно исключать те, которые явно не подходят. Метод исключения позволяет в итоге сконцентрировать внимание на одном-двух вероятных вариантах.

• Рассчитывать выполнение заданий нужно всегда так, чтобы осталось время на проверку и доработку (примерно 1/3-1/4 запланированного времени). Тогда вероятность описок сводится к нулю и имеется время, чтобы набрать максимум баллов на легких заданиях и сосредоточиться на решении более трудных, которые вначале пришлось пропустить.

• Процесс угадывания правильных ответов желательно свести к минимуму, так как это чревато тем, что обучающийся забудет о главном: умении использовать имеющиеся накопленные в учебном процессе знания, и будет надеяться на удачу. Если уверенности в правильности ответа нет, но интуитивно появляется предпочтение, то психологи рекомендуют доверять интуиции, которая считается проявлением глубинных знаний и опыта, находящихся на уровне подсознания.

2.1.3 Устный опрос. Информационное сообщение.

Опрос – Типовые контрольные задания, вопросы для обсуждения, описание показателей и критериев, шкал, методические материалы, определяющие процедуры оценивания уровней сформированности результатов обучения. Фронтальная форма контроля, представляющая собой ответы на вопросы преподавателя в устной форме по заданным темам, разделам.

Эффективными являются те формы опроса, которые делают неформальным контроль знаний, умений и навыков, органически вплетаются в содержание конкретного занятия и вытекают из его задач.

Контроль на занятиях может быть индивидуальным или коллективным.

Индивидуальный опрос – это наиболее эффективная форма проверки знаний. Он может быть устным или письменным.

Устный опрос необходим для проверки усвоения теоретического материала, умения раскрывать внутреннюю сущность явлений.

Индивидуальный опрос позволяет получить более полные и точные данные об уровне усвоения, однако он имеет существенный недостаток: при индивидуальном опросе очень малый охват обучаемых; при индивидуальном опросе отвечает лишь один студент, а остальные обучаемые остаются пассивными. Поэтому преподавателю следует, спрашивая одного, давать установку остальным таким образом, чтобы этот процесс был обучающим, то есть обеспечивал мобилизацию и активность внимания всех студентов. Студенты могут предложить свой план ответа или исправить те ошибки, которые были допущены при ответе их однокурсником, а также подготовить вопросы по содержанию ответа. Нужно рекомендовать студентам записывать свои замечания по ходу ответа. В этом случае можно будет оценить не только того, кто отвечал, но и того, кто принимал участие в обсуждении ответа.

Фронтальный опрос имеет определенные достоинства и недостатки. К его положительным качествам можно отнести возможность охвата проверкой одновременно всех студентов группы, возможность оценивать (поставить отметки) за один и тот же отрезок времени всех или большинство обучающихся. При фронтальном контроле все студенты находятся в напряжении, так как знают, что их в любую минуту могут вызвать, поэтому их внимание сосредоточено, а мысли сконцентрированы вокруг той работы, которая ведется в группе.

Обычно фронтальный опрос проводится как устное вопросно-ответное упражнение, в котором вопросы студентам задает преподаватель. Однако не стоит забывать, что при фронтальном опросе, необходимо сначала задать вопрос, а затем уже назвать фамилию или имя студента, которого необходимо вызвать, а не наоборот. Это гарантирует включение в работу внимания и мышления всех студентов, которые во время постановки вопроса уже готовятся к ответу. Темп опроса должен быть достаточно высоким, что активизирует умственную деятельность, внимание, сосредоточенность, вырабатывает быструю речевую реакцию на иностранном языке, а это, в свою очередь, повышает обучающий эффект процесса контроля.

Также при фронтальном опросе хорошо использовать различные лексические, грамматические, орфографические игры, соревнования и так далее.

Однако фронтальный опрос дает поверхностное представление о знаниях студентов. Фронтальный опрос считается относительно неглубоким в силу определенной рассредоточенности внимания преподавателя на многочисленные объекты.

Недостатки можно нейтрализовать комбинированным опросом.

Комбинированный опрос – это опрос, сочетающий в себе индивидуальный и фронтальный формы опроса. Не более трети занятия будет уделяться проверке умений монологической устной речи, т. е. индивидуальному контролю, а остальная часть - будет посвящена фронтальной работе. При использовании этой формы опроса, вопрос или задание адресуется не только одному студенту, которого планируется спросить индивидуально, но и всем обучающимся группы.

Информационное сообщение - это вид работы по подготовке небольшого по объему устного сообщения для озвучивания изученного материала в процессе чтения текста и выполнения упражнений по тексту. Сообщаемая информация носит характер обобщения, отражает изученные данные.

Сообщение отличается объемом и характером информации. Возможно письменное оформление задания. Регламент времени на озвучивание сообщения - до 5 мин.

При подготовке информационного сообщения необходимо:

- изучить материал по теме;
- составить план или графическую структуру сообщения;

• выделить основные понятия и идеи;

• разбить материал на введение, параграф, передающие основные мысли и заключение или выводы;

• оформить текст письменно (если требуется);

• сдать на контроль преподавателю и озвучить в установленный срок.

Требования к выполнению вышеописанных заданий:

При подготовке к устному опросу необходимо повторить лексический и грамматический материал соответствующих разделов учебника и учебных пособий по данной теме.

Порядок выполнения задания:

№ Задание	Содержание	Уровень сложности	Время на подготовку	Время ответа
1	Прочитать вслух отрывок из информационного или научно-популярного стилистически нейтрального текста.	Базовый	1,5 мин.	1,5 мин.
2	Выполнить перевод отрывка.	Базовый	15 мин.	1,5 мин.
3	Задать 5 вопросов на определенную тему. Студенту предлагается визуальный стимул и ключевые слова (о чем надо спросить).	Базовый	1,5 мин.	1,5 мин.
4	Ответить на несколько вопросов преподавателя по предложенной теме.	Средний	1,5 мин.	1,5 мин
5	Сравнить 2 предложенные темы	Высокий	1,5 мин	2 мин.

Форма контроля

Чтение и перевод отрывка из информационного или научно-популярного стилистически нейтрального текста:

•внимательно прочитать текст задания про себя;

•выделить синтагмы в длинных предложениях, трудные для произношения слова;

•разметить интонацию различных типов коммуникативных предложений;

•прочитать текст шепотом, а потом вслух, обращая внимание на слитность и беглость речи;

- выполнить перевод отрывка текста, пользуясь словарем и обращая внимание на грамматические и лексические сложности.

Условный диалог - расспрос:

•внимательно читать текст задания, обращая особое внимание на условия предлагаемой ситуации общения и ограничители (пункты плана) и объем диалога (время);

•задавать требуемые по содержанию вопросы, т.е. опираться на ключевые слова, данные в задании; задавать прямые вопросы, как требуется в задании; использовать лексику и грамматику, соответствующие коммуникативной задаче и сложности задания; использовать интонацию, соответствующую выбранному типу вопроса.

Условный диалог-ответ:

•внимательно выслушать вопрос, обращая особое внимание на ключевые слова;

•ответить на поставленные вопросы, излагая требуемую по содержанию информацию, т.е. опираясь на ключевые слова, данные в вопросе, представить ответ; использовать лексику и грамматику, соответствующие коммуникативной задаче и сложности задания; использовать соответствующую интонацию.

Тематическое монологическое высказывание

Внимательно прочитать текст задания, обращая особое внимание на выделяемые элементы содержания и ограничители (пункты плана) и объем монолога (время, кол-во фраз в ответе); раскрывать содержание всех пунктов; строить высказывание в соответствии с данным планом; при планировании монологического высказывания сначала продумать ключевые фразы каждого пункта; начинать следует с общего представления темы;

Перечень тем для подготовки к устному опросу:

№ п/п	Темы для подготовки к устному опросу (разделам)
1	**Подготовка, транспортировка и хранение нефти (**Объекты, через которые проходит нефть по пути от скважины до нефтеперерабатывающего завода; виды транспорта для перевозки нефти и нефтепродуктов)
2	**Трубопроводная арматура (**классификация трубопроводной арматуры по функциональному назначению; основные части трубопроводной арматуры)
3	**Переработка нефти (**основной принцип перегонки нефти; основные продукты, получаемые в результате перегонки нефти; методы переработки нефти)
4	**Обеспечение безопасности производства (**экологическая безопасность; промышленная и экономическая безопасность; охрана труда)
5	**Международный аудит запасов нефти и газа. Анализ риска геологоразведочных работ. Оценка рыночной стоимости нефтегазовых объектов (**Основные элементы аудита запасов нефти и газа, основные международные классификации запасов нефти и газа; основные методы определения запасов нефти и газа)
6	**Оборудование устья и конструкция скважины (**понятия «скважина» и «ствол скважины»; устье скважины; внешние и внутренние компоненты устьевого оборудования)

Перечень текстов и упражнений:

FORMATION OF OIL

A) Crude oil is a complex mixture of hydrocarbons with minor proportions of other chemicals such as compounds of sulphur, nitrogen and oxygen. To use the different parts of the mixture they must be separated from each other. This separation is called refining.

B) Crude oils from different parts of the world, or even from different depths in the same oilfield, contain different mixtures of hydrocarbons and other compounds. This is why they vary

from light colored volatile liquids to thick, dark oils - so viscous that they are difficult to pump from the ground.

C) Hydrocarbons vary in structure depending on the number of carbon atoms and the way in which the hydrogen atoms combine with them. Hydrocarbons can be arranged as straight chains, branched chains or closed rings. There are two main chemical families of hydrocarbons - the alkanes and the alkenes.

D) As the structure of hydrocarbons varies so much, thousands of synthetic products can be manufactured with many different properties. Hydrocarbons with small molecules make good fuels. Methane (CH4) has the smallest molecules, and is a gas, used for cooking and heating and generating electricity. Gasoline, diesel, aviation fuel and fuel oil are all liquid fuels.

E) Hydrocarbon molecules can be split up into smaller ones, or built up into bigger ones, or altered in shape, or modified by adding other atoms. This is why they are a very useful starting point (called a chemical feedstock) for making other materials. Even the thick black tarry residue left after distillation is useful. It is called bitumen, and is used in tarmac for road surfacing, and for roofing.

F) Oil is formed from the remains of tiny plants and animals (plankton) that died in ancient seas between 10 and 600 million years ago. After the organism died, they sank into the sand and mud at the bottom of the sea. Over the years, the organisms decayed in the sedimentary layers. In these layers there was little or no oxygen present. So microorganisms broke the remains into carbon-rich compounds that formed organic layers. The organic material mixed with the sediments, forming fine-grained shale, or source rock. As new sedimentary layers were deposited, they exerted intense pressure and heat on the source rock. The heat and pressure distilled the organic material into crude oil and natural gas. The oil flowed from the source rock and accumulated in thicker, more porous limestone or sandstone, called reservoir rock. Movements in the Earth trapped the oil and natural gas in the reservoir rocks between layers of impermeable rock, or cap rock, such as granite or marble.

EXERCISE 2 Give the English equivalents to the following word combinations.

Температура и давление, из пласта, остатки крошечных растений и животных, незначительное количество, сложное химическое соединение, компоненты смеси, различаются от … до, осадок, содержат смеси, могут располагаться, на более мелкие, азот, для производства других материалов, за многие годы, мелкозернистый сланец, пористый известняк, органика, непроницаемая порода, способ соединения атомов.

EXERCISE 3 Give the Russian equivalents to the following word combinations.

many different properties, tarry residue left after, different depths in the same oilfield, exerted intense pressure and heat, complex mixture of hydrocarbons, from light coloured to thick, be altered in shape, trap between, depending on the number, organic material mixed with, distilled into.

EXERCISE 4 Complete the following sentences, using the information from the text.

1. Two main chemical families of hydrocarbons…….
2. Hydrocarbon structure depends on……..
3. Different parts of the mixture can be used only after…….
4. Thick black tarry residue left after distillation is……
5. Different depths in one and the same oilfield contain……..
6. Hydrocarbons are difficult to pump from the ground because of…….
7. Crude oil is a mixture ……..
8. The smaller the hydrocarbon molecules, the better the…….
9. Hydrocarbon molecules are chemical feedstock for……
10. Bitumen is used in……

EXERCISE 5 Read and translate the text "How Oil Becomes Oil", using the words after the text.

How Oil Becomes Oil

Petroleum (literally rock oil, from the Greek *petra-* for rock and Latin *-oleum* for oil) is a general term used to refer to all forms of oil and natural gas that is mined from the earth. What most people concern them with is crude oil, the liquid mixture of naturally occurring hydrocarbons, and natural gas, which is a gaseous mixture of naturally occurring hydrocarbons. Hydrocarbons are complex molecules that are formed from long strings of hydrogen and carbon, such as propane (C3H8) or butane (C4H10).

Petroleum is the final product that we get out of the ground. But how does it get there? Petroleum begins as living animals, microscopic organisms (like diatoms or plankton) that live in the oceans. When these organisms die, their bodies sink and collect on the ocean floor. These organisms live all over the oceans and their bodies fall and collect on the ocean bottoms all over the world. When the organic matter becomes buried and begin to decompose, they are referred to as kerogen. Despite the apparent abundance of dead organisms raining down on the ocean bottoms, there are specific conditions that must be met for these organisms to be transformed into petroleum.

First, the area that the kerogen collects must be a restricted basin, a depression where sediment can accumulate and where there is poor water circulation. When the oxygen is gone, the decomposition stops and the remaining matter are preserved. The kerogen must be buried under sediment where it will be altered through high temperatures and high pressures. As the heat and pressure breaks down the kerogen, the hydrocarbon chains are freed. Long chains of hydrocarbon are oil; shorter chains are gas, generally methane (CH4) and condensates such as ethane, propane and butane. As the heat and pressure continues, the longer chains will continue to break into shorter chains. If the process continues long enough, all that will remain will be methane.

Compaction of the sediment, and the expansion of the kerogen as it is transformed into petroleum cause it to be forced out of the rock it was created in (the source rock) and into nearby sediments. If these sediments are porous enough (have microscopic holes) and permeable enough (allowing for the flow of liquids), then the petroleum will migrate through the rock. Since gas and oil are lighter than water, they can travel through water-saturated rock. Eventually the oil will stop migrating as it meets rock that is not porous or permeable, and will collect in a trap. It is these petroleum traps that geologists search for and that the oil companies drill into to recover the oil.

Despite the simplicity, there are several conditions that must occur, otherwise, no oil will be made.

First, there needs to be a source rock that contains the organic matter to be converted into petroleum. This source rock is generally shale or other mudstones. There must be a reservoir rock, usually sandstone or limestone that is porous and permeable where the oil can be stored and transported. There needs to be a trap, something that is non-porous and non-permeable that will hold the petroleum in the reservoir and prevent it from migrating further. Finally, there needs to be enough heat and pressure to sufficiently cook the oil and gas out of the kerogen. If anyone of these conditions is not met, then petroleum cannot be formed.

The important step in the process is the trap. Something needs to block or trap the petroleum so it will accumulate into a large enough deposit for geologists to be able to locate it. Petroleum traps come in several varieties, in various sizes and can be made through structural processes (like folds and faults), or by sedimentary processes.

Structural traps work by folding or breaking the reservoir rock and placing it adjacent to an impermeable rock layer, like shale. There are three types of structural traps. One of the most common is a trap from the folding of the rocks. Anticlines bend the reservoir rock and create a pocket at the apex of the fold where the petroleum cannot migrate. Normal and thrust faults can

result in petroleum traps by breaking the reservoir rock and moving it so that it is against an impermeable rock layer.

The other way to trap petroleum is through stratigraphic traps. The diagram shows five different types of stratigraphic traps. The differences between these and structural traps is that these traps occur by the nature of how the sediment was deposited and not whether it was broken or folded. The first two, sandstone lenses and sandstone pinch-outs, are the result of the changes in deposition of the sediment. Thick layers of mud are covered by thinner layers of sand from migrating shoreline, or by the sand deposited by large rivers. As sea level changes or rivers migrate, the different sand and mud layers are interwoven creating lenses or pinch-outs. These sand layers allow the petroleum to accumulate and the mudrock layers trap the petroleum.

Unconformities can create traps by burying truncated sandstone or limestone layers with layers of mudstone.

Finally, salt domes can push up through buried sediment and deform the overlying layers of rock. This causes folds and fractures to form in the rock, trapping the oil salt domes are the primary places where the oil is found.

The words to be memorized:

abundance – распространённость
to adjacent – смежный, прилегающий
apex – вершина
to cook – подвергаться тепловой обработке
compaction – уплотнение
decompose – decomposition – разлагаться - разложение
depression – впадина
expansion – распространение (на большую площадь)
fold – складка
fracture – разлом, трещина
to interweave – перемешивать, вкраплять
kerogen – кероген
lens – чечевицеобразная залежь, линза
to migrate – мигрировать, перемещаться
mudstone – аргиллит
pocket – карман
to pinch out – выклиниваться
to preserve – сохранять
restricted basin – ограниченный бассейн
recover oil – добывать нефть
truncated – срезанный, эродированный
thrust fault – сброс
unconformity – несогласованное напластование

EXERCISE 6 Give the Russian equivalents to the following words.

Accumulate, fracture, specific conditions, salt dome, unconformity, gasoline, sediment, opening up, decompose, organic matter, thrust faults, hydrocarbons trap, kerogen.

EXERCISE 7 Are the following statements true (T) or false (F)? Correct the false ones with the right information and discuss your answers with a partner.

1. Structural traps are of two types._____
2. It takes thousands of years for the petroleum to be made._____
3. Structural geology is the subject for the students to miss._____
4. Shorter hydrocarbon chains are oil._____
5. Decomposition does not stop when the oxygen is gone._____
6. The oil continues migrating in porous and permeable rocks._____

7. There are some specific conditions for the organisms to be met._____
8. Stratigraphic traps are the ones that occur by nature._____
9. A restricted basin is not the place for the kerogen to collect. _____
10. The traps are important steps in the process of oil accumulation._____

EXERCISE 8 Look through the text "How Oil Becomes Oil» again and put the facts from the text into the correct order.

1. Kerogen is developed.
2. The petroleum will collect in a trap.
3. The matter becomes buried.
4. Longer chains break into shorter ones, and methane remains.
5. The petroleum will migrate in the rocks which are porous and permeable enough.
6. The organic matter begins to decompose.
7. Kerogen is broken down.
8. The petroleum will stop migrating if rocks are not porous or permeable.
9. The petroleum is forced into nearby sediments.
10. Kerogen is altered through high temperature and high pressure.
11. Dead organisms accumulate on the ocean floor.
12. Hydrocarbon chains are freed.

EXERCISE 9 Read and translate the text "Physical and Chemical Properties of Oil". Tell about the main properties of oil and its characteristic features, based on the information from the text.

Physical and Chemical Properties of Oil

Oil is described by the physical properties of density, color, viscosity, thermal expansion and other properties related to the number of carbon atoms in the molecules.

Petroleum can be of different colors. Oil colors vary in a very wide range from oilfield to oilfield: from pale yellow, yellow and even colourless to dark grey, green and dark brown shades.

The SI unit is kg/m3 at a reference temperature, typically 15 C. Knowledge of density is required for quantity calculations. In the USA and some other countries the density of petroleum products is defined in terms of API gravity. This is an arbitrary scale adopted by the American Petroleum Institute for expressing the relative density of oils. The API gravity scale is read "backwards". The higher the API number, expressed as degrees API, the less dense (lighter) the oil is. Conversely, the lower the degrees API, the more dense (heavier) is the oil.

Density of oils range from 0.65 to 1.0 gr/cm and more at 20 C. According to density, oils may be light, medium and heavy. Light oil is characterized by the density of 0.5- 0.87; medium oil: 0.871- 0.910 and heavy oil is described being as 0.910 - 1.05 gr/cm3.

Viscosity is a property of fluids that indicates their resistance to flow, defined as ratio of shear stress to shear rate. Crude oils range in consistency from water-like to tar-like solids. Fluid with a high viscosity such as syrup deforms more slowly than fluid with a low viscosity such as water. Absolute viscosity is measured in Poise. The oil specific viscosity is usually defined as ratio of absolute viscosity of a given fluid to absolute viscosity of water at the same temperature. The viscosity of oil is dependent upon temperature, pressure and shear rate. Viscosity decreases at temperature increases because molecules vibrate and interact less. Conversely, the viscosity of oil increases at temperature decreases and it can become grease-like at very low temperature.

The volume of given oil mass increases with temperature, therefore, its density decreases. The degree of expansion is expressed as the coefficient of thermal expansion. Thermal expansion is useful to determine the size of container needed when the oil is heated. Thermal expansion is expressed as the ratio of volume change to initial volume after heating 10 °C.

Crude oils are complex mixtures containing hundreds of different hydrocarbon compounds that vary in appearance and composition from oil field to oil field, therefore, in

various oil fields the oil composition can vary significantly. All hydrocarbons are divided into two groups: saturated hydrocarbons and unsaturated hydrocarbons. Saturated hydrocarbons are not capable of attaching atoms and molecules while unsaturated hydrocarbons are capable of attaching atoms and molecules. The latter take part in chemical reactions easier. Hydrocarbons can be as simple as methane, but many are highly complex molecules and can occur as gases, liquids or solids. An "average" crude oil contains about 84% carbon, 14% hydrogen, 1-5% sulfur, and less than 1% of nitrogen, oxygen, metals and salts. In the refinery, most of these non-hydrocarbon substances are removed and the oil is broken down into various compounds and blended into useful products.

EXERCISE 10 Read and translate the text "Finding Oil", using the words after the text.

Finding Oil

The task of finding oil is assigned to geologists, whether employed directly by an oil company or under a contract from a private firm. Their task is to find the right conditions for an oil trap - the right source rock, reservoir rock and entrapment. Many years ago, geologists interpreted surface features, surface rock and soil types, and, perhaps some small core samples obtained by shallow drilling. Modern oil geologists also examine surface rocks and terrain, with the additional help of satellite images.

However, they also use a variety of methods to find oil. They can use sensitive gravity meters to measure tiny changes in the Earth's gravitational

field that could indicate flowing oil, as well as sensitive magnetometers to measure tiny changes in the Earth's magnetic field caused by flowing oil. They can detect the smell of hydrocarbons using sensitive electronic noses called sniffers. Finally, and most commonly, they use seismology, creating shock waves that pass through hidden rock layers and interpreting the waves that are reflected back to the surface.

The shock waves travel beneath the surface of the Earth and are reflected back by the various rock layers. The reflections travel at different speeds depending upon the type or density of rock layers through which they must pass. The reflections of the shock waves are detected by sensitive microphones or vibration detectors - hydrophones over water, seismometers over land. The readings are interpreted by seismologists for signs of oil and gas traps.

The words to be memorized:

core samples –образцы керна
to detect – обнаруживать, замечать
density – плотность
entrapment – захват, улавливание
hydrophone – гидрофон
to indicate – указывать, показывать
to interpret – расшифровывать
gravity meter – гравиметр
magnetometer – магнитометр
to measure – отмерять, измерять, расчитывать
to obtain – приобретать, добывать
reflect back – отражать
sniffer – газоанализатор
seismology – сейсмология
seismometer – сейсмограф
terrain – район, территория; местность

EXERCISE 11 Answers to the following questions, using the information from the text "Finding Oil".

1. Who usually finds oil?
2. What is the task of this kind of specialist?

3. How do modern specialists examine surface rocks?
4. What for do geologists use new methods to find oil?
5. What does seismology deal with?
6. Where and how do the shock waves travel?
7. By what are the reflections of the shock waves detected?
8. By whom are the readings interpreted?

EXERCISE 12 Read and translate the text "How to Find Oil".

How to Find Oil

Photographs from aircraft and satellites are used to begin the onshore search for oil and gas which is underground. This cuts down the time spent searching on the surface. The photographs are studied very carefully for the structures where oil might be found. If an area shows promise, then teams are sent to find out more about the rocks.

Geologists and geophysicists work closely together using a variety of methods. All the information is carefully considered, with the help of computer analysis, before any decisions to drill are made. A geologist collects small samples of rock. Sometimes the samples of rock are dug out by hand or cylindrical cores are drilled to give samples which can be cut and studied under a microscope. These help them to find out where the rocks have come from, what they are made of and how the rocks are arranged in strata.

Geologists also find out about the physical and chemical properties of the rocks and the fossil record from ancient times. All these clues give information to build up a picture of the area being surveyed. A geophysicist adds to the information of a geologist by studying the physics of the Earth. Surveys are made of the magnetic field, the gravity and how waves travel through the layers.

Magnetometers measure very small changes in the strength of the Earth's magnetic field. Sedimentary rocks are nearly non-magnetic and igneous rocks have a stronger magnetic effect. Because of these different effects on the magnetic field, measurements can be made to work out the thickness of the sedimentary layers which may contain oil.

Gravitometers measure the strength of the Earth's gravitational pull. This is not the same all over the Earth because of the different densities of the rocks. Igneous rocks like granite are denser than sedimentary rocks. Granite near the surface will have a stronger pull than the same lump deeper down, so measurements help to build up more information about the layers of rock.

Shock waves or seismic waves are used to help give a picture of deep rock structures. The idea is to make artificial shock waves and record how they travel through the Earth. The shock wave travels through the water and strikes the sea bed. Some of the energy of the wave is reflected back to the hydrophones. The rest of the wave carries on until it reaches another rock layer.

The time taken for the waves to travel from the source to the hydrophones is used to calculate the distance traveled- hence the thickness of the rock layers. The amplitude of the wave gives information about the density of the reflecting rock. A survey using artificial shock waves is called a seismic survey. The data from a survey is recorded and displayed by computer as a pattern of lines, called a seismograph.

Sometimes, surveys show that a structure is present which may contain oil and gas. If so, an exploratory well or wildcat well is drilled. Very few exploration wells find oil. Even in areas like the North Sea, where we know a great deal about the geology, only one in every eight wells which are drilled will find oil or gas in quantities worth developing.

Drilling is a very expensive activity, with each well on average costing several million dollars. Even with today's technology, there is still a low probability that oil or gas will be found. Most oil wells are between 900 and 5,000 metres deep, but it is now possible to drill 8 km below the surface, an achievement made possible by skilled operators using powerful equipment and advanced technology. However, the costs of drilling can double or treble when in very deep water, hostile environments and when high pressure or temperature is encountered.

The rock is drilled with a rotating drill bit, similar to those that are used to drill a hole in wood. The drill bit is attached to a string of steel pipes, each approximately 9 metres long. The derrick, the structure that stands above the hole, must be strong, as the drill pipe and bit are suspended from it. Only a small proportion of the total weight of the drilling string is allowed to bear on the drill bit. This proportion will vary depending on the rock formation being drilled. The derrick must also be tall enough to enable the individual lengths of drill pipe to be added to or removed from the string.

The drilling process is lubricated and cooled by a carefully constituted mud. This passes down inside the pipes to the drill bit and then returns to the top of the hole between the pipe and the sides of the hole, bearing rock debris with it. This provides the geologists with rock samples to indicate the kind of rock the drill is passing through.

The weight of the mud also prevents the escape of oil or gas if it is found. Usually the gas or oil is under pressure in the ground. To stop wasteful and dangerous gushers, a set of valves called a Christmas tree is fitted to the well head to control the flow of fluids from the well.

EXERCISE 13 Give the Russian equivalents to the following words.

The area being surveyed, a low probability, the time taken for the waves to travel, the rocks are arranged in strata, onshore search, advanced technology, the reflecting rock, fossil record, oil and gas in quantities worth developing, to work out the thickness, to give a picture of deep rock structures, show promise teams, to calculate the distance traveled.

EXERCISE 14 Give the English equivalents to the following words.

Небольшие образцы горных пород; предотвратить утечку нефти; неблагоприятная среда; возможное залегание нефти; работать в тесном взаимодействии; решение о бурении скважины; состав пород; нефтенасыщенные осадочные породы; толщина пластов горных пород; совокупность линий; поисковая или поисково-разведочная скважина; современные методы исследования; глубокое подводное бурение; ранние геологические эпохи; система стальных труб; буровая вышка; буровая колонна и долото; перспективная территория; буровой раствор; затрубное пространство; устье скважины; обломки; фонтанирование скважин; аэрофотосъёмка и съёмка со спутников; фонтанная арматура; количества, достаточные для промышленной разработки.

EXERCISE 15 Answer the questions below, using the information from the text "How to Find Oil".

1. What equipment is used in searching onshore oil and gas?
2. What methods are used to search for oil and gas?
3. How do specialists work?
4. How can you explain the term "seismic survey"?
5. What do surveys show?
6. What kind of activity is drilling? Can you prove it?
7. What kind of drilling equipment can you enumerate?
8. What for is a carefully constituted mud?

OIL TREATMENT, TRANSPORTATION AND STORAGE

EXERCISE 1 Read and translate the text "Types of storage tanks", using the words after the text.

Types of storage tanks

Every facility involved in the production of petroleum and related products requires some type of storage. Manufacturers also should be consulted for specific design information on a particular type of storage. During the early days of oil production, the method of storing was almost exclusively white-pine wooden tanks, which were followed by cypress tanks, and then redwood tanks. However, because of the constant and steep rise in the cost of redwood lumber and the diminution of skilled erectors required, the installation of new wooden tanks is nearly non-existent. The bolted-steel tank was developed next and replaced the wooden tank.

Bolted-steel tanks

Bolted tanks are designed and furnished as segmental elements assembled on location to provide complete vertical, cylindrical, above-ground, closed and open-top steel storage tanks. Standard API bolted tanks are available in nominal capacities of lOOto lO.OOObbl, and are designed for approximately atmospheric internal pressures. Bolted tanks offer the advantage of being easily transported to desired locations and erected by hand. To meet changing requirements for capacity of storage, bolted tanks can be easily dismantled and re-erected at new locations. If a tank develops a hole from corrosion or becomes damaged, a single sheet or more may be replaced. A complete tank bottom may be replaced in the field without dismantling the tank. Also, a section may be removed from the tank, a new connection installed in the sheet and the section replaced without danger. No special equipment is required for the erection of bolted tanks. These tanks are erected by non-specialized crews using hand tools and usually an impact wrench. Bolted tanks are available with painted, galvanized and special coatings, including factory-baked coatings. Painting on both sides of the sheets during fabrication gives the inside of the tank some corrosion protection. Galvanizing the sheets and all tank parts by the "hot-dip" process or applying a factory-baked coating affords high corrosion protection. Generally, bolted tanks are fabricated from 12- or 10-gauge steel, and if not galvanized or furnished with a protective coating for corrosion protection, they do not have the expected life of the welded - steel tanks, which are usually constructed of heavier steel.

Welded - steel Tanks

Shop-fabricated welded, cylindrical-shape tanks are available in a large variety of sizes as shop-fabricated items. Shop-welded tanks fabricated to API specifications provide the oil production industry with tanks of adequate safety and reasonable economy for use in the storage of crude petroleum and other liquids commonly handled and stored by the production segment of the industry. Shop-welded tanks are usually fabricated from 3/16-in. or heavier steel and will permit internal pressure up to 16oz. Shop fabrication permits testing in the shop for leaks and also provides immediate storage. Tanks are merely up-ended from a truck on the location.

Field-welded Tanks provide large storage capacities in a single unit. Large field-welded tanks providing storage capacities of 150.000 bbl or more have become prevalent for use in the storage of oil and petroleum products. Field-welded tanks are designed and erected in accordance with API Standard, which covers material, design, fabrication, erection and testing requirements for welded-steel storage tanks. It also includes an alternative basis for shell design, as well as one for calculating tank-shell thickness.

Fixed Roof are permanently attached to the tank shell. Welded tanks of 50 bbl capacity and larger may be provided with a frangible roof (designed for safety release of the welded deck-to-shell joint in the event excess internal pressure occurs). In this case, the design pressure should not exceed the equivalent pressure of the dead weight of the roof including rafters, if external.

Floating Roof storage tanks may be tank type is used primarily for storage near atmosphere pressure. Floating roofs are designed to move vertically within the tank shell to provide a constant minimum void between the surface of the stored product and the roof. Floating roofs normally are designed to provide a constant seal between the periphery of the floating roof and the tank shell. They can be fabricated in a type that is exposed to the weather or a type that is under a fixed roof. Internal floating-roof tanks, with an external fixed roof, are used in areas of heavy snowfall since accumulations of snow or water on the floating roof affect the operating buoyancy. These can be installed in existing tanks as well as new tanks. Both floating roofs and internal floating roofs are used to reduce vapour losses and to aid in conservation programs.

Cone - Bottom Tanks

The cone-bottom in either the bolted or the welded tank offer a means of draining and removing water or water-cut oil, from only the bottom of the tank, leaving the marketable oil above. The drain line from a sump-equipped cone bottom must be equipped with a vortex

breaker to drain off most of the water without coning oil into the drain. With a flat-bottom tank, some of the marketable oil must be removed if all the water is removed from the tank. Corrosion on the tank bottom is kept to a minimum by keeping all water removed. A cone bottom can be kept clean without having to open the tank if 1 or 2 bbl are drained off once or twice weekly and pumped back through the treating system. If this is not done and the bottom solidifies, the tank must be opened. The cone-bottom tank can be cleaned without entering. A water hose, handled just outside the cleanout opening, can be used to flush the solids to the centre of the cone and drain connection.

The words to be memorized:

adequate - соответствующий
to aid (in) - способствовать
bolted-steel tank - сборный резервуар
capacity - пропускная способность
cleanout - очистное отверстие
coating - покрытие / грунтовка
cone - воронка
dead weight - собственный вес
design pressure - расчетное давление
dismantle - разборка
to drain (off) - спускать; выпускать; сливать
equivalent pressure - равнозначное давление
erected by hand - установить ручной
erector - монтажник
excess - превышающий норму
expected life - предполагаемый срок службы
fabrication (be fabricated) - изготовление
factory-baked - прокаливать
floating roof - плавающая крыша (резервуара)
flush (out) - технологическая обработка
furnished (with) - снабжать
galvanized - оцинковывать
hot-dip process - пропитка
impact wrench - гайковерт
installation - монтаж / установка
internal pressure - внутреннее давление
leak - утечка
meet requirements - отвечать требованиям
non-existent - несуществующее
operating buoyancy - рабочая плавучесть
prevalent (for) - преобладающий
production - добыча
rafter - балка/стропила
replace - заменить
safety release - безопасность (выпуск)
seal - сальниковое уплотнение
segmental - сегментный
shell - корпус
shop-welded - заводской
storage tank - резервуар для хранения нефтепродуктов
thickness - толщина стенки
treating system - технологическая обработка
up-ended - опрокидывать

vapour loss - потери от испарения (нефтепродуктов)
void - интервал
vortex breaker - вихревой выключатель
water-cut oil - обводнённая нефть
welded tank (field) - сварной резервуар

EXERCISE 2 Match the verbs with the corresponding nouns. Translate them into Russian. Work in pairs, make up 3-5 your own sentences with these words, read them to your partner and he/she will translate them into Russian.

verbs	nouns
erect	. water
flush	. design pressure
provide	. API specifications
reduce	. tank bottom
meet	. requirements
fabricate	. **bolted tanks**
remove	. protection coating
design	. solids
replace	. fixed roof
. calculate	. tank-shell thickness
. exceed	. storage capacity
. attach	. field-welded tanks
. furnish	. vapour loss

EXERCISE 3 Read and translate the text "Bolted tanks", fill in the missing words and phrases from the box before the text.

API specification, segmental, sheet, tank bottom, storage, is mantle, manually, gauge steel, galvanized, bolted –steel, corrosion, re-erect, on location

Bolted tanks

The production of petroleum and its by-products requires _____. During the years, tanks developed from wooden to _____ tanks. Bolted tanks are _____ elements and assembled _____. They are designed according to _____. Bolted tanks can be easily _____ and _____ at new locations. The _____ can be replaced in the field. For example, a hole developed from _____ or damaged, a single _____ may be replaced. No special equipment is required. These tanks can be erected _____. These tank types include painted, _____, and special coatings. Bolted tanks are fabricated from 10-12 in _____.

EXERCISE 4 Read and translate the text "Tank battery operation", using the words after the text.

TANK BATTERY OPERATION

After passing through the gas-oil separator, the gas usually is measured through an orifice meter and the oil is flowed into one of the tanks where measurements of the height of oil in the tank are taken from time to time by the operator. The oil flow is usually directed into one tank of the lease battery until it is filled, after which the flow is switched to an empty tank.

The final gauging of a full tank is made by the pipeline company preparatory to running the oil from the tank into the pipeline. It is the lease operator's responsibility to watch the gauging and testing of the oil done by the pipeline gager and to be sure that the measurements are correct. The lease operator in this transaction represents the producer or seller, and the pipeline gager is the transporter. Similarly, it is often the duty of the lease operator to see that the metering equipment used to measure gas delivered off the lease is functioning and serviced properly, even though this may be the direct responsibility of other personnel or of the purchaser of the gas. Also, gas meter charts are commonly changed by lease operator gagers who make the proper notations and forward them to the production office for reading and calculation of the gas volumes registered. At times the lease operators site read the gas meter charts to estimate the daily volume of gas produced by each lease. The gas purchaser usually supplies and maintains the gas sales metering equipment.

When salt-water production occurs with the oil, the accumulated water must be drained from the stock tanks. The volume of salt water produced over each 24-hour period is measured by gauging before and after draining the water accumulated in the tanks. Sometimes it is necessary to transfer any oil emulsified with salt water from the stock tank to a treater for removal of the water or BS&W. In more modem operations the water is removed in a production treater. When the amount transferred is large, the lease operator will usually flow additional oil into the tank to more nearly fill it before delivering the tank to the pipeline gager for running the oil to the pipeline. This operation is referred to as topping out the tank. The treated or recovered oil is often returned to another tank being filled.

The words to be memorized:

1. Dehydration– обезвоживание
2. Hydrating –гидратообразование
3. Pig– скребок (поршень) для трубопроводов
4. Pipeline – трубопровод
5. Separator – сепаратор
6. Tank – емкость
7. Trunkline– основной коллектор, магистральный трубопровод
8. Vortex breaker– гаситель завихрений
9. Droplet – капелька
10. Mist pad–каплеуловитель
11. Coalescing device– коагулятор
12. Deflector plate – пластина дефлектора
13. Vapor section– секция для газа
14. Funneling effect– эффект воронкообразования
15. Corrosion – коррозия
16. Stripper well –истощенная скважина
17. Allowables – квоты
18. Well cluster –куст скважин
19. Plumb bob –свинцовое грузило
20. Reading box– считывающее устройство

EXERCISE 5 Answer questions about the text.

1. What is the common procedure to measure separated oil and gas at the tank battery?
2. Who does the final gauging of a full tank and what is the reason for that?
3. What are the main responsibilities of the lease operator during oil measuring operations?
4. Who usually supplies and maintains the gas metering equipment?
5. Describe how you understand tank topping out.

EXERCISE 6 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner.

1. The lease operator in this transaction represents the producer or seller, and the pipeline gager is the transporter.
2. The oil flow is usually directed into one tank of the lease battery, after which the flow is switched to the filled reservoir.
3. The gas purchaser doesn't supply and maintain the gas sales metering equipment.
4. When salt-water production occurs with the oil, the accumulated water mustn't be drained from the stock tanks.
5. It is necessary to transfer any oil emulsified with salt water from the stock tank to a treater to remove water.

EXERCISE 7 Connect the terms with their definitions.

1. Corrosion	a) a process of removing water from gas.
2. Dehydration	b) the change of pressure with depth a center where oil from wells is collected. Oil is transported from wells through flowlines and gathering lines first to booster pump stations, which pump it further to oil gathering facilities for metering and treatment.
3. Hydrates	c) a device in the form of a tank designed for separation of oil from gas and water. Separators can be vertical or horizontal, two-phase or three- phase. Some separators are also capable to separate oil from solids due to special filters installed in them. The force of gravity and the centrifugal force are used for separation process.
4. Oil gathering facilities	d) a large diameter pipeline that connects an oil or gas field with a refinery, or transportation terminal and used to transport commercial oil and gas.
5. Separator	e) chemical consumption or wearing away of equipment. Corrosion can be by either inorganic or organic bacteria. Corrosion is caused primarily by oxygen, carbon dioxide, hydrogen sulfide, and chlorides in petroleum drilling and production. Electrochemical corrosion produces a measurable current. Sour corrosion is caused by hydrogen sulfide, whereas sweet corrosion is caused by carbon dioxide and fatty acids.
6. Trunk pipeline	f) snow-like compounds of methane and water. Chemically speaking, a hydrate can be any compound formed by the union of water with some other substance.

EXERCISE 8 Find the English equivalents in column B to the Russian word combinations in column A.

A	B
1. Периодическая закачка	a) Gas line
2. Товарная нефть	b) Level controller
3. Газопровод	c) Hydraulic safety valve
4. Гидравлический предохранительный клапан	d) Pipe coating
5. Регулятор уровня	e) Batch treatment
6. Обессоливание нефти	f) Export oil

7.	Трубное покрытие	g)	Oil desalination

EXERCISE 9 Read and translate the text.

OIL GATHERING FACILITIES

At the gathering center, the oil is treated to bring it up to pipeline and refinery specification. Water and dissolved salts can seriously corrode chokes, valves and pipe walls, and must therefore be removed from the crude before it is transported. Dehydration and desalination can be accomplished by electrical method, heating and washing with fresh water.

Reservoir crude also has to be treated to separate associated gas. Natural gas may also require treatment at the gathering center, particularly if it contains water vapor. When high-pressure gas is expanded to a lower temperature, considerable cooling takes place. If the gas contains water vapor, this can cause formation of hydrates, and these may plug chokes, valves and pipelines. The gas is dehydrated in scrubbers.

Trunk lines connect the gathering center to the refinery or tanker terminal. Many kilometers of large-diameter pipeline may be required. Problems inside the lines must be prevented or quickly corrected when they occur.

The devices, which test, log, clean and unblock oil pipelines are known as "pigs". Each type of pig is usually referred to by a special name. One type of pig, for example, is known as a "rabbit". In product pipelines, pigs can be used to separate two or more different oil products, which are being sent at the same time through a single line.

SELECTION OF SEPARATOR INTERNALS

Internal devices are used in separators to speed up the separation process and reduce the size and cost of the separator. Proper selection of internal devices can reduce the cost of a separator by as much as 50%. Similarly, improper selection of internals can reduce the capacity of the separator by as much as 50%.

Most internal devices are installed in the vapor section to remove liquid droplets from the gas. The diameter will increase approximately 20% if there is no mist pad or another coalescing device in the vapor section. The diameter can be reduced approximately 10% by installing coalescing or other devices in addition to a mist pad.

Selection of internal devices will depend upon the composition and quality of the flow entering the separator. Coalescing devices should not be installed if there is a likelihood they will become plugged with wax, sand or corrosive products. A stainless steel mist pad can be installed in a corrosive gas flow without danger of becoming plugged with corrosive products.

Centrifugal devices are highly effective in removing mist from the gas as long as the gas flow is high enough to maintain proper velocity in the centrifuge. These devices are most effective when the inlet flow is mainly gas flowing at a fairly constant rate.

Each liquid outlet should always have vortex breakers installed. Without these devices, a funneling effect may occur when liquid is withdrawn, and gas will flow out with liquid.

An inlet deflector plate is another internal device that can be used in all separators. This device causes the liquid entering the separator to change direction (normally to the side or down) and prevents it from flowing out to the middle of the vessel and thereby reducing the effectiveness of the vapor section.

EXERCISE 10 Answer questions about the text.

1. Why must water and dissolved salts be removed from crude?
2. When can gas cause formation of hydrates?
3. What do trunk lines connect?
4. How are the devices which test, log, unblock and clean oil pipelines known?
5. Why it is necessary to make a proper selection of internal devices in separators?
6. What does the selection of internal devices depend upon?
7. Why should each liquid outlet have vortex breakers installed?

EXERCISE 11 Open brackets and use active or passive form of the verb.

1. At the gathering center, the oil (*to treat*) _____ to bring it up to pipeline and refinery specification.
2. When high-pressure gas (*to expand*) _____ to a lower temperature, considerable cooling takes place.
3. Trunk lines (*to connect*) _____ the gathering center to the refinery or tanker terminal
4. Most internal devices (*to install*) _____ in the vapor section to remove liquid droplets from the gas.
5. Internal devices (*to use*) _____ in separators to speed up the separation process and reduce the size and cost of the separator.

EXERCISE 12 Insert the omitted words from the text

1. Water and dissolved salts can seriously corrode chokes, valves and pipe walls, and must therefore_____ the crude before it is transported.
2. Natural gas may also require treatment at the gathering center, particularly if it contains_____.
3. In product pipelines, pigs can be used to separate two or more different oil products, which_____ at the same time through a single line.
4. Improper selections of _____can reduce the capacity of the separator by as much as 50%.
5. Coalescing devices should not be installed if there is a likelihood they will become plugged with_____ or_____.
6. This device causes the liquid entering the separator to change _____ and prevents it from _____out to the middle of the vessel and thereby reducing the effectiveness of the vapor section.

Internals, corrosive products, direction, water vapor, wax, sand, are being sent, be removed from, flowing.

EXERCISE 13 Translate into Russian in written form.

1. Chemical injection equipment consisting of a chemical tank, a chemical pump and some method to determine flow rate is usually applied as one of the ways to fight corrosion by means of corrosion inhibitors.
2. After thermal and chemical treatments emulsion comes to the settler, where water is separated from oil and drained into disposal system and oil goes to storage tanks.
3. When the tank is filled the oil jet under pressure lifts the internal check-valve lid, and when oil pumping is stopped the internal check-valve lid under its own weight comes down to its place closing the pipe.
4. I he pig was successfully launched through the pig launcher but by that time wax buildup was so high that the pig got stuck and did not arrive to the pig receiver.
5. Oil gathering facilities collect oil from well clusters transported in pipeline system through pumping stations for treatment and further delivery into the trunk line.

EXERCISE 14 Translate into English in written form.

ЗАМЕРЫ ЕМКОСТИ

В последние годы начали применять устройство автоматического замера емкостей. Это устройство состоит из металлической рулетки в корпусе с поплавком на ее конце, который располагается на поверхности нефти в емкости. Лента рулетки проходит через верх емкости, спускается с ее внешней стороны и проходит через считывающее устройство. Другой конец ленты рулетки свернут кольцами ниже считывающего

устройства, которое расположено на удобной для просмотра с земли высоте. Отметки на проходящей через считывающее устройство ленте показывают уровень нефти в емкости, который можно видеть через смотровое окошко в устройстве. Данное устройство может быть также адаптировано для постоянной регистрации данных замеров емкости.

OIL REFINING

EXERCISE 1 Read and translate the texts "Heat content" and "Refining methods", using the words after the texts.

HEAT CONTENT

Many economic considerations effecting production of different petroleum products are related to the amount of heat escaping when they burn. To select which flows should be used as refinery fuels we should take into consideration market price of petroleum products and also their heating value.

Two processes take place during hydrocarbon burning – chemical reaction and calorification. Chemical reaction usually means turning of hydrocarbon and oxygen into carbon dioxide and water.

Amount of heat escaping during the process varies for different hydrocarbons. Amount of heat in refining industry is normally measured in British Thermal units (1 BTU=1054,8Joules=252 calories).

One British Thermal unit equals to amount of heat needed for heating of one pound of water to 1°F.

There are two types of heating value. So called the highest heating value demonstrates total amount of heat, which escapes during chemical reaction (heat of combustion), and the lowest heating value shows condition of water generated during the reaction. Part of the chemical reaction heat is spent for water evaporation. Besides, not all the heat can be used, as it comes through the burner and out of the stack. The heavier is the fuel, the lower is ratio between hydrogen and carbon in its composition, and the less water is generated when it is burnt. This situation is reflected in heat efficiency value, which is calculated as ratio of net heat to total heating value.

REFINING METHODS

The most complex are refining methods including production of special valuable products, for example, lube oils or petrochemical products. Corresponding units have high complexity coefficients, which reflect CAPEX level for their construction. For example, complexity coefficient for aromatic hydrocarbons plant equals 33, and for production of olefins it is 10-20 (depending upon type of raw material and method of output product treatment). Pretty often refining method with output of chemical products (ethylene, propylene and aromatics) about 10% with complexity coefficient at least 16 is used. The idea of the analysis was to have a possibility to develop and use the chart reflecting dependability of refining costs upon its complexity accounting production scale effects.

The words to be memorized:

1. Carbondioxide – диоксид углерода (CO_2)
2. fueloil – котельное топливо
3. refinery – нефтеперерабатывающий завод
4. lubeoils – смазочные масла
5. Aromatic hydrocarbons – ароматические углеводороды
6. Olefin – олефин

EXERCISE 2 Answer the following questions.

1. What is related to the amount of heat?
2. Why should we take into consideration market price of petroleum products?

3. How many processes take place during hydrocarbon burning? What are they?
4. How is amount of heat in refining industry normally measured?
5. Are there two or three types of heating value?
6. What is spent for water evaporation?
7. Can all the heat be used as it comes through the burner and out of the stack?
8. What are the most complex refining methods?

EXERCISE 3 Decide whether the statements are true or false. Correct them if necessary.

1. Cracking is a very dangerous process during crude distillation as it can result in a complete destruction of the rectifying column.
2. Each of the crude fractions has its boiling temperature interval.
3. Lower pressure is used during vacuum distillation because products boil at lower temperatures if pressure is lower.
4. Initial products for thermal cracking are mostly gases.
5. Hydrocracking unit produces high quality gasoline.
6. Prior to distillation the crude is tasted by one of the operators. If sweet enough it can be used for refining, sour oil is usually rejected.
7. Downcomer is a maintenance person servicing rectifying plates starting from the top of the column.
8. Both light and heavy vacuum distillates can be used for lube oil production.
9. Used catalyst can be restored in the regenerator for repeated use.
10. Coke dehydration is called calcination.

EXERCISE 4 Translate from Russian into English.

1. Обычно сырая нефть содержит такие фракции, как углеводородные газы, бензин, нафта, керосин, газойль и мазут.
2. Прямогонный бензин направляется на компаундирование для получения автомобильного бензина.
3. Процесс вакуумной перегонки был разработан с целью правильного использования крекинга.
4. Остаток вакуумной перегонки используется в качестве сырья для производства битума.
5. Температура, при которой фракция начинает кипеть, называется точкой начала кипения, а температура, при которой фракция полностью испарилась, называется точкой выкипания.
6. Установка гидрокрекинга производит высококачественный бензин, при этом повышается качество компонентов бензина и дистиллята.
7. Лёгкий вакуумный дистиллят и тяжёлый вакуумный дистиллят иногда получают как отдельные продукты.
8. Прямогонный остаток подаётся на вакуумную перегонку.
9. В крекинг установке прямогонные фракции тяжёлого газойля нагревают при повышенном давлении в контакте с катализатором.
10. Часть углеводородов, которая в процессе каталитического крекинга превращается в кокс, оседает в виде отложений на катализаторе.

EXERCISE 5 Read and translate the text "Gas fractionation plants", using the words after the text.

GAS FRACTIONATION PLANTS

Four main methods can be used to produce gas spirit:

1. Cooling
2. Deep cooling

3. Absorption with denuded oil
4. Hard surface absorption.

In the cooling method gas containing liquid is cooled down to temperatures in the interval from -10°C to -40°C. At such temperature about 90% of propane and all butane (and also heavier compounds) are liquefied and can be separated during fractionation.

In the deep cooling method more complete ethane separation is performed. For that purpose temperature of gas containing liquid is decreased to the interval from -100°C to -140°C. In such conditions 95% of ethane and all propane (and also heavier compounds) are separated from the gas.

Absorption with denuded oil is performed in older gas fractionation plants the same way as it is done in appropriate refinery units. Standard procedure allows producing about 70% of propane and 100% of butane and heavier compounds. Using cooled denuded oil can in addition provide for 50-75% of ethane.

Hard surface absorption is an interesting process, which is used in cases when only dew point must be changed (i.e. remove only the heaviest compounds, which can condense during transportation). Many gas sale contracts include requirements for dew point (temperature at which drops start to settle out) to be not higher than -10°C with gas line pressure about 800 psi. Depending upon specific gas flow this may require complete removal of petroleum gasoline and partial removal of butanes.

Some porous materials, such as absorbent carbon, silica gel and alumina, may make big volumes of vapors condense on their surface. As liquid stays on the surface of hard substance, this process is called “adsorption” but not “absorption” (in the last case liquid gets inside the material). When sufficient volume of liquid is condensed (in this case, gas spirit) the process is stopped or the flow is directed to different tank containing new portion of adsorbent. Liquids are removed from adsorbent surface by treating it with superheated steam, collected and condensed.

Hard surface absorption produces 10-15% of butanes and 50-90% of petroleum gasoline.

The words to be memorized:

1. Gas fractionation plant – газофракционирующая установка (ГФУ)
2. denuded oil – отбензиненное абсорбционное масло
3. gasoline – бензин (газолин)
4. silica gel – силикагель
5. straight-run residue – прямогонный остаток
6. alumina – оксид алюминия

EXERCISE 6 Answer the following questions.

1. How many methods can be used to produce gas spirit?
2. Where is absorption with denuded oil performed?
3. Hard surface absorption is an interesting process, isn`t it?
4. What requirements do many gas sale contracts include?
5. What is dew point?
6. What kind of porous materials may make big volumes of vapors condense on their surface?
7. What is the difference between “adsorption” and “absorption”?
8. What is happening when sufficient volume of liquid is condensed?
9. How are liquids removed from adsorbent surface?

EXERCISE 7 Connect the terms with their definitions.

1. denuded oil	1. the removal of a liquid by the capillary, osmotic, chemical, or solvent reaction in a substance
2. crude distillation	2. a substance that promotes a chemical reaction but is not affected by the reaction
3.rectifier	3. mixing gasoline by adding components

	increasing octane number
4. absorption	4. naphtha, supplied for gas absorption
5. sour oil	5. a device in the rectifier providing for drainage of condensed hydrocarbons from the plate down to the lower plate
6. catalyst	6. oil containing low concentration of sulfur
7. sweet oil	7. oil containing high concentration of sulfur
8. run	8. separation of crude oil into fractions (fractionation)
9. downcomer	9. a column at the refinery in which crude oil is separated into5-6 fractions
10. compounding	10. a fraction of crude oil

EXERCISE 8 Translate from English into Russian.

1. Rectifier is used for crude distillation but vat residue cannot be cracked there due to insufficient temperature.
2. Effective limits of boiling are temperatures at which fractions are considered relatively separated.
3. Straight-run fractions of heavy gas oil are heated in the cracker under higher pressure with catalyst, which facilitates the process.
4. When catalyst surface is covered with sediments, it is not active no more and must be regenerated.
5. Sponge coke is used for production of electric rods, calcium carbide and graphite.
6. Jet and diesel fuels are produced from heavy gas oil during hydrocracking.
7. Highly aromatic gasoline distillates are used as high-level octane components or for production of aromatic hydrocarbons.
8. Heavy cracked gas oil can be used as an initial product for thermal cracking.
9. Light fractions are delivered to gas fractionation plant and straight-run gasoline is directed for compounding.
10. Crude is pumped into the rectifier with the crude pump, which first delivers the crude to the heater and then – to the rectifier.

EXERCISE 9 Translate the text into English.

Нефтеперерабатывающие заводы

В целом, нефтеперерабатывающие заводы делятся на простые и сложные, но аналитики также часто употребляют термин «очень сложные».

Нефтеперерабатывающий завод, работающий по простой схеме, включает перегонку сырой нефти, гидроочистку средних дистиллятов и каталитический риформинг нафты.

Нефтеперерабатывающий завод, работающий по сложной схеме, включает всё то же самое плюс каталитическую крекинг-установку и установки алкилирования и газофракционирования.

Нефтеперерабатывающий завод, работающий по очень сложной схеме, включает всё то же самое, что при сложной схеме, плюс установки либо по производству олефинов, либо по сокращению количества остатка (например, установка коксования).

В стандартной отраслевой модели могут быть рассчитаны выходы нефтепродуктов из каждого сорта сырой нефти для каждой схемы переработки. Это позволяет выяснить, насколько выгодна переработка конкретного сорта нефти по конкретной схеме.

EXERCISE 10 Make up your own topic "Oil refining" and be ready to retell it and discuss with your group mates.

THE EFFECT OF EXTRACTING, DELIVERING AND USING PETROLEUM PRODUCTS ON THE ENVIRONMENT

EXERCISE 1 Read and translate the text. Be ready to discuss with your group mates the question about the impact of different stages of oil extraction on the environment.

The effect of extracting, delivering and using petroleum products on the environment

Oil and natural gas burn cleaner than coal but are heavy polluters, too. Oil and gas are preferred fuels because coal is so polluting, and because it is less useful for many kinds of engines. But these fuels, too, cause a great deal of pollution. Burning gasoline in automobiles produces air pollution and smog. The effect of smog on vegetation and human health are well documented. In addition, oil used in cars, trucks, and airplanes sometimes spills and soaks into soil. Leaking oil and leaking underground gasoline tanks have caused pollution problems and expensive lawsuits; although it now seems that natural soil bacteria are capable of decomposing most oil.

Refineries, also, pollute. What comes out of the ground from a typical oil well is a thick substance that is a mixture of many chemicals from very heavy tars to very light gasoline and natural gas. A refinery is basically a gigantic chemistry set that separates this "crude oil" into its components and can also convert one form of the crude oil into more useful form, usually converting the heavier chemicals to lighter ones. Refineries have accidental spills and slow leaks of gasoline and other products from storage tanks and pipes. Over years of operation, large amount of liquid hydrocarbons may be released, polluting soil and groundwater below the site.

The pollution continues during delivery. A famous example happened on March 24, 1988, when the supertanker Exxon Valdez, carrying 1.2 million barrels of crude oil, ran aground on Bligh Reef in Prince William Sound, Alaska, and broke open. The ship was full of Alaskan crude oil that had been delivered to it through the Trans-Alaska Pipeline, which itself is a controversial way of transporting oil. The oil poured out of ruptured tanks of the tanker at about 20, 000 barrels per hour, spilling a total of about 250,000 barrels (llmillion gallons) into the sound. An even bigger spill was avoided when the remainder of oil was off-loaded onto another vessel.

The spill killed thousands of fish, birds, and mammals - 13 % of the sound's harbor seals, 28% of the sea otters, and 645,000 seabirds died. Within three days, winds began spreading the huge oil slick so widely that there was no hope of containing it. Of the 11 million gallons of spilled oil, about 20% evaporated and 50% was deposited on the shoreline. Only 14% was collected by skimming and other waste recovery. The *Exxon Valdez* spill showed that the technology for dealing with oil spills was inadequate. The spill disrupted the lives of the people who live and work in the vicinity of Prince William Sound. Even after more than $3 billion was sent to clean up, few people were satisfied with the results.

Long-term effects of large oil spills are probably not devastating. There is no evidence that the Ocean's ecosystems are seriously threatened by oil spills. Nevertheless, the effect can last several decades. Toxic levels of oil have been identified in salt marshes 20 years after a spill.

The Exxon Valdez spill led to the Oil Pollution Act of 1990 and new technology. More modern tankers are being built with double hulls designed to prevent or limit the release of oil in case of collision or grounding. We now also have new techniques to collect oil at sea, using floating barriers and skimmers (oil is lighter than water and so floats on water), but even the best methods are difficult to use in high winds and rough seas. Oil on beaches may be collected by spreading absorbent material, such as straw, waiting for the oil to soak in, and then collecting and disposing the oily straw.

EXERCISE 2 Look through the text again and say in what context these figures are mentioned in the text. Work in pairs.

1 200 000, 3, 20,14, 28, 645 000, 50, 250 000, 1988.

EXERCISE 3 Complete the sentences, using the information from the text.

1. We now also have new techniques to collect oil at sea, using ... , but …. .
2. Now It seems that natural soil bacteria are capable of ... .
3. Oil and natural gas burn cleaner than coal but ... .
4. A thick substance that comes out of the ground from a typical oil well is … .
5. A famous example of oil pollution during delivery is ... .
6. Oil and gas are preferred fuels because ... .
7. There is no evidence that....
8. Of the 11 million gallons of spilled oil, about 20% ... and 50% ... .

EXERCISE 4 Discuss with your group mates the following quotation from the standpoint of the ecological problems in mining and oil production.

1. One of the first laws against air pollution came in 1300 when King Edward I decreed the death penalty for burning of coal. At least one execution for that offense is recorded. But economics triumphed over health considerations, and air pollution became an appalling problem in England.

2. The system of nature, of which man is a part, tends to be self-balancing, self-adjusting, self-cleansing. Not so with technology.

3. When some high-sounding institute states that a compound is harmless or a process free of risk, it is wise to know whence the institute or the scientists who work there obtain their financial support.

EXERCISE 5 Make a presentation on one of the topics, be ready to discuss it in your group.

1. The Mining extraction and the Human health;
2. The Oil Production and the Human health;
3. Is it possible to develop the civilization without mining industry?
4. The development of society after depletion of mineral resources;
5. It has been known before that it is not advantageous for the Man to destroy the Nature. So, why does he do that?

OIL PIPELINES

EXERCISE 1. Read the text carefully and answer the following questions:

Pipelines are generally the most economical way to transport large quantities of oil, refined oil products or natural gas over land. Compared to shipping by railroad, they have lower cost per unit and higher capacity. Although pipelines can be built under the sea, that process is economically and technically demanding, so the majority of oil at sea is transported by tanker ships. Oil pipelines are made from steel or plastic tubes with inner diameter typically from 4 to 48 inches (100 to 1,200 mm). Most pipelines are buried at a typical depth of about 3 to 6 feet (0.91 to 1.8 m). The oil is kept in motion by pump stations along the pipeline, and usually flows at speed of about 1 to 6 metres per second (3.3 to 20 ft/s). Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline. Usually in multiproduct pipelines there is no physical separation between the different products. Some mixing of adjacent products occurs, producing interface. At the receiving facilities this interface is usually absorbed in one of the product based on pre-calculated absorption rates.

1. What way is the most economically to transport large quantities of oil or natural gas?
2. What types of pipelines do you know?
3. What materials are oil pipelines made from?

EXERCISE 2. Give English equivalents to the Russian words and word combinations:

Трубопровод; экономичное средство; очищенная нефть; природный газ; многофункциональный трубопровод; использовать; последовательность; распределение; смешивания продуктов; проникновение; оборудование на этапе получения продукта; предварительные расчеты; нормы абсорбции.

EXERCISE 3. Translate the following sentences into English:

1. Большинство трубопроводов строятся на глубине от 0,91 до 1,8 метров.
2. Нефть движется по трубопроводу с помощью насосных станций.

TYPES OF PIPELINES BY TRANSPORT FUNCTION

EXERCISE 1. Read the text carefully and answer the following questions:

For natural gas, pipelines are constructed of carbon steel and varying in size from 2 to 60 inches (51 to 1,500 mm) in diameter, depending on the type of pipeline. The gas is pressurized by compressor stations and is odorless unless mixed with a mercaptan odorant where required by a regulating authority.

In general, pipelines can be classified in three categories depending on purpose: Gathering pipelines - group of smaller interconnected pipelines forming complex networks with the purpose of bringing crude oil or natural gas from several nearby wells to a treatment plant or processing facility. In this group, pipelines are usually short - a couple of hundred meters - and with small diameters. Also sub-sea pipelines for collecting product from deep water production platforms are considered gathering systems.

Transportation pipelines - mainly long pipes with large diameters, moving products (oil, gas, refined products) between cities, countries and even continents. These transportation networks include several compressor stations in gas lines or pump stations for crude and multiproducts pipelines.

Distribution pipelines - composed of several interconnected pipelines with small diameters, used to take the products to the final consumer. Feeder lines to distribute gas to homes and businesses downstream. Pipelines at terminals for distributing products to tanks and storage facilities are included in this group.

1. What three groups can be pipelines classified in?
2. What does transportation pipeline network include?
3. Do feeder lines distribute gas to homes and business downstream?

EXERCISE 2. Give English equivalents to the Russian words and word combinations:

Соединенные между собой трубопроводы; комплекс сетей; газовые и нефтяные месторождения; сбор продукта; причины; движение продукта; насосные станции; состоять из нескольких трубопроводов; распределять; перерабатывающие заводы.

EXERCISE 3. Translate the following sentences into English:

1. В трубопроводе используются компрессорные станции для транспортировки газа.
2. Для подачи газа к потребителю используют сеть распределительных газопроводов.

THE MAIN ELEMENTS OF A PIPELINE SYSTEM

EXERCISE 1. Read the text carefully and answer the following questions:

Pipeline networks are composed of several pieces of equipment that operate together to move products from location to location. The main elements of a pipeline system are: Initial injection station. Known also as supply or inlet station, is the beginning of the system, where the

product is injected into the line. Storage facilities, pumps or compressors are usually located at these locations.

Compressor/pump stations. Pumps for liquid pipelines and Compressors for gas pipelines are located along the line to move the product through the pipeline. The location of these stations is defined by the topography of the terrain, the type of product being transported, or operational conditions of the network.

Partial delivery station. Known also as intermediate stations, these facilities allow the pipeline operator to deliver part of the product being transported. Block valve station. These are the first line of protection for pipelines. With these valves the operator can isolate any segment of the line for maintenance work or isolate a rupture or leak.

Block valve stations are usually located every 20 to 30 miles (48 km), depending on the type of pipeline. Even though it is not a design rule, it is a very usual practice in liquid pipelines. The location of these stations depends exclusively on the nature of the product being transported, the trajectory of the pipeline and/or the operational conditions of the line.

Regulator station. This is a special type of valve station, where the operator can release some of the pressure from the line. Regulators are usually located at the downhill side of a peak.

Final delivery station. Known also as outlet stations or terminals, this is where the product will be distributed to the consumer. It could be a tank terminal for liquid pipelines or a connection to a distribution network for gas pipelines.

1. What are pipeline networks composed of?
2. Where is the product injected into the pipeline?
3. What is the first line of protection for pipelines?

EXERCISE 2. Give English equivalents to the Russian words and words combinations:

Компрессорная станция; оборудование; операционные условия; поставлять; природный газ; поставлять приборы; сеть трубопроводов; насосная станция; вход в трубопровод.

EXERCISE 3. Translate the following sentences into English:

1. Компрессоры для трубопровода размещены вдоль трубопровода для продвижения продукта.
2. Промежуточные станции позволяют оператору поставлять лишь часть транспортируемого продукта.
3. С помощью защитного вентиля оператор может отключить любой отрезок трубопровода.

LEAK DETECTION SYSTEMS

EXERCISE 1. Read and translate the text:

Since oil and gas pipelines are an important asset of the economic development of almost any country, it has been required either by government regulations or internal policies to ensure the safety of the assets, and the population and environment where these pipelines run. Pipeline companies face government regulation, environmental constraints and social situations. Pipeline companies should comply with government regulations which may define minimum staff to run the operation, operator training requirements, up to specifics including pipeline facilities, technology and applications required to ensure operational safety. As an example, in the State of Washington, it is mandatory for pipeline operators to be able to detect and locate leaks of 8 percent of maximum flow within 15 minutes or less. Different types of technologies and strategies have been implemented, from physically walking the lines to satellite surveillance. The most common technology to protect these lines from occasional leaks is known as Computational Pipeline Monitoring Systems or CPM. CPM takes information from the field related to pressures, flows, and temperatures to estimate the hydraulic behavior of the product

being transported. Once the estimation is done, the results are compared to other field references to detect the presence of an anomaly or unexpected situation, which may be related to a leak.

EXERCISE 2. Give English equivalents to the Russian words and word combinations:

Система нахождения утечки; безопасно; элементы трубопровода; защита трубопровода; непредсказуемая ситуация; середина трубопровода; стратегия была внедрена; с высоким уровнем ожидания; размещение трубопровода; работники трубопровода; выполнять операции.

EXERCISE 3. Translate the following sentences into English:

1. Газопроводы - это важные имущественные активы экономического развития.
2. Операторы трубопровода могут определять и находить утечки газа.

THE CONSTRUCTION OF PIPELINE

EXERCISE 1 Read and translate the text "Pipeline Construction", using the words after the text.

Pipeline Construction

Oil pipelines are made from steel or plastic tubes with inner diameter from 30 to 120 cm (about 12 to 47 inches). Where possible, they are built above the surface. However, in more developed, urban, environmentally sensitive or potentially dangerous areas they are buried underground at a typical depth of about 1.3 - 1.6 meters (about 3 feet). The oil is kept in motion by a system of pump stations built along the pipeline and usually flows at speed of about 1 to 6 m/s. Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline.

Here are the following steps in pipeline construction:

1) Survey, setting out - marking the centerline of the pipeline ditch and edges of the right-of-way.

2) Right-of-way (ROW), clearing, grading - ROW width is determined by the diameter of the pipeline to be installed and includes room for the pipeline and working space for the construction equipment used to install the pipeline. A low silt fence protects it against corrosion.

3) Ditching - excavated soil {spoil) is deposited on the ditch bank. In certain areas, particularly farmland, the ditch will be excavated in two passes with a first pass removing topsoil and the second pass excavating the remaining soil to the required pipeline burial depth.

4) Stringing - laying sections of pipe along the ROW (stringing) uses pipe in varying lengths (joints). Stringing trucks transport pipe from a stockpile to the ROW where a pipe layer or crane lays them along the ROW.

5) Bending- joints of pipes can be bent to accommodate elevation changes, horizontal direction changes or both along the ROW. If a change cannot be designed within the field-bending constraints special pipe bends (factory bends, hot bends) must be manufactured for the special location.

6) Road crossing - boring beneath a road does not damage the road surface, and traffic flow is not interrupted by the boring activity. Line pipe used for the road crossing has a thicker external coating to provide extra protection during installation. The road crossing pipe is joined to the welded strings of line pipe by a tie-in crew using manual welding.

7) Skidding the pipe before being welded, line pipe is lifted onto skids made of timber and stockpiles along the ROW so that the entire circumference is accessible.

8) Welding - the work here assumes use of automatic welding to join the sections of line pipe, which provides consistency, uniform welds and fewer repairs. To prepare the line pipe for automatic welding, a beveling and facing machine trims, cuts and grinds the pipe ends with the special edge preparation required by the process. Line pipe comes from the pipe mill with a standard edge preparation or with a plain end if the pipe is specially ordered for automatic welding.

9) Line-up, internal welding - a series of pneumatically operated pistons radially spaced around the internal clamp centers the joints and correctly aligns the pipe ends for welding. The first welding pass is made with the internal welding torches and is called the "root"; this is the primary strength weld that fuses the two pipes.

10) External welding (firing line back end) - the external torches make the next welding pass {hot pass). Together the root and hot passes provide the required fusion and strength to join the pipes permanently. The remainder of the weld passes (fill passes) is made from the outside. The final welding pass (cap) completes the weld and forms a cap over the bevel. The number of welding stations for the automatic welding crew varies depending upon the wall thickness of the line pipe.

11) Horizontal directional drilling (HDD) - is often the preferred method for constructing the pipeline across such obstacles as streams or wetlands.

12) Non-destructive testing (NDT) after welding the joints are inspected by non-destructive methods to verify weld integrity. How many welds are inspected varies depending on the code to which the pipeline is designed, the service of the pipeline (gas or oil products), its location (environmentally sensitive areas, highly populated areas or other risk factors) and the requirements of the pipeline owner. Inspection of 100% of the welds is not uncommon. Customary inspection is by internal X-ray, external gamma ray or ultrasonics.

13) Field-joint-coating - the factory-applied external coating does not cover a few inches of each pipe to allow for welding. After NDT inspection, field – joint coating is applied to the bare sections at the pipe welds covering the exposed pipe and the weld.

14) Padding, lowering and backfilling- welded strings of pipe vary in length depending on the terrain conditions but are typically hundreds of feet long. Before the pipe strings are lowered into the ditch, selected padding, usually sand, is placed on the ditch bottom to cushion the pipe. In rocky soil, the fill may be placed around and on top of the pipe (shading). A fleet of sidebooms lifts the string off the timber skids and lowers it into the ditch. The sidebooms use special slings that cradle the pipe on rollers allowing the sideboom to travel down the ROW as the pipe slides into the ditch. The ditch spoil is pushed back into the ditch to cover the pipe except for certain sections that must be left uncovered to make tie-in welds and allow for hydrostatic testing.

15) Tie-in welding - individual pipe string ends are cut and trimmed to join the pipe strings with external clamps accurately aligning the pipe. NDT inspection is performed after the pipe has been welded and the field-joint coating applied. Tie-in welding is also required at road crossings, river crossings and other intersections along the ROW where the main production welding crew cannot access the pipe.

16) Hydrostatic testing, final tie-in - the pipeline is filled with water until the internal pressure in the pipeline exceeds the internal pressure to which the line will be subjected during operation. The elevation profile of the pipeline determines the lengths of the hydrostatic test sections because elevation changes affect the internal pressure. Water for hydrostatic testing is typically taken from rivers and lakes along ROW. Dry areas may require a well to be drilled or water to be delivered by truck along the ROW. After sections have been hydro statically tested, they are joined with a manual tie-in weld. These final welds are NDT inspected. After hydrostatic testing and final tie-in, open sections of the ditch are filled in.

17) Final clean-up, ROW restoration - grading the ROW smooth and clear, placing marker signs to identify the pipeline location, repairing any fences or other structures temporarily removed for construction and seeding the soil to reintroduce vegetation are the final activities. Special attention is paid to drainage and erosion control so that ROW, with time, is restored as closely as possible to its pre-construction while allowing access for regular visual inspections.

The words to be memorized:

backfilling – засыпка траншей трубопровода

bending – сгибание труб

beveling – подготовка кромки welding – сварка
cleaning– расчищение
crane– подъёмный кран
ditching – прокладывание траншеи
external welding – наружная сварка
field-joint coating– изоляция сварного шва
final tie-in – последнее соединение секции
final clean-up – восстановление
grading – планировка, выравнивание
horizontal directional drilling (HDD) – горизонтально-направленное бурение
hydrostatic testing– опрессовка, гидравлические испытания
internal welding – внутренняя сварка
lowering – спуск трубопровода в траншею
line-up– центровка
non-destructive testing (NDT) – неразрушающий контроль
padding – наружная присыпка
pass– проход
Right-of-way (ROW) – отвод земли
road crossing– пересечение дорог
ROW restoration – восстановление
sideboom– трубоукладчик с боковой стрелой
survey – разведка
setting out – установка, трассирование
slings – трубный строп
stringing – укладка плетей трубопровода
skidding the pipe– опорная рама для сварки трубопровода
tie-in welding – соединение секции
welding – сварка

EXERCISE 2 Match the Russian equivalents to the following English words and word-combinations.

A) последнее соединение секции
B) восстановление
C) планировка, выравнивание
D) разведка
E) сварка
F) отвод земли
G) пересечение дорог
H) горизонтально-направленное бурение
I) пересечение дорог
K) изоляция сварного шва
L) внутренняя сварка
M) опрессовка
N) опорная рама для сварки трубопровода
O) подвижной участок фронта нефтепроводных работ
P) укладка плетей трубопровода (вдоль трассы)

1. trenching (ditching)
2. hydrostatic testing
3. padding
4. setting out
5. line-up
6. clearing
7. skidding the pipe
8. **survey**
9. ROW restoration
10. stringing
11. grading
12. lowering
13. welding
14. external welding
15. Field – joint – coating
16. road crossing
17. ROW
18. firing line
19. internal welding
20. tie-in welding
21. HDD

Q) присыпка
R) наружная сварка
S) неразрушающие испытания
T) сгибание труб
U) засыпка траншеи трубопровода
V) расчищение
W) соединение секции
X) спуск трубопровода в траншею
Y) центровка
Z) установка

22. land backfilling
23. final tie-in
24. bending
25. NDT

EXERCISE 3 Match the English equivalents to the following Russian words and word-combinations.

There is one extra Russian word.

1. thickness
2. pass
3. topsoil
4. constraints
5. pipe bend
6. manual welding
7. skid
8. timber
9. circumference
10. uniform
11. consistency
12. plain end
13. strength
14. room
15. low silt
16. fence
17. root
18. cap
19. bevel
20. burial depth
21. leading end
22. stockpile
23. elevation
24. cradle

A) ручная сварка
B) подъем уровня
C) изгородь
D) толщина
E) пахотный слой
F) лотковая опора трубопровода
G) проход
H) место
I) гладкий конец, ненарезанный конец
K) подготавливать кромки
L) колено трубопровода
M) длина окружности
N) врезка в магистральный трубопровод
O) ограничения
P) сплошной
Q) штабель, склад труб
R) илистые отложения
S) опорная рама для сварки трубопровода
T) прочность
U) передний край
V) глубина залегания
W) вершина сварного шва
X) лесоматериал
Y) трубная головка
Z) устойчивость

EXERCISE 4 Read and translate the sentences, using the active vocabulary.

1. How many welds are inspected varies depending on the code to which the pipeline is designed.

2. Crews attach a reaming device to enlarge the pilot hole to accommodate the line pipe.

3. The ditch will be excavated in two passes with a first pass removing topsoil and the second pass excavating the remaining soil to the required pipeline burial depth.

4. After NDT inspection, field-joint coating is applied to the bare sections at the pipe welds covering the exposed pipe and the weld.

5. Line pipe used for the road crossing has a thicker external coating to provide extra protection during installation.

6. NDT inspection is performed after the pipe has been welded and the field-joint coating applied.

7. Together the root and hot passes provide the required fusion and strength to join the pipes permanently.

8. For installing the line pipe, a cap is connected to the leading end of the pipe string.

9. Line pipe is lifted onto skids made of timber and stockpiles along the ROW so that the entire circumference is accessible.

10. The swivel joint is connected to the reamer and the drilling rig again pulls the reamer back through the hole from the pipe side to the rig side, along with the pipe string connected to the reamer.

11. Working space for the construction equipment is used to install the pipeline.

12. Tie-in welding is also required at road crossings, river crossings and other intersections along the ROW where the main production welding crew cannot access the pipe.

EXERCISE 5 Find the definitions to the key words, using the information from this chapter and translate them into Russian.

The definitions:

A) customary inspection by internal X-ray, external gamma ray or ultrasonic.

B) ditch spoil pushed back into the ditch to cover the pipe except for certain sections that must be left uncovered to make tie-in welds and allow for hydrostatic testing.

C) line pipe lifted on skids along the ROW so that the entire circumference is accessible.

D) width determined by the diameter of the pipeline to be installed and includes room for the pipeline and working space for the construction equipment used to install the pipeline.

E) sand placed on the ditch bottom to cushion the pipe.

F) the primary strength weld that fuses the two pipes.

G) laying sections of pipe along the ROW.

H) individual pipe string ends that are cut and trimmed to join the pipe strings with external clamps accurately aligning the pipe.

I) join sections of line pipe providing consistency, uniform welds and fewer repairs.

J) excavated soil (spoil) deposited on the ditch bank.

K) bare sections at the pipe welds covering the exposed pipe and the weld.

L) method for constructing the pipeline across such obstacles as streams or wetlands.

The key words:

1. **HDD**
2. **padding**
3. **ROW**
4. **welding**
5. **trenching (ditching)**
6. **stringing**
7. **skidding**
8. **backfilling**
9. **field-joint coating**
10. **NDT**
11. **root**
12. **tie-in welding**

PIPELINE VALVES AND FITTINGS

EXERCISE 1 Read and translate the text "Valves", using the words after the text.

Valves

Valves are mechanical devices that are installed in pipelines to control flow or pressure. Valves are an important part of piping systems and if not properly selected and operated, they can cause operation problems. The primary valve types, classified by their function, are:

- **control valves** - used to control flow, pressure, liquid level, *cavitation* and *pressure transients;*
- **isolation (block) valves** - placed on each side of control valves and pumps, allowing them to be removed for repair or replacement*;*
- **check valves** - used to prevent reverse flow*;*
- **relief valv**es - admit air to the pipe while the pipe is being drained to prevent excessive vacuum pressures and reduce the possibility of collapsing thin-walled pipes;
- **air valves** - designed to expel large amounts of air at low pressure during filling and release small amounts of pressurized air during operation.

The words to be memorized:

air valve – воздуховыпускной клапан
cavitation – кавитация
check valve – обратный клапан
collapsing – разрушающий
control valve – распределительный клапан
excessive (pressure) – избыточное давление
to expel – исключать
isolation (block) valve – стопорный клапан
operation – работа / процесс
pressure transient – неустановившееся давление / давление в переходном режиме
replacement – замена
release valve – выпускной клапан
relief valve – перепускной клапан

EXERCISE 2 Read and translate the text "Pipe Joints and Fittings", using the words after the text.

Pipe Joints and Fittings

Pipe and fittings are produced in a wide range of materials including: ductile or cast iron, malleable iron, brass, copper, cast steel, plastic and fiberglass. Pipe joints can be permanent or mechanically joined, allowing disconnection. Permanent joints involve welding or crimping metal pipe and cementing plastic pipe. Joints that can be taken apart include threaded, flanged and coupled designs. Flanges can be loose, threaded or welded to pipe ends and are used on metal and plastic pipe.

Threaded

Threading is one of the most popular and least expensive methods of joining steel pipes. The tapered male fitting is forced into the tapered female fitting. Yielding metal creates a seal. Threads other than taper pipe threads can be used for piping connections where tightness of the joint depends on a seal weld or seating surface other than the threads. While threaded joints can be dismantled, it is preferable to use unions. Threaded pipe is available in sizes from 1/16 to 24 in.

Welded

Welded joints are commonly used with steel pipe because these joints are stronger and less prone to leakage than threaded and flanged joints. Also, this method does not add weight to the piping system as flanges do or require a pipe wall thick enough to be threaded.

Pipe up to 2-in. size is generally socket-fitting, fillet welded. Larger pipe 3 – 36 in, is usually butt welded. The most common joint is the circumferential butt joint. During the welding procedure, to avoid entrance of welding material into the pipe, backing rings may be used.

Soldered

A soldered joint is a rigid, pressure-type joint made with a filter metal that, when heated to its melting point, is drawn into the annular space between pipes and fitting by capillary action. This type of joint is generally limited to pipe up to 8 in. because of the difficulty of applying heat evenly to the joint. Bra ing is similar to soldering except higher heat is required for the filler metal. It is used where higher pressure ratings are required.

Compression

Compression couplings usually can be used with all types of pipe and do not require any pipe preparation. They consist of an inner elastometric gasket and an outer metallic sleeve with integral bolts for compressing the gasket. They are available for pipe up to 144-in. OD.

Crimped or grooved

The use of mechanical joints in piping systems is becoming popular. A crimped joint is designed to join light-wall steel and copper pipe, metallic or nonmetallic that is capable of being cut or roll grooved up to 2-in.

Cemented

Solvent joining can be used on vinyl pipe and some others, available up to 12-in. Poly olefin and other pipes require heat fusion and are available up to 6-i. Fibreglass pipe requires an adhesive, resin impregnated fabric or threads to make a joint. It is readily available in sizes from 1/2 to 144-in.

(http://www. Wikipedia.org)

The words to be memorized:

adhesive – связывающий
annular space – кольцевое пространство
backing ring – горловое кольцо
brass – латунь butt welded – сваренный встык
brazing – пайка твердым припоем
butt joint – соединение встык / контактное фланцевое соединение
capillary action – капиллярное действие
cast steel – литая сталь
circumferential – периферический
coupled – сдвоенный
to convey– переправлять
compression – прокладка / набивка / уплотнение
coupling – соединение (муфта)
crimped joint – опрессованное соединение
crimping – гофрирование
disconnection – разделение
dismantle – разбирать
ductile or cast iron – чугун с шаровидным графитом (чугун)
(elastometric) gasket – прокладка / набивка / уплотнение /сальник
female fitting – фитинг с внутренней резьбой
fillet welded – сварка угловым швом
flange – фланец
flanged – ребристый
grooved – гофрированный

(heat) fusion – плавка
impregnated – пропитанный
loose – неприкрепленный
malleable iron – ковкий чугун
prone – свойственно
polyolefin – полиолефин
resin – смола
rigid – негибкий
seal – перемычка
seating surface (seal weld) – монтажный фланец (сварная перемычка)
sleeve – рукав / муфта
socket-fitting – муфта (патрубок)-фитинг
soldered joint – паяное соединение
tapered male fitting – фитинг с наружной резьбой
tapered – конусообразный / клиновидный /скошенный / заостренный
threaded – с резьбой
tightness – герметичность
union – соединение
vinyl (pipe) – винил
welding – сварка
yielding (metal) – пластичный металл

EXERCISE 3 Match the methods with the description. Translate into Russian. The first one has already done.

The discriptions:

A) is a metal-joining process wherein coalescence (соединение) is produced by heating to suitable temperatures with or without the use of filler metal.

B) a substance that hardens under heat to bond pipes.

C) joining light-wall steel and copper pipe, metallic or nonmetallic that is being cut or rolled

D) pressure-type joint made with a filter metal that, when heated to its melting point, is drawn into the annular space between pipes and fitting by capillary action.

E) a continuous helical (винтовое зубчатое колесо) has threads on each end, making it possible to screw two pieces of pipe together.

F) consists of an inner elastometric gasket and an outer metallic sleeve with integral bolts for compressing the gasket.

The methods:

1. **compressed**
2. **soldered**
3. **threaded**
4. **crimped (grooved)**
5. **cemented**
6. **welded**

EXERCISE 4 Read and translate the texts "Valve body" and "Choke replacement", using the words after the texts.

VALVE BODY

The body, sometimes called the shell, is the primary pressure boundary of a valve. It serves as the principal element of a valve assembly because it is the framework that holds everything together.

The body, the first pressure boundary of a valve, resists fluid pressure loads from connecting piping. It receives inlet and outlet piping through threaded, bolted, or welded joints.

Valve bodies are cast or forged into a variety of shapes. Although a sphere or a cylinder would theoretically be the most economical shape to resist fluid pressure when a valve is open, there are many other considerations. For example, many valves require a partition across the valve body to support the seat opening, which is the throttling orifice. With the valve closed, loading on the body is difficult to determine. The valve end connections also distort loads on a simple sphere and more complicated shapes. Ease of manufacture, assembly and costs are additional important considerations. Hence, the basic form of a valve body typically is not spherical, but ranges from simple block shapes to highly complex shapes in which the bonnet, a removable piece to make assembly possible, forms part of the pressure-resisting body.

Narrowing of the fluid passage (venture effect) is also a common method for reducing the overall size and cost of a valve. In other instances, large ends are added to the valve for connection into a larger line.

CHOKE REPLACEMENT

The choke used on wells with contained in produced fluids sand consists of a body with a tightly inserted steel bushing thermally treated or made of hard alloys. Steel gaskets are installed between the choke shoulder and flanges to provide for integrity. When the choke is to be replaced the flowing stream is switched over from the working line to the backup line by means of opening and closing relevant valves.

Two connections on the choke nipple must be unbolted in order to replace the choke, bottom bolts must not be removed from holes. Further, in order to remove the choke it is necessary to move aside the choke nipple, then turn it for 180°, remove from it the deteriorated choke and install a new one. The new choke must be installed in reserve order. Easily removed and adjustable chokes are used to make choke replacement faster and easier.

In order to change the choke flow area, the needle end must be moved to the bushing or from it by means of rotating the handwheel. The choke opening value is shown by the arrow on the indicator. Adjustable chokes can be applied only for wells with small content of sand in flowing fluids.

The words to be memorized:

1. primary pressure boundary – первичная защита от давления;
2. castor forged – отливаются или выковываются;
3. throttling orifice – дросселирующее отверстие;
4. venture effect – эффект Вентури;
5. valve body – корпус задвижки
6. bonnet – крышка корпуса (задвижки)
7. fitting – фитинг
8. adjustable choke –регулируемый штуцер
9. flow area – проходное сечение
10. inlet and outlet – входное и выходное отверстия
11. packing – уплотнение
12. gasket – уплотнительное металлическое кольцо
13. hand wheel – штурвал (задвижки)
14. integrity class – класс герметичности
15. nipple – ниппель
16. pressure drop – падение давления
17. reverse flow – обратный поток
18. rotary motion – вращательное движение
19. stop valves – запорная арматура
20. straight through valve – проходной клапан

EXERCISE 5 Answer the following questions.

1. What is the primary pressure boundary of a valve?
2. How does it serve and why?
3. How does it receive inlet and outlet piping?
4. What is the most economical shape to resist fluid pressure when a valve is open?
5. The basic form of a valve body is spherical, isn`t it?
6. What is a common method for reducing the overall size and cost of a valve?
7. What does the choke used on wells consist of?
8. Why are steel gaskets installed between the choke shoulder and flanges?
9. What is necessary to do in order to remove the choke?
10. Where can adjustable chokes be applied?

EXERCISE 6 Decide whether the statements are true or false. Correct them if necessary.

1. Nominal size and nominal pressure are key characteristics of gate valves.
2. Compared to globe valves gate valves have significantly better integrity.
3. Compared to a gate valve a control valve is much easier to repair.
4. Choke is a variation of needle valve and is used to control well fluid flow.
5. Check valve is used to check volume of pumped fluid.
6. Plug valve can be used both to stop and control fluid flow.
7. Most quick-union connections are designed for work with products containing hydrogen sulfide and are made of materials resistant to aggressive environment.
8. A specific feature of ball valve design is that its body is made in the form of a ball.
9. In rising stem gate valves the stem can rotate and move up and down, and in nonrising stem gate valves the stem cannot rotate.
10. Gate valves maintain straight flow with insignificant pressure drop.

EXERCISE 7 Connect the terms with their definitions.

1. Adjustable choke	1. small pieces such as pipes, nipples or elbows that are used in a pipe system for connecting pipes
2. nipple	2. a valve for very accurate fluid flow control
3. safety valves	3. pipe pieces which are threaded on one end and have a wing union on the other end
4. swing check valve	4. a short pipe that has either threads or welds on both ends
5. elbow	5. a pipeline valve in which the gate is opened by direct fluid flow and is closed by reverse flow
6. ball valve	6. a choke diameter of which can be adjusted
7. fittings	7. a short bent pipe-joint with outside thread on both ends
8. needle valve	8. devices installed on a pipeline to close and open fluid flow
9. quick-union connections	9. a plug valve with the plug in the form of a ball with a through hole
10. stop valves	10. devices installed on a pipeline to release

	excessive pressure in a pipeline

EXERCISE 8 Translate the sentences from English into Russian.

1. The function of safety valves is to relieve excessive pressure in a pipeline by releasing excessive volume of fluid.
2. Materials for valve seat, disk and stem include brass, bronze, malleable iron, steel or alloys or other materials depending upon working temperature and operational conditions.
3. Choke is a variation of needle valve and is used to control well fluid flow, for example, mixture of oil, gas and water produced from a well.
4. Stopping element of swing check valve revolves on its horizontal axis, located above the center of the valve seat.
5. Nipple can have various length and thread on its ends with similar or different step.
6. Pipe elbow is used in cases when in order to lay a pipeline a straight line must be turned towards the set target.
7. Quick-union connections are used to perform well operations, associated with application of mobile equipment during well workover.
8. Working fluid passes through the check valve and lifts the plug, which can come down under its own weight when stream direction changes.
9. Gate valve consists of a handwheel and a disk controlled with a screw-shaped stem, which moves up and down at right angle to fluid flow.
10. A wedge can be solid, flexible and split.

EXERCISE 9 Translate the sentences from Russian into English.

1. В нефтегазовой промышленности применяются различные типы трубопроводной арматуры, которая обеспечивает управление потоком жидкой или газообразной рабочей среды путём изменения проходного сечения.
2. При аварии предохранительная арматура открывается для выпуска жидкости, а защитная арматура закрывается для отсечения защищаемого участка от остальной части трубопровода.
3. Задвижки используются в качестве запорной арматуры и не предназначены для регулирования или дросселирования потока.
4. В задвижках с выдвижным шпинделем шпиндель совершает как вращательное движение, так и поступательное движение вверх-вниз.
5. По сравнению с шиберной задвижкой, регулирующий клапан имеет короткий шток и относительно небольшой износ.
6. Арматура с ручным управлением может быть оснащена зубчатой передачей, снижающей прилагаемые усилия к маховику.
7. Фитинги используются для соединения труб одинакового и разных диаметров, подключения второстепенных трубопроводов к главному, изменения направления прямой линии и т.д.
8. В случае необходимости отсоединения боковой линии от главной работающей линии, резьбовая пробка обеспечивает временное перекрытие отверстия.
9. На основном трубопроводе тройник может быть установлен заблаговременно, а его боковое резьбовое отверстие заглушено при помощи резьбовой пробки, если оно не используется.
10. В отличие от задвижек, в клапанах запорный орган (тарелка) совершает движение в направлении, перпендикулярном плоскости седла.

EXERCISE 10 Read and translate the text "Maintenance of stop devices", using the words after the text.

MAINTENANCE OF STOP DEVICES

Maintenance system of flowing wells includes equipment of their wellheads with X-mas trees. Key elements of X-mas tree are stop devices.

Plug valve and straight-flow valve sealed with grease do not require much effort to control them. In the process of operation of X-mas tree equipped with straight-flow valves stem bearings must be greased every two-three months. Grease must be also packed in compliance with instructions through the choke in the valve body bottom. Integrity of the straight-flow valve gate is improved due to sealing grease, which is automatically supplied to the gate surface by the medium pressure in the valve body.

When X-mas tree with plug stop valves is installed on a well, sealing grease must be additionally packed into all plug valves the gate functioning must be tested. Grease is added with an oil feeder, which is screwed into the stem threaded hole in the place of the pressure bolt. In the process of grease packing the plug valve must be either fully open or fully closed.

When the plug valve is filled with grease the pressure bolt must be put into initial position. Regular greasing of plug valve sealing surfaces provides for continuous integrity of the gate.

For reliable functioning of the gate grease presence in plug valve system must be regularly checked and grease must be packed as required.

Straight-flow valve or plug valve repairs include: disassembling and washing of details in a kerosene bath, their calibration and rejection, repair of deteriorated details and fabrication of new details, assembling of the valve and hydraulic testing.

Simple in design details, which do not require special thermal treatment are fabricated in a mechanical repair shop.

The words to be memorized:

1. straight-flow valve – прямоточная задвижка;
2. plug stop valves – крановые запорные устройства;
3. sealing grease – уплотнительная смазка;
4. oil feeder – масленка;
5. pressure bolt – нажимной болт;
6. grease packing – набивка смазки;
7. calibration and rejection –промер и отбраковка.

EXERCISE 11 Make up your own sentences using the following words:

Control valves, choke, fittings, gate valves, quick-union connections, stop valves, safety valves, plug valves.

EXERCISE 12 Translate the following text into English.

Трубопроводная арматура

Трубопроводная арматура предназначена для управления потоками нефти, транспортируемой по трубопроводам. Арматура делится на три класса: запорная, регулирующая и предохранительная.

Запорная арматура (задвижки) служит для полного перекрытия сечения трубопровода, регулирующая (регуляторы давления) – для изменения давления или расхода перекачиваемой жидкости, предохранительная (обратные и предохранительные клапаны) – для защиты трубопроводов и оборудования при превышении допустимого давления, а также предотвращения обратных токов жидкости. Задвижками называются запорные устройства, в которых проходное сечение перекрывается поступательным перемещением затвора в направлении, перпендикулярном направлению движения нефти.

Регуляторами давления называются устройства, служащие для автоматического поддержания давления на требуемом уровне.

Предохранительными клапанами называются устройства, предотвращающие повышение давления в трубопроводе сверх установленной величины.

EXERCISE 13 Make up your own topic "Pipeline valves and fittings" and be ready to retell it and discuss with your group mates.

HEALTH, SAFETY, ENVIRONMENT

EXERCISE 1 Read and translate the text "Health, safety, environment", using the words after the text.

Health, safety, environment

In the modern business world the abbreviation HSE stands for Health, Safety and Environment. In practice this means that any business has legal responsibilities to ensure the health and safety of employees and other people affected by their business activities while operating in an extremely friendly manner towards the environment.

If you happened to be present at any meeting in a western oil company the first thing you would notice is that the meeting starts with a brief safety introduction, that is to say an action plan that you have to follow in case of emergency. Another example of how seriously HSE is taken is that at every operational meeting or meeting related to the general company performance one of the first indicators to be discussed is performance in HSE. The lower the number of incidents or accidents, the better it is for the company.

Oil companies put HSE first amongst their priorities because the stock market and the shareholders consider the HSE performance of companies to be a main indicator of the professionalism of the company. Everybody who works in companies like these, anywhere, is responsible for getting HSE right. Good HSE performance and the health, safety and security of everyone who works for the Company arc critical to the success of its business.

Goals can be simply stated: no accidents, no harm to people, no damage to the environment. Under these circumstances companies continue to improve the environmental and health impact of their operations by reducing waste, 50 emissions and discharges, and using energy efficiently. They will produce quality products that can be used safely by their customers. ЛИ leaders within companies are held accountable for accomplishing the HSE goals by demonstrating correct HSE behaviors, by clearly defining HSE roles and responsibilities and by providing needed resources and by measuring, reviewing and continuously improving HSE performance. In many companies the yearly bonus is not paid, if the HSE targets are not achieved.

The leadership is responsible for the HSE performance of its workforce. They should do this by personal example, by developing employee's positive attitude towards HSE, setting clear goals and objectives, and creating an environment where employees understand it is all right for them to stop the work if they think HSE rules are not being followed.

All accidents, incidents or any other event causing danger to health safety or environment (including near misses an accident that nearly happens), no matter how severe, need to be reported. Once reported they should be investigated and analyzed to develop learnings which can be used to prevent the same accident from occurring again. These learnings are distributed throughout the company.

Personal protective equipment (PPE) provides the last line of defense in protecting employees from injury and illness in the workplace. It docs not replace prevention of an accident in the first place but it is an essential part of the HSE management system.

Alcohol and drug use is not permitted by the company and leaders shall ensure people under the influence of alcohol or drugs are not permitted to work on any company location. Storage or distribution of alcohol is not permitted anywhere under the company control. The

company will carry out random testing for alcohol and searches for drugs and alcohol. If an employee is found to be addicted to drugs or alcohol the company will contribute to medical treatment.

No work shall commence until the number of HSE conditions are met. Risk and safety assessment have been done. All personnel are appropriately trained to do the work. The correct PPE is being worn. An escape plan form the place of work is in place. A permit to work for hazardous areas has been obtained. If any changes are made to the work conditions after the relevant permissions are obtained then work will stop.

When work is to be carried out at less than 2 m from the edge at a height of 1.3 m or more the following HSE rules must be followed: a fixed platform with hand rails shall be used; a preventer (safety line) shall be used that can bear the weight of at least 700 kg per person attached; special instructions and training for persons working at height shall be given.

Lifting operations utilizing cranes, hoists, or other mechanical devices can be carried out under the following conditions: risk assessment has been carried out prior to the work starting; all involved staff (crane operators, assistants etc) have been trained and certified (and carry the certificates) to operate the lifting machinery. The lifting equipment should have an up to date technical inspection certificate.

Vehicle Requirements: all vehicles must be fit for the purpose and be maintained and in a safe condition; scat belts must be present and functional and the vehicles should be fitted with a fire extinguisher and first aid kit; the number of passengers and loads should not exceed the manufactures specifications.

Drivers Requirements: seat belt must be worn by all the occupants at all times, whenever a vehicle is in motion; drivers must hold the appropriate licenses; drivers must not be under the influence of drugs or alcohol; headlights are to be used day and night during the winter; mobile phones arc not to be used when the vehicle is on motion.

Contractors are one of the key factors in the company's HSE performance. Contractors are expected to follow the same HSE requirements as the employees; therefore contracts will contain an HSE section. The company will use contractors that meet the standards of HSE required and will work with other contractors to help them improve. The company will also continuously monitor the contracts HSE performance and demand improvements when identified.

The crisis and emergency management system is a system of interaction between various company units to manage the company's activities in the event that various incidents, accidents and other emergencies arise.

In the air protection area the company will monitor all polluting emissions including green house gas emission, eliminate continuous flaring of associated gas, strive to avoid working in environmentally protected or sensitive areas, strive to avoid installing impassable obstacles that may prevent migration of animals, minimize the impact on wildlife, minimize the consumption of fresh water; not discharge waste water into the water table, carry out its operations in a manner that doesn't contaminate water sources, continuously monitor its water usage and discharge, optimize land usage to minimize the industrially effected area, avoid operating in native habitation areas or sites of archeological or cultural value, minimize soil erosion.

The words to be memorized:

abuse – злоупотребление

to accomplish HSE goals – достигать поставленные задачи по технике безопасности, охране здоровья и окружающей среды

accident – авария

associated gas flaring – сжигание на факеле попутного газа

backfilling – засыпка траншей трубопровода

to be addicted to smth (v) – злоупотреблять ч-л. (алкоголь и наркотические вещества)

to be certified (v) – быть аттестованным

to be held accountable – быть привлеченным к ответственности
to be under the influence of smth – быть под воздействием ч-л.
biodiversity preservation – сохранение биологического разнообразия
contractor – подрядчик
damage to (v) – наносить ущерб
discharge – сброс (загрязняющие вещества в водной среде)
to eliminate (v) – устранять, ликвидировать
emergency – аварийная ситуация, чрезвычайная ситуация
emissions – выбросы (загрязняющие вещества в атмосфере)
to ensure (v) - обеспечивать, гарантировать
an escape plan – план эвакуации
to exceed – превышать
fire extinguisher – огнетушитель
first aid kit – аптечка первой помощи
to follow the rules – следовать правилам
greenhouse gas – парниковый газ
hand rails – поручни
harm to (v) – причинять вред
hazardous – связанные со скрытой опасностью
headlights – ближний свет фар
HSE (Health, Safety and Environment) – охрана здоровья (ОЗ), техника безопасности (ТБ) и охрана окружающей среды (ООС)
impassible obstacles – непреодолимые препятствия
incident investigation – расследование происшествия
injury – травма, травматизм
learnings – сбор информации
leadership – руководство
legal responsibility – юридическая ответственность
license – водительское удостоверение
lifting operations – работы на высоте
to meet the standards – соответствовать стандартам
near misses – предпосылки к происшествию
operational meeting – оперативное совещание
performance – эффективность деятельности
to permit (v) – разрешать, допускать
Personal Protective Equipment (PPE) – средства индивидуальной защиты (СИЗ)
to prevent (v) – предотвращать, предупреждать наступление последствий
preventer/safety line – страховочное устройство для работы на высоте
to report – сообщать, докладывать
risk assessment – оценка рисков
seat belts – ремни безопасности
security – безопасность
severe – тяжелый (степень тяжести происшествия)
up to date – соответствующий современным требованиям, обновленный
water table – уровень грунтовых вод

EXERCISE 2 Fill in the gaps with the word(s) from the list below. Explonation to these terms are given in the brackets. Translate them into Russian.

1. The accident took place because of the absence of _____ and other necessary equipment at the workplace (**safety line**).
2. At the beginning of field development an oil company should assess the possible _____ to the environment **(influence**).

3. To prevent accidents from occurring again it is necessary to investigate not only incidents, but also _____ (**an accident that nearly happens)**.

4. Before starting oil exploration a company should perform _____ including identification of risks and hazards as well as the ways of removing them (**defining risks out of the work**).

5. The personnel of our company is specially trained in safety method of work _____ (**doing, fulfillment**).

6. The drivers are required to hold the _____ driving licences (**proper, relevant**).

7. Labour protection includes application of _____ in the process of operation (**safety clothes and footwear**).

EXERCISE 3 Match the problems with the ways of their solutions. Translate them.

The problems:

1. The employee was found drunkard on the company location
2. Great damage is done to landscape of the area in the process of field development
3. The operator collapses in the process of pumping fluid
4. The accident happened because the driver was distracted by mobile phone call
5. The crewmember can fall from the platform at 2 meter height

The ways of the problems' solutions:

1. Mobile phones are not to be used when vehicle is on motion.
2. The employee should contribute to medical treatment.
3. The company will remediate the impact to the environment.
4. A preventer shall be used that can bear the weight of at least 700 kg per person attached.
5. The personnel should wear PPE.

EXERCISE 4 Match the key - words with the definitions and translate them into Russian.

key – words:

1. Fire extinguisher
2. Personal protective equipment
3. Seat belts
4. Ear-protector
5. Preventer
6. Respirator

Definitions:

A. a special rope intended for working at height
B. straps in a car to prevent passengers from falling out of it
C. a special tool for extinguishing fire
D. a means of protecting ears from laud noises
E. a means of protecting breathing organs from inhaling harmful gases
F. safety tools given for every worker

EXERCISE 5 Read the text below and match the safety rules to its explanation in the text.

The safety rules:

- Driving safety
- Confined space entry
- Lifting operations
- Energy isolation
- Management of change (MOC)

- Permit to work
- Working at heights
- Ground disturbance

BP's 8 golden rules of safety

1._____ : Before conducting work that involves confined space entry, work on energy system, ground disturbance or hot work in potentially explosive environments, a permit must be obtained. This should be authorized by a responsible person; it should also identify hazards, assess risk and establish control measures.

2. _____ : Working at heights of two meters or higher above the ground cannot begin unless the workers are competent to do this work, and the correct equipment is in place and has been inspected.

3. _____ : An isolation of energy systems, mechanical, electrical, process, hydraulic and others, cannot proceed unless the method and discharge of stored energy arc agreed and executed by a competent person. They should also lest that the isolation is effective and continue to monitor effectiveness periodically.

4. _____ : Entry into any confined space cannot proceed unless all other options have been ruled out and the area has been tested for safety. All affected personnel, including a stand-by person, should be competent and issued with a permit.

5. _____ : Lift utilizing cranes, hoists, or other mechanical lifting devices will not commence unless an assessment of the lift has been completed. The equipment must be certified for use and examined before each lift. The operators must be trained, and the rigging of the load must be done by a competent person.

6. _____ : Work arising from temporary and permanent changes to organization, personnel, system, process, procedures, equipment, products, materials or substances, and laws and regulations cannot proceed unless a Management of change process is completed. This should include a risk assessment conducted by all affected by the changes, authorization of the changes and a clear work plan for the changes.

7. _____ : All categories of vehicle? Including self – propelled mobile plant, must not be operated unless the vehicle has been inspected.

INTERNATIONAL OIL AND GAS RESERVE AUDIT. RISK ANALYSIS OFEXPLORATION OPERATIONS. FAIR MARKET VALUE OF OIL AND GAS OBJECTS.

EXERCISE 1 Read and translate the first text, using the words after the text.

TEXT 1

The estimation of Fair Market Value (FMV) begins with the collection and review of available data. The evaluators are concerned with the type, quantity, and quality of data available because these characteristics determine the valuation approach employed and provide a basis for establishing confidence in the value obtained through the evaluation process. After the data have been collected and examined, a method to estimate FMV must be selected. There are two commonly accepted methods for FMV estimation: the comparable sales approach and the income approach.

The comparable sales approach is a valuation procedure in which the prices paid in prior transactions of similar oil and gas rights or properties are used to value the rights or property to be disposed of through leasing, exchange, or other means. This procedure generally is preferred to income procedures, if prior sales data are available, since it is thought that prices paid in prior transactions of similar oil and gas properties provide the best indication of value. However, in developed oil and gas areas, where tracts tend to be unique and information good, the income approach described below is often used instead. In comparable sales, similar oil and gas rights or

properties are those of similar geologic, engineering, and oil or gas marketing prospects. These characteristics are usually heavily dependent on time and geographic proximity.

The income approach is the alternative approach to the comparable sales approach, and it involves the estimation of annual net income from the expected annual costs and revenues associated with the development of the oil and gas rights or property under realistic conditions. Annual net cash income from the difference between expected annual revenues and costs are discounted to their present value. Thus, the rights or property`s net income potential, discounted to the present, provides an estimate of current tract sale value if similar tract sales data are not available.

The words to be memorized:

1. Fair market value – справедливая рыночная стоимость
2. net pay – эффективная нефтенасыщенная толщина
3. cash flow – поток наличных средств
4. development risk analysis – анализ рисков разработки нефтегазовых месторождений
5. net revenue – чистый доход
6. oil and gas properties (assets) – нефтегазовые объекты
7. producing reserves – разрабатываемые запасы
8. recovery factor – коэффициент нефтеотдачи
9. reserve estimator – эксперт по оценке запасов
10. US Security and Exchange Commission, SEC – комиссия по ценным бумагам и биржам США.

EXERCISE 2 Answer the following questions.

1. What does the estimation of Fair Market Value begin with?
2. Why are the evaluators concerned with the type, quantity and quality of data available?
3. How many methods are commonly accepted for FMV estimation? Name them.
4. What is the comparable sales approach?
5. What characteristics are usually heavily dependent on time and geographic proximity?
6. The income approach is the alternative approach to the comparable sales approach, isn`t it?
7. What does it involve?

EXERCISE 3 Decide whether the statements are true or false. Correct them if necessary.

1. Reserves are categorized by their recoverability.
2. Multi-reservoir pays are more attractive for exploration since the probability of success is higher than for a single-reservoir structure.
3. Risk analysis forms a basis for developing Prospect Inventories and implementing Portfolio Management.
4. Proved resources are those quantities of petroleum which, by analysis of geological and engineering data, can be estimated with 50% certainty to be commercially recoverable.
5. Economic analysis does not take into account the taxes subtracted from the oil price.
6. Fair market value assessment has nothing to do with reserve audit.
7. There are four methods to determine recoverable resources.
8. Exploration efficiency is better determined by annual estimation as compared to a long-term history.

EXERCISE 4 Read and translate the text, using the words after the text.

TEXT 2

The largest uncertainties probably attend forecasts on reserve size, and the smallest are associated with predictions of finding costs. Predictions as to reserves and discovery probability lie almost entirely within the geotechnical purview, whereas finding-cost estimates require input from several other disciplines as well. All three types of predictions are made routinely by geologists, geophysicists, and engineers, and have enormous financial consequences, in as much as they directly impact key elements of risk ventures.

Accordingly, it is somewhat surprising that few data seem to be available as to actual performance records of explorationists` predictions. Most exploration organizations and individuals do not examine predictive performance, and the few that do have been reluctant to publicize their records. The reasons are mostly due to human nature: the forward press of exploratory events, lack of staff continuity, corporate politics, intra-organizational trepidation, individual chagrin, perceived proprietary advantage, and even professional modesty!

The words to be memorized:

Reservesize – величина запасов
Findingcost – стоимость обнаружения
Geotechnical purview – гео-технология

EXERCISE 5 Connect the terms with their definitions.

1. proved reserves	A.unproved reserves which analysis of geological and engineering data suggests are less likely to be recoverable, with a probability of at least 10%
2. possible reserves	B. reserves expected to be recovered from completion intervals which are open and producing at the time of estimate
3. behind-pipe reserves	C. a system of geological and engineering estimates as well as economic analysis based on those estimates that allow to determine OOIP
4. original oil [and gas] in place – OOIP	D. recoverable reserve ratio
5. fair market value and capitalization	E unproved reserves which analysis of geological and engineering data suggests are more likely than not to be recoverable, with a probability of at least 50%
6. producing reserves	F. the price that an interested but not desperate buyer would be willing to pay and an interested but not desperate seller would be willing to accept on the open market assuming a reasonable period of time for an agreement to arise
7. oil and gas reserve audit	G. those quantities of petroleum which, by analysis of geological and engineering data, can be estimated with reasonable certainty to be commercially recoverable
8. probable reserves	H. reserves expected to be recovered from wells not capable of producing for mechanical reasons

9. recovery factor – RF	I. estimated quantities of petroleum contained in the sub-surface, as well as those quantities already produced
10. shut-in reserves	K. reserves expected to be recovered from zones in existing wells which will require additional completion work or future re-completion

EXERCISE 6 Make up your own sentences using the following word expressions.

Cash flow, recovery factor, producing reserves, oil and gas properties, development risk analysis, finding cost, reserve estimator, recoverability, net revenue.

EXERCISE 7 Read and translate the text.

TEXT 3

Given the strategic importance of reliable oil and gas reserves estimates, all major US energy producers with significant oil and gas reserves are currently required by the Securities and Exchange Commission to report their estimates of proved developed reserves and proved underdeveloped reserves in their annual filings with the SEC. The SEC disclosure regulations on reserves date back to the energy crisis of the late 1970s.

The SEC disclosure rules on reserves are highly respected. The SEC uses strict definitions of the terms "proved" and "proved developed" reserves, and there is general consensus in the industry and among analysts that the SEC`s definitions are quite conservative, if not too restrictive. Under SEC definitions, reserves can only go in the "proved" category reporting if there is a "reasonable certainty" that they can be developed at current prices. SEC requires evidence from test wells, rather than allowing companies to rely on newer technologies for estimating reserves. Specifically, the SEC requires that "Reserves are considered proved if economic producibility is supported by either actual production or conclusive formation test".

Companies also provide additional reserves-related data to other federal agencies, including "standardized measure of discounted future net cash flows relating to proved oil and gas reserved quantities".

EXERCISE 8 Answer the following questions.

1. What is currently required by the Securities and Exchange Commission?
2. The SEC disclosure rules on reserves are highly respected, aren`t they?
3. What definitions does the SEC use?
4. Does SEC or FMV require evidence from test wells?
5. Who provides additional reserves-related data to other federal agencies?

EXERCISE 9 Translate from Russian into English.

Аудиторы должны доказать, что с достаточной достоверностью имеется рынок сбыта углеводородов и что имеется или рентабелен и, возможно, будет существовать в ближайшее время экономический метод извлечения, подготовки и транспортировки их на рынок сбыта.

Для того, чтобы отнести эти запасы к доказанным не разбуренным требуется обязательство компании по развитию соответствующей инфраструктуры для добычи, подготовки и транспортировки.

Отсутствие какого-либо значительного прогресса при разработке таких запасов может служить доказательством отсутствия такого обязательства.

EXERCISE 10 Make up your own topic "International oil and gas reserve audit, exploration risk analysis, fair market value of oil and gas properties" and be ready to retell it and discuss with your group mates.

THE IMPACT OF MINING AND OIL EXTRACTION ON THE ENVIRONMENT

EXERCISE 1 Read and translate the text "The impact of mining and oil extraction on the environment", using the words after the text.

Be ready to discuss the answers to the following questions with your group mates.

- What impacts of mining and mineral extraction on the atmosphere, hydrosphere and biosphere do you know?
- What stages of mineral extraction from the subsurface do you know?

The impact of mining and oil extraction on the environment

Coal, oil and gas - fossil fuels - are called conventional fuels because people are accustomed to using them. Today, approximately 80 % of the energy consumed worldwide comes from burning petroleum, natural gas, and coal. However, coal is the dirtiest fuel to burn because it has many impurities which influence the environment.

Mineral deposits represent concentrations of an element or elements to a level at which they can be profitably extractable. As such these deposits represent concentrations of several elements well above crustal abundance. Such naturally occurring high concentrations are reflected in the chemistry of the soils, waters, sediments, plants, etc., close to the deposit. Indeed, measurement of the concentrations of various metals and non-metals in the media such as soil, sediments and waters has been used to locate mineral deposits.

Although there are likely to be significant natural enrichments of several elements in the vicinity of mineral deposits, mining and extraction of the deposit will add greatly to these enrichments. The mining and subsequent beneficiation of minerals and the separation and refining of their various components is one of the most serious sources of contamination of soils, waters, and the biosphere.

Humans have extracted minerals, particularly the metalliferous ores, since ancient times, and the extraction and refining of metals have played a major role in human development. The mining and processing of minerals have increased through time, due to population growth and the greater utilization of raw materials for manufacture. Many areas of past mining activity, in both the Old and New Worlds, bear witness to these extractions in the form of abandoned workings and extensive waste tips. Modern mineral extraction technology is generally far more efficient than past practices, and in many countries such processes are heavily regulated to limit the degree of contamination from extractive industries. However, historical mineral extraction involved less efficient technologies and in those times virtually no environmental regulations were in place. Long-abandoned mineral workings are currently the cause of serious environmental pollution in many countries.

A large number of different materials are extracted from the Earth ranging from fuels such as oil and coal, industrial minerals such as clays and silica, aggregates for building and roadstone, and minerals for fertilizers as well as sources of non-metals. However, the major cause of concern is the metalliferous ores that are used as sources of metals and metalloids.

The extraction and subsequent processing of ores can be summarized as follows:

Mining — crushing/grinding

Mining — concentration of ore mineral

Mining — smelting/refining.

Ores are extracted from the Earth by either subsurface mining, open pit surface techniques, or in a few cases by solution mining, which carries with it risk of groundwater pollution. Both subsurface and surface extraction result in waste material, which is generally piled on the surface in the vicinity of mine. However, while such waste piles, which frequently contain ore minerals, are sources of environmental contamination, it is the subsequent processing of the ores that result in the greatest environmental problems.

The crushing and grinding (comminution) of mineral processing has the objective of separating the ore minerals from the waste, generally referred to as gangue. To effect separation, the mined ore is finely crushed to liberate individual ore mineral grains to enable concentration of the sought after ore mineral. The very fine waste material left after this concentration process is referred to as tailings, and this material can contain, along with the gangue minerals, residual amounts of the ore minerals and can be a serious source of pollution. The tailings are very fine hence are subject to wind ablation and can easily transported by surface runoff. At many mine sites tailings have been left open to the environment resulting in serious contamination of surrounding soil and water.

Following the mining and processing of the ores, the resultant concentrate is transported to a smelter. Pyrometallurgical smelting involves roasting of the ore concentrate at high temperatures with the subsequent emission of large quantities of potentially harmful elements. The smelter emissions can be in the form of gases, such as sulphur dioxide, aerosols, and larger particulates. Modern smelter stacks are fitted with electrostatic precipitators and other dust recovery mechanisms, which results in the retention of most of the particulates, but some gaseous and aerosolic emissions are still released into the atmosphere. Although any larger particulates released are likely to be deposited close to the source, aerosols and gases can be transported long distances and as a result the smelting of ores has far wider aerial impact than the mining and processing of these ores.

The words to be memorized:

ablation – вынос, абляция
beneficiation – обогащение (руды)
contamination – загрязнение
enrichment – обогащение
electrowinning – электрохимическое извлечение
gangue – пустая порода, породные примеси
impact – влияние, воздействие
in the vicinity – в близи чего-либо.
leak, leakage – утечка, течь
particulate – частица
precipitator – фильтр
processing – обработка
retention – удержание
runoff – сток
smelter – плавильная печь
spill – продливание, разливание
spillage – утечка, проливание
tailings – хвосты, шлам
waste tip – отвал, отвальная куча

EXERCISE 2 Give the Russian equivalents to the following word combinations.

to be likely,to be fitted with, to play a major role, to bear witness, to have impact, to carry risk, to be heavily regulated, to be referred to.

EXERCISE 3 Translate the following words and word combinations into Russian. Write down five sentences in English, using these word combinations. Work in pairs: read your sentence and let your partner translate it.

gangue material, ore minerals, ore mineral grains, wind ablation, smelter stack, open pit surface technique, groundwater pollution, surface extraction, mineral extraction technology, population growth, surface run off.

EXERCISE 4 Match the key words with their definition. Translate into Russian.

The key words:

1. **Ablation**
2. **Grinding**
3. **Extraction**
4. **Gangue**
5. **Enrichment**
6. **Smelting**

The definitions:

A) process of increasing the concentration of desirable properties in minerals, improving them in quality and value.

B) process of extracting a valuable material from an ore by heating.

C) valueless and undesirable material in an ore.

D) wearing away of a rock or glacier.

E) process of getting ore or oil from the deposit.

F) process of reduction to small particles by pounding or abrading.

EXERCISE 5 Complete the sentences translating the Russian words.

1. Many surrounding regions are evident to virtually (неконтролируемому) coal extraction.

2. Extensive mineral extraction is still the reason of worry in many countries due to (загрязнения окружающей среды) it causes.

3. Ancient extraction technologies (приводили к) serious environmental pollution.

4. Significant increase in concentration of (некоторых химических соединений) is observed in vicinity of local mineral deposits.

5. The mined ore is finely crushed (чтобы обеспечивать) concentration of the sought after ore mineral.

6. The process of extraction is strictly controlled (для того, чтобы снизить степень загрязнения) of the surrounding soils.

EXERCISE 6 Are the following statements true (T) or false (F)? Correct the false ones with the right information and discuss your answers with a partner.

1. Modern mineral extraction technology is heavily regulated in many countries.
2. Waste material is the greatest environmental problem.
3. Aerosols and gases can be deposited close to the source.
4. Geologists can define mineral deposits by concentration of some elements.
5. Mining and subsequent beneficiation of minerals do not affect the environment.
6. The major cause of concern is mineral extraction such as clays and silica.
7. Mineral extraction is a modern human activity.
8. Tailings are subject to wind ablation and can easily transported by surface runoff.

EXERCISE 7 Read and translate the text and be ready to answer whether the following statements after this text true (T) or false (F). Correct them and translate into Russian.

Through its interdisciplinary environmental teams, industry is directing large amounts of capital and technological resources both to define and resolve environmental challenges. The solution of the complex environmental problems requires the skills and experience of persons knowledgeable in health, sanitation, biology, meteorology, engineering and many other fields.

Each air and water problem has its own unique approach and solution. Restrictive standards necessitate high retention efficiencies for all control equipment. Off-the-shelf items, which were applicable in the past, no longer suffice. Controls must now be specifically tailored to each installation. Liquid wastes can generally be treated by chemical or physical means, or by a combination of the two, for removal of contaminants with the expectation that the majority of

the liquid can be recycled. Air or gaseous contaminants can be removed by scrubbing, filtration, absorption or adsorption and the clean gas discharged into the atmosphere. The removed contaminants, either dry or in solution, must be handled wisely, or a new water- or air-pollution problem may result.

Industries that extract natural resources from the Earth, and in so doing disturb the surface, are being called upon to reclaim and restore the land to a condition and contour that is equal to or better than the original state.

Air quality management. The air contaminants which pervade the environment are many and emanate from multiple sources. A sizable portion of these contaminants are produced by nature. The greatest burden of atmospheric pollutants resulting from human activity comprises carbon monoxides, hydrocarbons, particulates, sulphur oxides and nitrogen oxides, in that order. About 50 % of the major pollutants come from the use of the internal combustion engine.

Industrial and fuel combustion sources together contribute approximately 30 % of the major pollutants.

The general trend in gaseous and particulate control is to limit the emissions from a process stack to a specified weight per hour based on the total material weight processed to assure compliance with ambient air regulation. Process weights become extremely large in steel and cement plants and in large nonferrous smelters. The degree of control necessary in such plants can approach 100 % of all particulate matter in the stack. Retention equipment can become massive both in physical size and in cost. The equipment may include high-energy venturi scrubbers, fabric arresters, and electrostatic precipitators. Each application must be evaluated so that the selected equipment will provide the retention efficiency desired.

Sulphur oxide retention and control present the greatest challenges to industrial environmental engineers. Ambient air standards are extremely low and the emission standards calculated to meet these ambient standards place an enormous challenge on the affected industries. Many copper smelters and all coal-fired utility power plants have large volume, weak-sulphur-dioxide gas streams with limestone slurries or caustic solutions is extremely expensive, requires prohibitively large equipment, and creates water and solid waste disposal problems of enormous magnitude. Installations employing dry scrubbing have been used on very low-sulphur-dioxide gas streams.

Copper smelters are required to remove 85-90 % of the sulphur contained in the feed concentrate. Smelters using the old-type reverbatory furnaces produce large volumes of gas containing low concentrations of sulphur dioxide which is not amenable to removal by acid making. However, gas streams from newer- type flash and roaster-electric furnace operations can produce low-volume gas streams containing more than 4 % sulphur dioxide which can be treated more economically to obtain elemental sulphur, liquid sulphur dioxide, or sulphuric acid. Smelters generally have not considered the scrubbing of weak-sulphur-dioxide gas streams as a viable means of attaining emission limitations because of the tremendous quantities of solid wastes that would be generated.

The task of upgrading weak smelter gas streams to produce products which have no existing market has led to extensive research into other methods of producing copper. A number of mining companies piloted, and some have constructed, hydrometallurgical plants to produce electrolytic-grade copper from ores by chemical means, thus eliminating the smelting step. These plants have generally experienced higher unit costs than smelters and a number have been plagued with operational problems. It does not appear likely that hydrometallurgical plants will replace conventional smelting in the foreseeable future. Liquid ion exchange followed by electrowinning, is also being used more extensively for the heap leaching of low-grade copper. This method produces a very pure grade of copper without the emission of sulphur dioxide to the atmosphere.

Statements:

- Limestone slurries and caustic solutions are used to control sulphur oxide gas emissions.

- Environmental problems require the expertise of people with differing scientific backgrounds.
- Regulations are concerned with emissions into the atmosphere of gases rather than solids.
- 50 % of air pollutants have natural causes.
- Mining industry is no longer allowed to leave the land surface in a disturbed condition.
- There are many devices on the market which can be used to solve all kinds of air and water problems.
- New methods of producing copper by chemical means have been highly successful.
- The highest proportion of atmospheric pollutants produced by man comprises carbon monoxides.
- Useful by-products can be obtained by treating gas streams from modern copper smelting operations.
- Liquid wastes can be largely recycled after treatment.

EXERCISE 8 Discuss with your groupmates the answers to the following questions. Make a presentation on this theme.

What kind of air pollution is found in the Astrakhan region?

What could be done to control them?

WELL DESIGN AND WELL HEAD EQUIPMENT

EXERCISE 1 Read and translate the text "Drilling Rig Components".

Drilling Rig Components

Once the equipment is at the site, the rig is set up. Here are the major systems of a land rig:

1. **Power system**

- Large diesel engines - burn diesel fuel oil to provide the main source power;
- Electrical generators - powered by the diesel engines to provide electrical power;

2. **Mechanical system**

• Hoisting system - used for lifting heavy loads; consists of a mechanical winch (drawworks) with a large steel cable spool, a block-and-tackle pulley and a receiving storage reel for the cable;

• Turntable - part of the drilling apparatus

3. **Rotating equipment**

• Swivel - large handle that holds the weight of the drill string; allows the string to rotate and makes a pressure- tight seal on the hole;

- Kelly- four\six-sided pipe that transfer rotary motion to the turntable and drill string;
- Turntable (rotary table) - drives the rotating motion using power from electric motors;
- Drill string - consists of drill pipe (connected sections of about 30ft\10m) and drill collars (large diameter, heavier pipe that fits around the drill pipe and places weight on the drill bit);
- Drill bit - end of the drill that actually cuts the rock;

4. **Casing**- large-diameter concrete pipe that lines the drill hole; prevents the hole from collapsing and allows drilling mud to circulate

5. **Circulation system** - pumps drilling mud (mixture of water, clay and weighting material and chemicals; used to lift rock cuttings from the drill bit to the surface) under pressure through the kelly, rotary table drill pipes and drill collars:

- Pump- sucks mud from the mud pits and pumps it to the drilling apparatus;
- Pipes and hoses - connects pump to drilling apparatus;
- Mud-return line - return mud from hole;
- Shale-shaker- shaker\ sieve that separates rock cuttings from the mud;
- Shale slide - conveys cuttings to the reserve pit;
- Reserve pit - collects rock cuttings separated from the mud;
- Mud pits - where drilling mud is mixed and recycled;
- Mud-mixing hopper - where new mud is mixed and then sent to the mud pits

6. **Derrick** - support structure that holds the drilling apparatus: tall enough to allow new sections of drill pipe to be added to the drilling apparatus as drilling progresses

7. **Blowout preventer** - high-pressure valves (located under the land rig) that relieve pressure when necessary to prevent a blowout (uncontrolled gush of gas or oil to the surface, often associated with fire).

EXERCISE 2 Find the definitions to the key words, using the information after the text and translate them into Russian.

The definitions:

A) a piece of equipment used to prevent the rotary motion of the kelly (or drill string) from being transferred to the drilling line.

B) a device that is attached to the bails of the traveling block and used to grip joints.

C) a device that has several independently mounted sheaves or pulleys and used to lift and lower elevators.

D) the part of the drive assembly which transmits motion to the kelly and permits the kelly to move vertically while it is rotating or still.

E) a shallow cased hole close to the rotary table. When making up a string, each single is stood here so that it can be connected quickly and easily to the kelly.

F) a piece of equipment designed to mix and prepare drilling mud.

G) a wire rope made up of a number of strands wound around a steel core, used to lift or lower drill pipe.

H) a double or a triple, two or three joints connected together.

I) a piece of equipment used to transfer rotary motion through a master bushing to the kelly, to drillpipe and, eventually, to the drill bit.

J) a device on the top of the derrick that provides means of taking drill line from the hoisting drum to the travelling block.

K) a structure above the well used for drilling string tripping, location of stands and protection of drilling crew against wind and precipitation.

The key words:

1. **swivel**

2. **drill line**
3. **mousehole**
4. **elevator**
5. **traveling block**
6. **kelly bushing**
7. **crown block**
8. **rotary table**
9. **derrick**
10. **shale shaker**

EXERCISE 3 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner.

1. Drilling crew members use scratchers to scratch each other and thus clean themselves of oil.

2. Conductor is a person who knows everything at the drilling site. He is in charge of coordinating work of drilling crews.

3. Elevator is a device for lifting derrickman to the monkey board.

4. Doghouse is a room where security guard and patrol dog live.

5. Drilling cuttings are washed out to the surface with drilling mud made of clay and water.

6. Drill pipe is hollow. The reason for this is to make it possible for the mud to pass through it.

7. Cement job is performed only when quality of casing is poor.

8. Cuttings in a well mean cracks on wellbore walls.

9. The kelly is hexagonal. The reason for that is to make it possible for the rotary table to turn the kelly without slipping.

10. Shale shaker is used for separating fluid from drilling cuttings.

EXERCISE 4 Translate the sentences from Russian into English, using the active vocabulary.

1. При выходе из ствола скважины буровой раствор проходит через вибросито, где шлам отделяется от раствора.
2. Мощность от двигателей передается через лебёдку к ротору при роторном бурении.
3. Колонна бурильных труб и привинченное к ней долото, которое дробит породу, вращаются ротором.
4. Кронблок, талевый блок и буровой крюк составляют талевую систему.
5. Вертлюг представляет собой шарнирное соединение и позволяет колонне бурильных труб вращаться.

6. Буровой насос закачивает в скважину буровой раствор, приготовленный в виброситах.
7. Ротор вращает квадрат, квадрат в свою очередь вращает бурильную колонну и колонна вращает бурильное долото.
8. Буровой раствор вымывает шлам из забоя скважины при бурении.

EXERCISE 5 Read and translate the text "Drilling Rig", fill in the missing words from the box before the text. There is one extra word.

oil; cuttings; crews; mud; derrick; equipment; deposits; penetrate; water; natural gas; holes; mobile

Drilling Rig

A drilling rig is a machine which creates ***1. holes*** and/or shafts in the ground. Drilling rigs can be massive structures housing ***2.*** _____used to drill ***3.*** _____, ***4.*** _____ wells, or ***5.*** _____extraction wells or they can be small enough to be moved manually by one person. They sample sub-surface mineral ***6.*** _____, test rock, soil and groundwater physical properties, and to install sub-surface fabrications, such as underground utilities, instrumentation, tunnels or wells. Drilling rigs can be ***7.*** mounted on trucks, tracks or trailers, or more permanent land or marine-based structures (such as oil platforms, commonly called "offshore oil rigs"). The term "rig" therefore generally refers to the complex of equipment that is used to ***8.*** _____the surface of the earth's crust.

Drilling rigs can be:

• Small and portable, such as those used in mineral exploration drilling and environmental investigations.

• Huge, capable of drilling through thousands of meters of the Earth's crust. Large "mud pumps" circulate drilling ***9.*** _____ through the drill bit and the casing, for cooling and removing the ***10.*** "_____" while a well is drilled. Hoists in the rig can lift hundreds of tons of pipe. Other equipment can force acid or sand into reservoirs to facilitate extraction of the oil or mineral sample; and permanent living accommodation and catering for ***11.***
which may be more than a hundred. Marine rigs may operate many hundreds of miles or kilometres offshore with infrequent crew rotation. Oil and Natural Gas drilling rigs can be used not only to identify geologic reservoirs but also to create holes that allow the extraction of oil or natural gas from those reservoirs. An oil or gas pumping rig, sometimes called a derrick, is used to retrieve oil/gas from a reservoir.

EXERCISE 6 Read and translate the text "Rig system".

Rig system

A rotary rig's main job is to make hole. To make hole, the drilling crew places a bit on bottom, then the driller rotates it and pumps drilling mud to it. A rig needs a multitude of equipment to make these operations happen. A first look at all the gear on a drilling rig can overwhelm you. It is, however, easy to understand a rig's components if you divide them into systems: power, hoisting, rotating, and circulating.

Power system includes:diesel engine 1, diesel engine 2, diesel engine 3 and electric motors.

Hoisting system includes:drawworks, cathead, blocks and drilling lines.

Rotating system includes:swivel, kelly, rotary table, top drive, drill pipe and drill bit.

Circulating system includes:drilling mud, mud pits, mud pumps, rotary hose, return line and shale shaker.

EXERCISE 7 Read and translate the text "Power system", fill in the missing words from the box before the text. There is one extra word.

rig; **power;** fuelt; driller; transfer; drilling; circulate; mix

Power system

Without ***1. power*** nothing on a rig operates. Machinery must have an energy source to make it go. On virtually every drilling rig, the power comes from internal-combustion engines, which are called prime movers. Further, they often use diesel ***2.*** _____. Because of the way diesel engines operate, they deliver more turning force, or torque, than gasoline engines. As a result, many industries, including the ***3.*** _____ industry, use diesels.

A ***4.*** _____may need from two to four prime movers, depending on its size. The bigger the rig, the deeper it can drill and the more power it needs. Thus, big rigs have three or four prime movers. Together, they develop 4,500 horsepower (about 3,300 kilowatts) or more. In comparison, a powerful car engine may put out only 300 horsepower (220 kilowatts) or so; most develop even less.

This power must ***5.*** _____ to the rig's components to make them work. For example, at the same time as the rotary table needs power to turn the bit, the mud pump needs power to ***6.*** drilling mud. What is more, to provide maximum power to a component, the ***7.*** _____must also be able to combine the power of two or more engines. Two common methods transfer power on today's rigs and allow the driller to combine engine power: mechanical transmission and electrical transmission.

EXERCISE 8 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner.

1. The rig height is in propotion to well depth. _____
2. As a rule, big rigs have three prime movers._____
3. Diesel engines are used in drilling industry mainly because of its operation regime._____
4. There are two main ways of power transmission. _____
5. Actually, power is generated by internal – combustion engines almost on all drilling rigs._____

EXERCISE 9 Read and translate the text "Hoisting system components", using the words after the text.

Hoisting system components

The drawworks is one of the largest and heaviest piece of equipment on a rig. It has a spool-shaped revolving drum around which crew members wrap the wire rope they call drilling line. It also has several shafts, clutches, brakes, and chain-and-gear drives. The shafts, clutches, and drives allow the driller to engage and disengage equipment on the drawworks. The driller

can also change the speed with which the drum revolves, thereby varying the speed with which the drawworks raises the traveling block and hook. The driller controls the drawworks from a panel, or console, near the drawworks.

The drawworks also has a heavy-duty main brake. Large bands on both rims of the drum stop the drum from turning when the driller engages the brake. When the brake is disengaged, the drawworks drum lets out drilling line to lower the traveling block. An auxiliary hydraulic or electric brake assists the main brake when the draw-works is raising or lowering heavy loads. The auxiliary brake absorbs some of the momentum created by a heavy load. The main brake thereby works more efficiently.

A cathead is a winch, or windlass, on which a line, such as rope, cable, or chain, is coiled. When activated, the cathead reels in the line with great force. Pulling on a rope, cable, or chain is vital to screwing and unscrewing (making up and breaking out) drill pipe.

A friction cathead is a steel spool a foot (30 centimetres) or so in diameter. It revolves as the catshaft revolves. Crew members used to employ friction catheads and a length of catline—a large-diameter rope made out of plant fiber, or hemp—to move heavy equipment around the rig floor. One floorhand rigged up one end of the catline to the object they wished to move. Another wrapped the other end of the catline a couple of times around the cathead. (Rig hands called this operation "taking wraps around the cathead.") This second crew member gripped the line near the turning cathead and, by pulling hard or not so hard on the line, adjusted the amount of friction the cathead applied to the line. When the crew member tightened the line— applied more friction—on the cathead, the cathead pulled on the catline and lifted the object. When the crew member loosened the catline wraps on the cathead— released the friction—the cathead stopped pulling on the catline.

An automatic cathead also pulls on a wire rope or, in some cases, on a chain, but in a way very different from a friction cathead. Instead of having to manually adjust tension on a line, the driller simply moves a control lever on the console to engage or disengage an automatic cathead. The automatic cathead on the driller's side of the drawworks is the makeup cathead. The automatic cathead on the opposite side of the drawworks is the breakout cathead, which looks exactly like the makeup cathead.

Drilling line is wireline, or wire rope. Drilling line is, however, considerably larger than the wire rope on the tongs. Wire rope is what most of the world calls cable. Wire rope manufacturers make drilling line by braiding several steel wires together. It looks like cloth, or fiber, rope except that it is made from steel wire rather than plant or plastic fibers. Drilling line ranges in diameter from % to 2 inches, or about 22 to 51 millimetres.

First, assume that the derrick is lying horizontally in its cradle in the substructure. The drawworks is on the rig floor and the rig's engines are running. To begin, workers take one end of the rope off the supply reel, which is resting on the ground near the substructure. They pull the line from the reel to the top of the derrick. There the rig builders installed a large set of pulleys, or sheaves, termed the crown block. Crown blocks have several sheaves over which workers string the drilling line. They thread, or reeve, the drilling line over a groove in a crown block sheave. Then they pull the end of the line to another set of sheaves placed near the middle of the derrick. This sheave set is the traveling block.

The driller raises and lowers the traveling block in the derrick as drilling progresses. During string-up, however, the traveling block is also stationary until workers complete the string-up job. To continue stringing up, they reeve the end of the drilling line through one of the traveling block sheaves. Then they pull the line back to the crown block. They reeve the line over another sheave in the crown block and pull it back to the traveling block. There, they reeve the line through another traveling block sheave and pull it back to the crown.

The number of times the workers reeve the line through the blocks depends on the weight the line has to support and on the size of the crown and traveling blocks. Crown blocks and traveling blocks vary in the size and the number of sheaves they contain.

After the workers reeve the line for the last time over the crown block sheaves, they pull the end of the line to the drawworks. They secure the end of the drilling line to the drum in the drawworks. A worker then powers up the drawworks and takes several wraps of line around the drum, much as an angler reels in fishing line after a cast. Since the traveling block is resting on a support that holds it stationary, the line runs through it without moving it. The part of the drilling line running from the drawworks to the crown block is the fast line. It moves when the rig is operating. That is, after the drilling crew readies the rig, the fast line moves on or off the drawworks drum when the driller raises or lowers the traveling block.

During the drilling of a well, the drilling line carries many tons of drill pipe and other tools in and out of the hole over a distance of several miles; or it uses many newtons of force moving drill pipe over a distance of thousands of metres. The crew therefore rates drilling line use in ton-miles or megajoules. (When a line has moved 1,000 newtons of load over a distance of 1,000 metres, the line has given i megajoule of service.) The driller keeps careful track of how many ton-miles (megajoules) of wear occur over time. By consulting specially prepared tables, the driller knows when it is time to slip the line. Slipping the line places unworn line on the wear points where the line goes through and over sheaves in the traveling and crown blocks. The drilling line also wears where it spools off the drawworks drum.

The words to be memorized:

auxiliary – дополнительный, вспомогательный

catline – канат для работ со шпилевой катушкой

fast line – ходовой конец (талевого каната)

cathhead – шпилевая катушка

friction cathhead – фрикционная шпилевая катушка

makeup cathhead, breakout cathhead – шпилевая катушка для свинчивания бурильных труб

brake – тормоз

clutch – муфта

reeve – надевать (на шкив) ось, вал, шток; оснащать (талевую систему); продевать канат (через блок)

shaft – ось, вал, шток

sheave – шкив, блок, ролик

slip –травить канат, скользить; скольжение

spool – шпулька, бобина

winch – лебедка

EXERCISE 10 Fill in the gaps with the correct words from the text. Translate the sentences into Russian.

1. The extra sheave is needed for the deadline.
2. You can lift an object on the rig floor wrapping the rope around a _____.

3. A typical hoisting system is made up of the drawworks, a mast or derrick, the crown block,_____ _____, and the wire rope drilling line.
4. Once the last line has been strung over the _____ sheaves, the end of the line goes down to the drawworks drum, where it is firmly _____.
5. The brake is mounted on the end of the .
6. The main brake is used for _____ and _____ the drawworks drum.
7. For heavier loads, twelve or more _____ could be strung.

EXERCISE 11 Find the definitions to the key words, using the information from the text and translate them into Russian.

The definitions:

A) a cylinder around which wire rope is wound in the drawworks.

B) a spool-shaped attachment on the end of the catshaft, around which rope for hoisting and moving heavy equipment on or near the rig floor is wound.

C) wedge-shaped pieces of metal with teeth or other gripping elements that are used to prevent pipe from slipping down into the hole.

D) it is essentially a large winch that spools off or takes in the drilling line and thus raises or lowers the bit.

E) the end of the drilling line that is affixed to the drum or reel of the drawworks.

F) an assembly of sheaves mounted on beams at the top of the derrick or mast and over which the drilling line is reeved.

G) grooved pulley.

H) a device for arresting the motion of a mechanism, usually by means of friction.

I) the drawworks drum.

J) a wire rope used to support the drilling tools.

The key words:

1. **cathead**
2. **crown block**
3. **drawworks**
4. **sheave**
5. **bit**
6. **drilling line**
7. **brake**
8. **fastline**
9. **drum**
10. **spool**

EXERCISE 12

1) Read and translate the text A "Rotary system components", using the words after the text.

Text A Rotary system components

Rotating equipment includes the devices that make the bit turn. On a conventional rig, the equipment consists of a swivel, an upper kelly cock, a special length of pipe called the kelly, a lower kelly cock, a kelly saver sub, the rotary table, the drill pipe, the drill collars, and the bit . Some contractors install a special system on their rigs called a top drive. It replaces many parts of the conventional rotating system; top drives are discussed in more detail later.

According to the American Petroleum Institute (API), all the pipe between the swivel and the bit, including the kelly, the drill pipe, and drill collars, is the drill stem. (The API is a trade association that sets oilfield standards and specifications.) The drill string includes only the drill pipe — not the kelly and the drill collars. Be aware, however, that practically everybody in the oil patch uses "drill string" to mean the drill pipe and the drill collars.

The words to be memorized:

drive shaft – приводной вал

drill collar –утяжелённая бурильная труба, утяжелённая штанга, воротник бура

drill stem – бурильная колонна, бурильная штанга (при роторном бурении), ударная штанга

drill string – бурильная колонна

die – плашка, оправка

gooseneck – S – образное колено трубы

slips – шлипс, клин

drive shaft – приводной вал

kelly bushing – вкладыш под ведущую бурильную трубу

master bushing – постоянная втулка

tool joint – бурильный замок

to stab – заводить конец верхней трубы в муфту нижней

mate – соединять

saver sub – переводник с перенарезаемой резьбой в бурильной колонне

threaded – с резьбой

2) Read and translate the text B "Rotary system components". Define what is IT in bold in each paragraph using the words before the text.

IT in bold in each paragraph can mean:

- **Tool joints**
- **Kelly**
- **Hose**
- **Rotary table**
- **Diesel engine**
- **Swivel**
- **Drilling stem**

- **Drill bit**
- **Drill string**
- **Top drive**

Text B

1) ***IT*** is a remarkable device. ***IT*** sustains the weight of the drill stem, permits it to rotate, and provides a passageway for drilling mud to get into the drill stem. ***IT*** also has a large bail, similar to the bail, or handle, on a bucket but much, much larger. **IT**'s bail fits inside the hook at the rotary, or kelly, hose to **IT'**s side at the gooseneck. The gooseneck is a curved piece of erosion-resistant pipe. Drilling mud enters **IT** through the rotary hose and the gooseneck.
2) **IT** is square or hexagonal, instead of round, because the flat sides provide a way to make **IT** turn. The driller lowers IT inside a corresponding square or hexagonal openng in the kelly bushing. The kelly bushing fits into another rotating component called the master bushing. The master bushing fits inside the rotary table. Thus, as the rotary table rotates, the master bushing and the kelly bushing also rotate. Since the **IT** mates with the kelly bushing, **IT** also rotates. The pipe rotates because the crew connects it to the **IT'**s bottom. Finally, the drill collars and the bit rotate because the crew connects them to the drill pipe.
3) **IT** passes through the kelly bushing. The master bushing rotates the kelly bushing, which rotates **IT**. The drill pipe, drill collars, and bit rotate as well. They disappear into the rotary table where you can't see them. At the same time, the mud pump sends mud through the rotary hose and into the swivel. From the swivel, the mud flows inside and down the kelly, the drill pipe, the drill collars, and out the bit. The mud shoots out the bit and lifts cuttings up the hole to the surface.
4) The crew fits the master bushing into **IT**. During normal drilling operations, the master bushing drives the kelly bushing. When drilling stops and the kelly bushing is out of the master bushing, the master bushing can hold the slips.. Slips have strong, toothlike gripping elements called dies. Slips fit around the drill string and suspend it in the hole. With the drill string suspended by the slips, the crew can remove the kelly and the swivel from the drill string. The traveling block and hook no longer suspend the drill string.
5) **IT** hangs from the traveling block's hook in place of a conventional swivel. A powerful heavy-duty motor in **IT** turns a threaded drive shaft. The crew stabs, or inserts, the unit's drive shaft directly into the top of the drill stem. When the driller starts **IT's** motor, it rotates the drill stem and the bit. The rig therefore does not use a conventional swivel, a kelly, a rotating rotary table and master bushing, or a kelly bushing. Rigs with **IT** still need, however, a rotary table and master bushing to provide a place for the slips to suspend the pipe.
6) **IT** consists of the drill pipe and special, heavy-walled pipe called drill collars. Manufacturers make **IT** from steel, but they also use aluminum. **IT** is heavier than drill pipe, however. The drilling crew uses them to put weight on the bit to make it drill. They install them in the drill string below the drill pipe. Number of drill collars depends on how much weight the bit needs and on how much the drill collars weigh.
7) **IT** is a threaded piece on each end of the pipe. The pipe maker welds **IT** to the pipe. The crew connects the pipe with **IT. IT** adds a significant amount of weight to drill pipe, but not enough to make it weigh anywhere near as much as drill collars.
8) Manufacturers make two types of **IT** for rotary drilling: roller cone and diamond. Roller cone have steel cone-shaped devices that roll, or turn, as the bit rotates. Most of them have three cones; some have two and some have four, however. **Its** makers mill or forge teeth out of the body of the cones, or they insert very hard tungsten carbide buttons into the cones. The teeth or inserted buttons cut, scrape, or gouge the rock as **IT** rotates.

EXERCISE 13 Find the definitions to the key words, using the information from the text and translate them into Russian. There is one extra definition.

The definitions:

A) a rotary tool that is hung from the rotary hook and the traveling block to suspend the drill stem and to permit it to rotate freely.

B) a heavy coupling element for drill pipe.

C) the heavy steel tubular device suspended from the swivel through the rotary table and connected to the top joint of drill pipe to turn the drill stem as the rotary table turns.

D) a flexible tube for conveying liquids or gases under pressure

E) the principal component of a rotary, or rotary machine, used to turn the drill stem and support the drilling assembly.

F) a device similar to a power swivel that is used in place of the rotary table to turn the drill stem.

G) seamless steel or aluminum pipe made up in the drill stem between the kelly or top drive on the surface and the drill collars on the bottom.

H) all members in the assembly used for rotary drilling from the swivel to the bit.

I) the column of drill pipe with attached tool joints that transmits fluid and rotational power from the kelly to the drill collars and the bit.

J) a special device placed around the kelly that mates with the kelly flats and fits into the master bushing of the rotary table.

K) a heavy, thick-walled tube, usually steel, placed between the drill pipe and the bit in the drill stem.

L) the cutting or boring element used for drilling

The key words:

1. **drill bit**
2. **swivel**
3. **drill collar**
4. **rotary table**
5. **drill string**
6. **hose**
7. **kelly bushing**
8. **kelly**
9. **drill stem**
10. **top drive**
11. **drill pipe**

EXERCISE 14 Read and translate the text "Circulating System", using the words after the text.

Circulating System

Mud circulates through many pieces of equipment, including the mud pump, the discharge line, the standpipe, the rotary hose, the swivel, the kelly (or the top drive), the drill pipe, the drill collars, the drill bit, the annulus, the return line, the shale shaker, the desilter, the desander, the mud pits, and the suction line.

The mud pump draws in mud through a suction line from the mud pits, or tanks, and sends it out a discharge line. From the discharge line, the mud goes into the standpipe. The standpipe runs vertically up one leg of the derrick. Mud exits the standpipe into a strong, flexible, and reinforced rubber hose called the rotary hose, or kelly hose. The rotary hose joins the swivel at the gooseneck. The mud then flows down the kelly (or through the top drive), drill pipe, and drill collars. It jets out of the bit nozzles and moves cuttings away from the bit. The mud and cuttings then head up the hole in the annulus. The annulus, or annular space, is the area between the drill string and the wall of the hole.

The mud leaves the annulus through a steel pipe called the mud return line. It falls over a vibrating screen, the shale shaker. The shaker screens out the larger cuttings and, in some cases, dump them into the reserve pit. Offshore and in environmentally sensitive areas, however, the shaker dumps the cuttings into a receptacle. Later, the contractor removes the receptacle, washes the cuttings if required, and properly disposes of them. In either case, the clean mud drains back into the mud tanks. The pump then recycles it back down the hole. The mud pump recirculates the mud over and over throughout the drilling of the well. From time to time, the derrickhand adds water, clay, and other materials to make up for downhole losses. This crew member also adjusts the mud's properties as the borehole encounters new and different formations.

The words to be memorized:

annulus – кольцеобразный зазор

bulk storage – хранение в резервуаре

discharge line – напорный трубопровод, нагнетательный трубопровод

mud pit – отстойник, амбар для хранения бурового раствора

return line – возвратная линия, канат

rotary hose – нагнетательный шланг роторной буровой установки,
соединяющий стояк с вертлюгом

standpipe – водозаборная колонна

suction line – приёмная линия (насоса),
всасывающий трубопровод (бурового насоса),
впускной трубопровод

EXERCISE 15 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner.

1. Mud is drained into the mud tanks._____

2.The mud properties are changed according to various formation._____

3. Shaker screens always dump the cuttings into the reserve pits._____

4. Having flowed through the swivel, mud flows down the top drive._____

5. Mud is circulated during the drilling of the well._____

EXERCISE 16 Read and translate the texts, using the words after the text.

TEXT 1

EMERGENCY SHUT DOWN SYSTEMS

Emergency Shut Down (ESD) systems are control systems used to safely shut down and isolate equipment at production facilities in the event of abnormal condition occurs which could damage the equipment or pose a hazard to operations personnel or the public. All field operations personnel should have a clear understanding of the function and operation of the ESD systems for the facilities they operate. They must know what control point activates the ESD and take action to maintain conditions within the control limits. They also must know how to reset the ESD devices in the event of a shut down and the procedures necessary to restart the equipment and re-arm the ESD system.

ESD systems can be as simple as a pressure-sensing device which trips a valve on the flow line from a well closed in the event of a high or low pressure in a pipeline or separator. It may also be as complicated as one which monitors various points in a production facility such as vessel pressures, levels, temperatures and flows, and activates isolation valves, stops pumps or compressors, heaters and so on, if any of the many points exceed the designed conditions. ESD systems can be designed only to shut down and isolate equipment, or activate valves that isolate equipment and depressure it to flare. No matter what the ESD system is designed to do, under no circumstances should any of the control points of the system be bypassed or tampered with.

If there are problems that must be corrected within the system, a review of this process should be made to ensure the suggested changes will not create hazards. Only then should the necessary changes be implemented. Too often, personnel bypass parts of the ESD system in an effort to overcome a perceived minor problem and forget about the change. Then an occasion arises where the ESD system should function but cannot and a catastrophic failure occurs resulting in loss of production, damage to equipment, injury and loss of life.

ESD systems are designed to provide a final safety back up in case something goes wrong and should not be made inoperative for any reason.

TEXT 2

WELLHEAD

The wellhead is the equipment used to maintain surface control of the well. It is usually made of steel, cast or forged, and machined to a close fit; and forms a seal to pre-vent well fluids from blowing or leaking at the surface. It is sometimes made up of many heavy fittings with certain parts of the wellhead designed to hold very high pressures. Other wellheads maybe just a simple assembly to support the weight of the tubing in the well, and may not be built to hold pressure.

The kind of head and configuration to be used is determined by well conditions. The high pressure wellhead is required where formation pressures are extremely high. High pressures found in some fields require the use of a heavy wellhead. In the fields where production and pressures are very low, the simple wellhead may be used if only small amounts of gas are produced with the oil.

The wellhead is formed of combinations of parts called the casing head, tubing head, X-mas tree and pressure gauges.

The words to be memorized:

1. Back pressure valve – обратный клапан;
2. Control point – контрольная точка;
3. Emergency shut down system – система аварийного отключения;
4. Floatcollar – муфта обсадной трубы с обратным клапаном;
5. Flow string – лифтовая колонна;
6. Guide shoe – направляющий башмак;
7. Heater – нагреватель;

8. Landing nipple – посадочный ниппель;
9. Perforate – перфорировать;
10. Pressure-sensing device – сенсор давления;
11. Reservoir pressure – пластовое давление;
12. Electrical submersible pump – электрический погружной насос
13. Tamper – трогать, портить.
14. Tamper Artificial lift – механизированная добыча;
15. Tubingless completion –заканчивание скважины без использования лифтовой колонны;
16. Valve – клапан; вентиль; золотник; затвор

EXERCISE 17 Answer questions about the texts.

1. What are emergency shutdown systems used for?
2. What must field personnel know about ESD systems?
3. Give examples of ESD systems.
4. What are the main purposes of ESD systems?
5. In which cases is it admissible to bypass ESD systems?
6. What must be done in case there are problems with ESD systems?
7. What can ESD system bypassing result in?
8. When are ESD systems used?
9. What is the wellhead?
10. What is the wellhead made?
11. Name the components of the wellhead

EXERCISE 18 Insert the omitted word from the text

1. ESD systems can be as simple as a _____ device which trips a valve on the flow line from a well closed in the event of a high or low pressure in a pipeline or separator.
2. The _____ wellhead is required where formation pressures are extremely high.
3. It is usually made of steel, cast or forged, and machined to a close fit; and forms a seal to pre-vent well _____ from blowing or leaking at the surface.
4. No matter what the ESD system is designed to do, under no circumstances should any of the _____ of the system be bypassed or tampered with.
5. It is sometimes made up of many heavy _____ with certain parts of the wellhead designed to hold very high pressures.
6. ESD systems can be designed only to shut down and isolate equipment, or activate _____ that isolate equipment and depressure it to flare.
7. The wellhead is formed of combinations of parts called the casing head, _____, X-mas tree and pressure gauges.

Fluids, tubing head, valves, pressure-sensing, high pressure, fittings, control points.

EXERCISE 19 Give the Russian equivalents to the following word combinations.

1. Pump
2. Isolation
3. Control limit
4. High pressure
5. Valve

6. Pressure-sensing
7. Fittings
8. Control points
9. Pressures gauges

EXERCISE 20 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner. Use the texts 1, 2 if necessary.

1. The personnel should have a clear understanding of the function and operation of the ESD system.
2. Emergency Shut Down (ESD) systems isolate equipment at production facilities in the event of abnormal condition occurs which could damage the equipment or pose a hazard to operations personnel or the public.
3. The wellhead is usually made of glass, cast or forget, and machined to a close fit.
4. ESD systems can be as complex as a pressure-sensing device.
5. The ESD system exclude any catastrophic failure.
6. In the fields where production and pressures are very high, the simple wellhead may be used.

EXERCISE 21 Read and translate the text.

TUBING

As long as the casings must remain in a well for a long time and their repair or replacement would be costly, another string of pipe is placed in the well through which the oil is produced. This is called tubing. During the later life of the well, the same tubing may be used to support a submersible pump or for other means of artificial lift. The tubing is suspended from the wellhead (surface) and usually reaches to within a few feet of the bottom of the well. Tubing is used as the flow string because casing is usually too large to permit the well to flow efficiently, or (in some cases) to maintain continuous flow.

Tubing packers are sometimes used in the tubing string to seal off the space between the tubing and the oil string of casing. This is done particularly in wells where there are high reservoir pressures. By sealing off this space the casing is not exposed to high pressure, and the chances of a casing failure are reduced. Tubing packers also sup-port part of the weight of the tubing in the casing and prevent the tubing string from moving up and down.

Sometimes it is both practical and economical to drill a small diameter hole and use conventional tubing as casing in completing a well. This is called tubing less completion since no retrievable inner string of tubing is used to conduct fluids to the surface. The casing is cemented from bottom to the top and perforated opposite the pay zone. The equipment used is essentially the same as a conventional well, including a float collar, guide shoe with backpressure valve, and landing nipple. Tubing less completions provide for well control, well stimulation, work over and an artificial lift system.

EXERCISE 22 Answer questions about the text.

1. Why is another string of pipe placed in the wellhead?
2. What can be used for artificial lift?
3. How is this tubing installed?
4. Why is tubing used as the flow string?
5. What is the purpose of sealing off the space between the tubing and the oil string of casing?

EXERCISE 23 Connect the terms with their definitions.

1. The equipment	a) packers are sometimes used in the tubing string to seal off the space between the tubing and the oil string of casing.
2. During	b) off this space the casing is not exposed to high pressure, and the chances of a casing failure are reduced.
3. The casing	c) used is essentially the same as a conventional well, including a float collar, guide shoe with backpressure valve, and landing nipple.
4. Tubing	d) the later life of the well, the same tubing may be used to support a submersible pump or for other means of artificial lift.
5. By sealing	e) is cemented from bottom to the top and perforated opposite the pay zone.

EXERCISE 24 Translate into English in written form.

1. Колонна НКТ крепится к фонтанной арматуре и обычно спускается на глубину несколько футов от забоя скважины.
2. Иногда на колонне НКТ устанавливается пакер для изоляции пространства между НКТ и эксплуатационной колонной.
3. Изоляция этого пространства дает возможность защитить обсадную колонну от воздействия высокого давления и, тем самым, уменьшить вероятность ее повреждения.
4. Обсадная колонна цементируется от забоя скважины до поверхности и перфорируется напротив продуктивной зоны пласта.
5. Способ закачивания скважины без использования лифтовой колонны обеспечивает возможность контроля и стимуляции скважины, проведение капитального ремонта и применение механизированной добычи.

EXERCISE 25 Give the English equivalents to the following word combinations.

1. Пробурить скважину
2. Посадочный ниппель
3. Муфта
4. Обсадные колонны
5. Фонтанная арматура
6. Насосно-компрессорные трубы
7. Лифтовая колонна
8. Погружной насос
9. Забой скважины
10. Направляющий башмак

EXERCISE 26 Open brackets and use active or passive form of the verb. Consult the text if necessary.

1. As long as the casings must remain in a well for a long time and their repair or replacement would be costly, another string of pipe (*to place*) _____ in the well through which the oil (*to produce*) _____.

2. Tubing (*to use*) _____ as the flow string because casing (to be) _____ usually too large to permit the well to flow efficiently, or to maintain continuous flow.

3. Tubing packers (*to use*) _____ sometimes in the tubing string to seal off the space between the tubing and the oil string of casing.

4. Tubing packers also (*to support*) _____ part of the weight of the tubing in the casing and (*to prevent*) _____ the tubing string from moving up and down.

5. Tubing less completions (*to provide*) _____ for well control, well stimulation, work over and an artificial lift system.

TYPES OF DRILLING AND INCIDENT PREVENTION

EXERCISE 1 Read and translate the text "Types of Oil Wells", using the words after the text.

Types of Oil Wells

Oil wells come in many varieties. By produced fluid, there can be wells that produce oil, wells that produce oil and natural gas, or wells that only produce natural gas. Natural gas is almost always a by-product of producing oil, since the small, light gas carbon chains come out of solution as it undergoes pressure reduction from the reservoir to the surface. Unwanted natural gas can actually be quite a disposal problem at the well site. If there is not a market for natural gas near the wellhead it is virtually valueless since it must be piped to the end user. Until recently, such unwanted gas was burned off at the wellsite, but due to environmental concerns this practice is becoming less and less common. Often, unwanted (or 'stranded'; gas without a market) gas is pumped back into the reservoir with an injection well for disposal or repressurizing the producing formation. Another solution is to export the natural gas as a liquid. Of course, in locations such as the United States with a high natural gas demand, pipelines are constructed to take the gas from the wellsite to the end consumer.

Another obvious way to classify oil wells is by land or offshore wells. There really is very little difference in the well itself; an offshore well simply targets a reservoir that also happens to be underneath an ocean. Also, due to logistics, drilling an offshore well is far more costly than an onshore well. By far the most common type of well is of the onshore variety. Another way to classify oil wells is by their purpose in contributing to the development of a resource. They can be characterized as:

- production wells when they are drilled primarily for producing oil or gas, once the\producing structure and characteristics are established
- appraisal wells when they are used to assess characteristics (such as flowrate) of a proven hydrocarbon accumulation
- exploration wells when they are drilled purely for exploratory (information gathering) purposes in a new area
- wildcat wells when a well is drilled, based on a large element of hope, in a frontier area where very little is known about the subsurface. In the early days of oil exploration in Texas, wildcats were common as productive areas were not yet established. In modern times, oil exploration in many areas has reached a very mature phase and the chances of finding oil simply by drilling at random are very low. Therefore, a lot more effort is placed in exploration and appraisal wells.

At a producing well site, active wells may be further categorized as:

- oil producers producing predominantly liquid hydrocarbons, but mostly with some associated gas.
- gas producers producing virtually entirely gaseous hydrocarbons.
- water injectors injecting water into the formation either to maintain reservoir pressure or simply to dispose of water produced with the hydrocarbons because even after treatment, it would be too oily and too saline to be considered clean for dumping overboard let

alone into a fresh water source, in the case of onshore wells. Frequently, water injection has an element of reservoir management and produced water disposal.

• aquifer producers intentionally producing reservoir water for re-injection to manage pressure. This is in effect moving reservoir water from where it is not as useful, to where it is more useful. These wells will generally only be used if produced water from the oil or gas producers is insufficient for reservoir management purposes. Using aquifer produced water rather than sea water is due to the chemistry.

• gas injectors injecting gas into the reservoir often as a means of disposal or sequestering for later production, but also to maintain reservoir pressure.

Lahee classification

• *New Field Wildcat* (NFW) - far from other producing fields and on a structure that has not previously produced.
• *New Pool Wildcat* (NPW) - new pools on already producing structure.
• *Deeper Pool Test* (DPT) - on already producing structure and pool, but on a deeper pay zone.
• *Shallower Pool Test* (SPT) - on already producing structure and pool, but on a shallower pay zone.
• *Outpost* (OUT) - usually two or more locations from nearest productive area.
• *Development Well (DEV)* - can be on the extension of a pay zone, or between existing wells *{Infill).*

The words to be memorized:

aquifer – водоносный горизонт или пласт, законтурная зона пласта
by-product – побочный продукт
disposal – сброс, отведение, утилизация
dumping – сброс, утечка
gaseous – газовый, газообразный
injection(input) well – нагнетательная скважина
offshore well – морская скважина
onshore – береговой, прибрежный
on-structure well – скважина, расположенная в нефтеносной структуре
pay zone – продуктивная зона, продуктивный интервал
producing formation – продуктивный пласт
saline – соленый, минерализованный
wellhead – устье скважины
well site – буровая площадка

EXERCISE 2 Fill in the gaps in the sentences with the correct prepositions and translate them.

2. ____ modern times, a lot more effort is placed ____ exploration and appraisal wells.
3. Wells can be classified _____ various aspects.
4. Wildcat wells, based _____ a large element of hope, are used mainly _____frontier area.
5. Wells can be classified ____ their purpose _____ contributing ____ the development of a resource.
6. These kinds of wells are used only when produced water _____ oil or gas producers is insufficient _____ reservoir management purpose.
7. Pipelines are constructed to take crude oil ___ fields ____ the terminals.
8. There is low chance to find oil simply ____ drilling _____ random.

EXERCISE 3 Fill in the gaps with the correct words. Translate the sentences into Russian.

1. Gas is pumped back into the reservoir to repressurize the _____.
2. Development wells are used for extension of a _____ _____.

3. Wildcat wells are used in _____ areas.
4. It's better when the terminal for natural gas is close to the _____.
5. Natural gas is considered to be a _____ of producing oil.
6. Due to environmental concerns, gas is no longer burned off at the _____.
7. One can classify oil wells by land or _____ wells.

EXERCISE 4 Match the well type in English with its definition in Russian.

The definitions:

A) эксплуатационная скважина

B) поисково-разведочная скважина (на новой недостаточно разведанной площади)

C) эксплутационная скважина, (добывающая)

D) поисковая \ разведочная скважина (бурится для обнаружения ранее неизвестного месторождения новых коллекторов, залегающих на других горизонтах, который был открыт на малоисследованной территории)

E) поисковая скважина

F) вновь пробуренная скважина (при постепенном разбуривании месторождения); отдаленная скважина

G) продуктивная скважина

H) наклонная скважина, пробуренная для глушения другой скважины (в случае открытого фонтанирования пожаров); вспомогательная скважина; разгрузочная скважина

I) оценочная скважина, пробуренная для подтверждения присутствия/ оценки углеводородов в пласте-коллекторе, который был открыт на малоисследованной территории

J) скважина, открывшая новое месторождение/вскрывшая новый пласт

K) доразведочная скважина, подтверждающая скважина (вторая пробуренная продуктивная скважина на месторождении)

The key words:

2. **wildcat**
3. **development**
4. **relief**
5. **discovery**
6. **prospect**
7. **production**
8. **appraisal**
9. **step-out**
10. **recovery**
11. **confirmation**
12. **exploration**

EXERCISE 5 Comprehend the following definitions and translate them into Russian.

1. **Crown block** - a device on the top of the derrick that provides a means of taking drill line from the hoisting drum to the traveling block.
2. **Exploratory well** - a pilot well drilled in an area with identified commercial oil and gas bearing capacity to survey size and structure of formations, obtain required initial data to calculate oil and gas reserves and design its development.
3. **Injection well** - a well drilled to inject into pay zones water (air, steam, gas) in order to maintain formation pressure and prolong flowing period of field development, increase rate of production wells equipped with pumps.
4. **Key well** - a well drilled in an unexplored with drilling area to survey composition and age of rocks.
5. **Observation well** - a well drilled to control development of commercial value formations.

6. **Parametric well** - a well drilled in a relatively explored area to survey its geological structure and oil and gas bearing prospects.
7. **Production well** - a well drilled in compliance with the plan of formation development to produce oil and gas.
8. **Wildcat –** a single well drilled to find new commercial depositions of oil and gas.

EXERCISE 6 Learn the following well types in English and in Russian. Work in pairs and ask your partner about different types of wells.

abandoned well – ликвидированная скважина

adjoining well – смежная скважина

appraisal well – оценочная скважина, пробуренная для подтверждения присутствия/ оценки углеводородов в пласте- коллекторе, который был открыт на малоисследованной территории

barren (dry \ non- productive) well – безрезультативная скважина (не дающая промышленного количества нефти)

beam well – скважина, эксплуатирующаяся глубинным насосом

belching well – пульсирующая скважина/ скважина, периодически выбрасывающая жидкость

borderline well – краевая скважина

borehole / bore well – буровая скважина

brought in well – скважина, вступившая в эксплуатацию

cable tool well – скважина, бурящаяся канатным способом

cased through well – обсаженная до забоя скважина

cased well – обсаженная скважина

commercial well – скважина, имеющая промышленное значение

completed well – скважина, законченная бурением / освоенная скважина

confirmation well – доразведочная скважина, подтверждающая скважина (вторая пробуренная продуктивная скважина на месторождении)

controlled directional well – наклонно-направленная скважина

dead well – заглохшая (истощенная) скважина

development well – эксплуатационная скважина (добывающая)

discovery well – скважина, открывшая новое месторождение/ вскрывшая новый пласт

drowned well – обводненная скважина

dually completed well – двухпластовая скважина

edge well – краевая (приконтурная) скважина

exhausted well – истощенная скважина (дебит которой ниже экономического предела эксплуатации)

exploration well – эксплуатационная скважина

infill well – скважина, пробуренная при уплотнении первоначальной сетки размещения скважин

injection (input) well – нагнетательная скважина

intake well – нагнетательная скважина (для нагнетания жидкости в пласт)

junked well – скважина, засоренная железным ломом; скважина, заброшенная вследствие безрезультатной ловли оборванного инструмента

key well – опорная скважина; нагнетательная скважина (скважина для нагнетания сжатого воздуха/ газа)

line wells – скважины, расположенные вдоль границ участка

marginal well - малодебитная (близкая к истощению) скважина

natural well – скважина, выдающая нефть без кислотной обработки, гидроразрыва, прострела без применения насосов

offset well – соседняя скважина, скважина, пробуренная вблизи другой скважины

offshore well – морская скважина

off-structure well – скважина, пробуренная за пределами нефтеносной структуры

on-structure well – скважина, расположенная в нефтеносной структуре

paying well – окупающая себя скважина (экономически выгодная)

pinch out well – скважина, определяющая границу нефтяной залежи/малопродуктивная скважина на границе залежи

production well – продуктивная скважина

prolific well – малодебитная скважина

prospect well – поисковая скважина

recovery well – поисковая/разведочная скважина (бурится для обнаружения ранее неизвестного месторождения новых коллекторов, залегающих на других горизонтах, который был открыт на малоисследованной территории)

relief well – наклонная скважина, пробуренная для глушения другой скважины (в случае открытого фонтанирования пожаров); вспомогательная скважина; разгрузочная скважина

sand (ed) well – скважина, в которой нефтеносным коллектором являются песчаники; скважина, в которую вместе с жидкостью поступает из пласта много песка

service well – вспомогательная скважина

step-out well – вновь пробуренная скважина (при постепенном разбуривании месторождения); отдаленная скважина

stripper well – дебитная скважина, дающая менее 1.5м3/сут нефти

test well – разведочная скважина

twin well – скважина, пробуренная в тех же условия, что и другая скважина того же участка; скважина, пробуренная близко к соседней скважине

well in operation – действующая скважина

well off – простаивающая скважина

well out of control – скважина, фонтанирование которой не удается закрыть

well under control – скважина с закрытым фонтанированием

wellhole – буровая скважина

wild well – некартированная скважина

wildcat – поисково-разведочная скважина (на новой недостаточно разведанной площади)

EXERCISE 7 Read and translate the text", using the words after the text.

STRAIGHT HOLE DRILLING

Frequently it is necessary to drill a straighter hole than was originally planned when the job was started with a certain string of drill collars. Also, it may happen that it is desired to put more weight on the bit without increasing the deviation. The best single proven way to do either of these things with the same string of drill collars is to add stabilizers. For deviation control a single stabilizer is sufficient if it is properly located in the drill string. The proper location is the first bend in the drill string above the bit. Since the bending point depends on the hole size, drill size and weight on the bit, it may occur at different points. To some extent the placement is also dependable on the formation characteristics.

It has been considered good practice in some cases to space additional stabilizers about one stand apart through a portion or all of the rest of the drill collar string. The additional stabilizers do not help to keep the hole straight. They do help in preventing wall sticking and other problems associated with hole conditions.

With the use of stabilizers, it is important to remember that stabilizers are usually the weakest point in the drill string and, therefore, subject not only to wear but failure. Some of the more modern stabilizers have been designed so that the wings do not create a serious hazard in the hole. For example, some of these are made of drillable material and some may be removed with washover pipe.

By reducing the weight on the bit, the bending characteristics of the drill string are changed and the hole will tend to be straighter. One of the oldest techniques for straightening a hole was to reduce the weight on the bit and speed up the rotary table. In recent years it has been found that this is not always the best procedure because reducing the bit weight sacrifices considerable penetration rate.

The straightening of a hole by reducing bit weight should be done very gradually so that the hole will tend to return to vertical without sharp bends and will therefore be much more safer for future drilling.

The words to be memorized:

1. Bending point – точка перегиба
2. Penetration rate – скорость проникновения
3. Space – помещать, размещать
4. Washover pipe – промывочная труба
5. Stabilizer – стабилизатор
6. Sticking – прихват
7. Collar – муфта трубы
8. Drilling equipment – буровое оборудование
9. Rotary table – роторный стол
10. Bottom-holeassembly(BHA) – компоновка инструмента для бурения
11. Logging – каротаж
12. Blowout preventer (BOP) – противовыбросовый превентор
13. Pay zone – продуктивная зона
14. Wild well –неуправляемая скважина;
15. Kill line –линия глушения;
16. Flare pit –факельный амбар;
17. Dummytrip – «холостой» подъем-спуск

EXERCISE 8 Answer questions about the text.

1. What is the best way to put more weight on a bit without increasing deviation?
2. What does the placement of a stabilizer depend upon?
3. What are the purposes of a stabilizer?
4. Describe stabilizer's disadvantages.
5. What was one of the oldest techniques to straighten the hole and what is the disadvantage of this method?
6. What is the proper method to straighten a hole?

EXERCISE 9 Give the English equivalents to the following word combinations.

1. Drilling
2. Formation
3. Stabilizer
4. String
5. The drill collar
6. Sticking, failure
7. The wings, weight
8. To tend
9. The rotary table
10. To sacrifice
11. The straightening
12. Gradually
13. Sharp bend.

EXERCISE 10 Make up sentences out of two parts from the table:

1. For deviation control a single stabilizer …	a) … wall sticking and other problems associated with hole conditions.
2. To some extent the placement …	b) … was to reduce the weight on the bit and speed up the rotary table.
3. The additional stabilizers do help in preventing …	c) … is also dependable on the formation characteristics.
4. Some of the more modern stabilizers …	d) … by reducing bit weight should be done very gradually.
5. One of the oldest techniques for straightening a hole …	e) … is sufficient if it is properly located in the drill string.
6. The straightening of a hole …	f) … have been designed so that the wings do not create a serious hazard in the hole.

EXERCISE 11 Open brackets and use active or passive form of the verb.

1. Horizontal drilling (*to be*) _____ a type of drilling in which directional well gradually becomes horizontal.
2. Drilling incidents (*to include*) _____ oil and gas blowouts, breakage and leaving in a well of drill pipe and casing, drilling bits, down hole engines, pipe string sticking, twist-off.
3. Annular preventer (*to design*) _____ in such a way that it can close annulus around drill pipe, drill collars or completely close an open well.
4. Well blowout can (*to define*) _____ as uncontrolled flow of formation fluid under pressure, which may damage drilling equipment and injure maintenance personnel.
5. Production surveys (*to perform*) _____ to determine production rate of an oil or gas well.

EXERCISE 12 Translate into English in written form.

1. Чтобы контролировать отклонения достаточно одного стабилизатора, если он правильно расположен в бурильной колонне.
2. Дополнительные стабилизаторы не помогают сохранить скважину прямой.
3. С использованием стабилизаторов, важно помнить, что стабилизаторы, как правило, самое слабое место в бурильной колонне.
4. Один из старейших методов для выпрямления скважины было снижение нагрузки на долото и ускорение роторного стола.
5. Скважина будет стремиться вернуться в вертикальное положение без резких перегибов

EXERCISE 13 Read and translate the texts.

TEXT 1

BLOWOUT CONTROL

Hydrocarbon accumulations are becoming more and more difficult to find, and oilmen are drilling deeper and deeper in search for them. In some oilfields the pay zones are about four miles deep. At that depth pressures are extremely high, so there is always the risk of a blowout. A well, which blows out is known as a wild well and forms a gusher.

To prevent a well from blowing out, the mud weight is carefully controlled. The most common material for weighting a drilling fluid is ground barite.

If the bit suddenly enters a high-pressure formation, the weight of the mud column may not be great enough to hold back the pressure of the gas, oil or water in the borehole. Then, there will be a kick; and if the BOP rams cannot be closed quickly enough, the well will blow out. The

flow must be then brought under control, so that heavy mud can be pumped to the well through the kill line. In the case of a gas-well blowout, it may be necessary first to divert the gas into a flare pit. The gas is set ablaze in the flare pit in order to prevent an explosion.

Logging the well can provide information, which may help to avoid dangerous situations down hole. Before the logging tools can be run in, the hole must be clean. If there are any tight spots, for example, it may be necessary to make a dummy trip before the drill string is pulled out. In a dummy trip the string is hoisted only a quarter or a third of the way up. Then it is run back to bottom again. In this way the bottom-hole assembly can be used to clean up the well and prepare it for logging.

TEXT 2
WELL DRILLING EQUIPMENT

Rotary drilling technology operations require different in functional assignments machines, mechanisms and equipment. A set of required for well drilling machines, mechanisms and equipment having interrelated operational functions and technical parameters is called a drilling complex. Drilling rig is the core unit in the drilling complex.

Drilling rig is a complex of drilling machines, mechanisms and equipment mounted in the drilling site and by means of drilling tools providing for independent implementation of well construction process operations. Modern drilling rigs include the following components: drilling equipment (traveling block, mud pumps, draw works, swivel, rotor, power tongs, etc.); drilling structures (derrick, substructure, catwalk and pipe-racks); equipment for heavy work mechanization (mechanisms for automation of pipe tripping operations, pneumatic slips, automatic spinner, auxiliary hoist, control stations); equipment for preparation, treatment and regeneration of drilling mud (preparation block, shale-shakers, desanders and desilters, tanks for chemicals, water and drilling mud) and other equipment.

EXERCISE 14 Answer questions about the text.

1. Why is there always the risk of a blowout?
2. How do you understand the term “a wild well”?
3. What is ground barite used for?
4. Why is gas set ablaze in the flare pit?
5. What is the bottom-hole assembly used for?
6. What is a drilling complex?
7. What is a drilling rig?
8. What components do modern drilling rigs include?

EXERCISE 15 Are the following statements true or false? Correct the false ones with the right information and discuss your answers with a partner.

1. Reciprocating is a method to drill a well.
2. The tool used to determine stuck points is called sticking.
3. Blowouts occur during drilling through formations with relatively high pressure exceeding wash fluid pressure.
4. Blowout preventer is a device installed on casing head to prevent potential blowouts from the well.
5. Pipe rams are designed to close space inside tubing.

EXERCISE 16 Connect the terms with their definitions.

1. Blowout	a) a tool placed above the bit along the bottom hole assembly in order to control hole deviation and prevent differential sticking.
2. Blowout preventer	b) change of drilling direction in order to reach target
3. Stabilizer	c) sudden overshoot of oil and gas under

	pressure from the well that may result in serious damage to equipment, fire, explosion, death and oil spill.
4. Pipe rams	d) a tool placed along the casing joint to limit the movement of centralizes while the casing is run or reciprocated.
5. Well deviation	e) a device for well emergency shut in when there is a danger of oil and gas blowout.
6. Stop-collar	f) a type of BOP rams designed to close annular around drill pipe or tubing.

EXERCISE 17 Make up dialogues on the topics:

1. Straight hole drilling
2. Blowout control
3. Well drilling equipment

2.2.Тестирование

Тестирование – Вопросы и типовые контрольные задания (тесты), описание показателей и критериев, шкал, методические материалы, определяющие процедуры оценивания уровней сформированности результатов обучения

На выполнения всего теста дается определенное время: на решение индивидуального теста отводится 30 мин. Тест считается успешно выполненным в том случае, если он оценивается в 40 баллов (по 1 баллу за каждый верный ответ на закрытые задания). Тест выполняется на индивидуальных бланках, выдаваемых преподавателем, и сдается ему на проверку

Порядок выполнения задания:

Тесты составлены с учетом материала практических занятий по каждой теме дисциплины (модуля). Для подготовки к тестам необходимо изучить материал по каждой теме дисциплины, необходимо понять логику изложенного материала.

При решении тестов необходимо выполнить следующее:

• Прежде всего, следует внимательно изучить структуру теста, оценить объем времени, выделяемого на данный тест, увидеть, какого типа задания в нем содержатся. Это поможет настроиться на работу.

• Лучше начинать отвечать на те вопросы, в правильности решения которых нет сомнений, пока не останавливаясь на тех, которые могут вызвать долгие раздумья. Это позволит успокоиться и сосредоточиться на выполнении более трудных вопросов.

• Очень важно всегда внимательно читать задания до конца, не пытаясь понять условия «по первым словам» или выполнив подобные задания в предыдущих тестированиях. Такая спешка нередко приводит к досадным ошибкам в самых легких вопросах.

• Если вы не знаете ответа на вопрос или не уверены в правильности, следует пропустить его и отметить, чтобы потом к нему вернуться.

• Психологи также советуют думать только о текущем задании. Как правило, задания в тестах не связаны друг с другом непосредственно, поэтому необходимо концентрироваться на данном вопросе и находить решения, подходящие именно к нему. Кроме того, выполнение этой рекомендации даст еще один психологический эффект – позволит забыть о неудаче в ответе на предыдущий вопрос, если таковая имела место.

• Многие задания можно быстрее решить, если не искать сразу правильный вариант ответа, а последовательно исключать те, которые явно не подходят. Метод исключения позволяет в итоге сконцентрировать внимание на одном-двух вероятных вариантах.

• Рассчитывать выполнение заданий нужно всегда так, чтобы осталось время на проверку и доработку (примерно 1/3-1/4 запланированного времени). Тогда вероятность описок сводится к нулю и имеется время, чтобы набрать максимум баллов на легких заданиях и сосредоточиться на решении более трудных, которые вначале пришлось пропустить.

• Процесс угадывания правильных ответов желательно свести к минимуму, так как это чревато тем, что обучающийся забудет о главном: умении использовать имеющиеся накопленные в учебном процессе знания, и будет надеяться на удачу. Если уверенности в правильности ответа нет, но интуитивно появляется предпочтение, то психологи рекомендуют доверять интуиции, которая считается проявлением глубинных знаний и опыта, находящихся на уровне подсознания.

Типовые тестовые задания по темам:

Вариант 1

1. *Read the textbook excerpt and choose the correct answer, using the information from it.*

1.1 What is the purpose of the passage? _____

A. to explain the methods for measuring reserves
B. to describe current global reservoir estimates
C. to give advice on graphing production data
D. to compare oil in place and reserve growth.

1.2 What is NOT part of the volumetric method? _____

A. other fields' assumptions
B. amount of oil in place
C. previous years' production data
D. estimated recovery factors.

1.3 What is part of the materials balance method equation? _____

A. a reserve number
B. petroleum pressure
C. reserve growth
D. volumetric method

Oil workers cannot extract all of the oil in place in a reservoir. The recovery factor is the fraction of petroleum that they can collect. This fraction is also called a reserve. Oil workers measure reserves in several different ways.

In the volumetric method, engineers measure the reservoir's dimensions. They figure in the properties of liquid and rock in the reservoir. This gives them the amount of OIP. Next, they estimate the recovery factor. They figure in assumptions from other reservoirs. Finally, they multiply the recovery factor by the quantity of oil in place. The result is a reserve number. There is a lot of diversity in the kind of liquid in reservoirs. Therefore, recovery factors are different at all reservoirs.

The second process is the materials balance method. Engineers utilize specific equation. The equation computes amounts of produced fluid and the changes in reservoir pressure. This gives them the amount of oil left.

The production decline curve method is the final method. Engineers rely on production data. With it, they measure the decline in oil production over a few years. Then, they graph the numbers. After that, they estimate oil production and reserve growth. They can also speculate about a production trend that is statistically significant.

2. *Match the words or phrases (A-H) with the definitions (2.1-2.8).*

A. assumption	_____the increase of collected oil
B. diversity	2.2_____the estimate of oil in place
C. graph	2.3_____a decrease or reduction
D. decline	2.4_____a variety in something
E. reserve number	2.5_____an important set of numbers
F. reserve growth	2.6_____the recovery factor times oil in place
G. statistically significant	2.7_____statistics about reservoir production
H. production data	2.8_____to chat numbers or results.

3. *Read the webpage about the drillship and mark the following statements as true (T) or false (F), using the information from it.*

3.1 _____ The new drill ship can drill in water six miles deep.
3.2_____ The Endeavor IV uses a shorter riser pipe than other drill ships.
3.3_____ The drill ship has anchors that can be used in shallow water.

Why choose Noble Oceanic?

If you are looking for easy mobility while drilling at sea, look no further. Noble Oceanic has built a state-of-the-art fleet of ultra deepwater drill ships. Our newest ship, Endeavor IV, is capable of drilling in water two miles deep. It can reach oil six miles below the drill floor.

The ship uses 135 meter long stretchers of riser pipe. Other drill ships use 93 meter long pipes. The longer pipes allow for fewer connections.

Currents, winds and tides will not affect the ship's position. The ship has a dynamic positioning system (DPS). This computer system monitors the winds and waves. When necessary, it turns on its six thrusters to compensate for these changes. Our ships also have extensive mooring equipment. This includes 12 anchors suitable for shallower waters.

We are able to modify any of the ships in our fleet to suit your needs. Just send us your design specifications.

4. ***Read the sentences and fill in the blanks with the correct words or phrases before them.***

A) dynamic positioning system
B) anchor
C) modified
D) thrusters
E) design specifications
F) fleet

4.1. The _____ uses computers to ensure that the ship does not move.
4.2 The _____ turn on when currents are strong and move the ship into position.
4.3 The _____ state that there must be accommodations for 230 staff.
4.4 The ship raised the _____ before setting sail.
4.5 The company owns a(n) _____of over forty ships.
4.6 The ship has been _____ to give it better maneuverability.

5. *Read the excerpt and choose the correct answer, using the information from it.*

Each type of well has a slightly different role to play. Before beginning production, drillers need to find oil reservoirs. They use appraisal wells to sample the underground rock. After evaluating the samples, they may drill a production well. These use pumps to get the oil. Occasionally, these flow naturally. Such wells are called flowing wells. However, sometimes the oil does not flow naturally. In that case, they can then drill injection wells to stimulate production. To expand production from a reservoir, drillers often drill offset wells. Regulations determine the spacing of these. For very large reservoirs, they may also put in satellite wells.

5.1 What is the article mainly about? _____

A. the different functions of oil wells
B. why drillers use appraisal wells
C. how to increase oil well flow
D. the regulations used to drill wells.

5.2 Which of the following is NOT a reason for drilling a well? _____

A. to increase production
B. to study rocks
C. to create an oil reservoir
D. to stimulate production.

5.3 When is an injection well drilled? _____

A. when samples are needed
B. when oil does not flow naturally
C. when production is expanded
D. when the reservoir is very large.

6. ***Match the words or phrases (A-H) with the definitions (6.1-6.8).***

A. stimulate	6.1_____a well near a main well
B. spacing	6.2_____a law limiting activity
C. satellite well	6.3_____to increase activity
D. offset well	6.4_____the distance between things
E. evaluate	6.5_____being without any artificial means
F. regulation	6.6_____to test a part of something
G. sample	6.7_____a well at the edge of a reservoir
H. naturally	6.8_____to judge the value of something

7. Choose which word or phrase best fits each blank.

7.1. The company drilled its first successful _____.

7.2. Water was forced down the _____ to stimulate production.

A) injection well
B) production well

7.3. The geologist studied the rocks taken from the _____.

7.4. A pump is not needed for a(n) _____.

A) appraisal well
B) flowing well

8. ***Match the words or phrases (A-D) with the definitions (8.1-8.4).***

8.1 __ leakage
8.2 __ detect
8.3__ seepage
8.4__ breach

A. to break or get through a barrier of some kind
B. the instance of a liquid oozing or trickling out of something
C. to find or discover a fact, or that something exists
D. the instance of a liquid escaping from an object

Вариант 2

1. *Read the article and choose the correct answer, using the information from it.*

1.1 What is the main idea of the article?

A. different ways to create artificial drive mechanisms
B. how to best use reservoir drive mechanisms
C. different types of drive mechanisms
D. how drive mechanisms have improved

1.2 Which of the following is NOT part of a naturally occurring drive mechanism?

A. a gas cap forming
B. water compressed and expanded
C. water or gas injected
D. gas cap expanding and pushing down

1.3 According to the article, why would an artificial drive be necessary?

A. an aquifer does not push up the oil
B. a natural drive does not maintain pressure
C. the pressure drops below the bubble point
D. a gas cap has already been formed

Natural reservoir drive mechanisms
Oil and Gas Digest
Drive Mechanisms by E. Ford.

Natural reservoir drive mechanisms are an important part of producing oil and gas. A virgin reservoir can use the natural pressure to release fluids. Natural drive mechanisms occur to maintain pressure that is lowered due to the release of fluids. Each reservoir can have different pressure points that cause fluids to be released.

One type of drive mechanism is a solution gas drive. In this case, gas is naturally formed due to drops in pressure. Once the pressure drops below the bubble point, gas and liquid can be released, creating a flow.

Another drive mechanism is a gas cap drive, where a gas cap is already formed. This can occur when the pressure is already below the bubble point. The gas cap expands which pushes down and releases the oil.

In some instances, aquifers containing water are present. This can induce a type of drive mechanism known as a water drive. Water can become compressed and then expand to push up the oil.

If natural drive mechanisms are not sufficient to maintain pressure, humans can intervene. An artificial drive can be created by using injections of water or gas.

2. *Match the words or phrases (A-I) with the definitions (2.1-2.9).*

2.1 __ gas cap
2.2 __ aquifer
2.3 __ drive mechanism
2.4 __ water drive
2.5 __ virgin reservoir
2.6 __ gas cap drive
2.7 __ solution gas drive
2.8 __ pressure point
2.9 __ bubble point

A a type of drive mechanism that releases gas when pressure is dropped
B the temperature at which the first bubble appears
C a type of drive mechanism that expands the gas cap which forces out oil
D the layer of gas over an oil zone
E an underground rock through which water can pass or be stored
F a type of drive mechanism that forces oil out due to the expansion of water
G the point at which the pressure is high enough to release fluids
H a reservoir that produces fluids under pressure with pressure declining as fluids are released

I something that causes fluids to leave reservoir rock

3. Read the sentence pairs. Choose which word or phrase best fits each blank.

3.1 If a reservoir does not _____ pressure, the oil will not flow as well.
3.2 The gas cap _____ , causing the oil to be released.
A) maintain B) expanded

3.3 The pressure _____ on the water causing it to compress.
3.4 The water drive caused the oil to be _____ to the surface.
A) pushed down B) pushed up

3.5 If something is _____ , it was created to look or act like something else.
3.6 _____ air takes up far less space than air in the atmosphere.
A) Compressed B)artificial

4. Read the webpage and mark the following statements as true (T) or false (F), using the information from it.

4.1 _____ This company`s mines are located in areas with a lot of oil share.
4.2_____ The company prefers to use surface mining techniques.
4.3_____ The company retorts the oil shale inside the mine.

Oil shale
Petro-eX inc.

At Petro-Ex, we specialize in extracting petroleum from oil shale. We use underground mining techniques to harvest our abundant oil shale deposits. Our preferred method is room and pillar mining. It causes very little environmental surface damage. We pride ourselves on being a company that cares about our Earth. In addition, we use ex situ retorting. This protects our workers from dangerous and combustible oil shale. We have a state-of-the-art extraction plant. There, we use pyrolysis to remove shale oil and shale gas from the rock. The oil and gas are then processed. Finally, they are offered as substitutes for petroleum and natural gas.

5. ***Read the sentences and fill in the blanks with the correct words or phrases (A-F)before them.***

A. oil shale
B. retorting
C. shale oil
D. shale gas
E. combustible
F. room and pillar mining

5.1. Many see _____ as a new form of natural gas.
5.2 The workers use heavy machines to crush the _____ .
5.3_____ is one way to remove the liquid from the shale.
5.4 The company used _____ to prevent tunnels from collapsing.
5.5 Some companies provide _____ as a substitute for natural gas.
5.6 Lighting a match around _____ materials may start a fire.

6 *Read the email and choose the correct answer, using the information from it.*

Indicators of petroleum: Seepage

To: Robert Bollinger r.bollinger@blackwelloil.com

From: Jocelyn Hauser j.hauser@blackwelloil.com
Re: Petroleum Seepage

Hi Bob,

The team found indicators of petroleum at the proposed drill site. We detected seepage, indicating a seal failure. The petroleum was near the surface and already in the dissipation stage. We have not measured pressure in the reservoir yet. We don`t know if the breach is a fracture failure or a capillary failure. Obviously there is tertiary migration occurring if there is visible seepage.

From that we have observed, the extent of the seepage is small. My guess is the leakage is the result of a fracture failure. We will need to do further testing to ensure there is a worthwhile petroleum reservoir in the area. However, due to the seepage we know two things:

- this basin has mature petroleum source rock
- which part of the basin contains hydrocarbons

Based on statistics, 75% of the world`s producing oil fields have seepage. I`m fairly certain this area will yield a profit if we drill here.

Regards,Jocelyn

6.1 What is the main purpose of the email?

A. to compare capillary and fracture failures
B. to describe the tertiary migration stage
C. to notify of a possible petroleum reservoir
D. to explain why further testing is needed

6.2 How does the writer describe the seepage?

A. it is due a capillary failure
B. it is a minimal amount
C. it is still far below the surface
D. it is not visibly noticeable

6.3 Which of the following is NOT mentioned in the email?

A. what stages of seepage have occurred in the reservoir
B. what the seepage tells the team about the reservoir
C. what the pressure measurement of the reservoir is
D. what percentage of oil fields have seepage

7. ***Read the sentences and fill in the blanks with the correct words or phrases (A-F)before them.***

A. seal failure
B. stages
C. extent
D. dissipation
E. tertiary migration

7.1 The oil leaking to a great _____ .
7.2 The petroleum is moving towards the surface in the _____ stage.
7.3 There are three _____ in petroleum seepage.
7.4 The geologist saw evidence of a(n) _____ at the site.
7.5_____ happens when oil disperses above ground

8. *Match the words or phrases (A-D) with the definitions (8.1-8.4).*

8.1 __ indicator
8.2 __ fracture failure
8.3 __ capitally failure

8.4 __ leakage
A act of a capitally breaking so that petroleum escapes
B something that points to or reveals something else
C the instance of petroleum escaping through a fracture
D to break or get through a barrier of some kind

2.3. Письменные сообщения по темам рабочей программы.

Письменное сообщение - это краткий вид письменной работы, представляющий собой развёрнутое изложение на определённую тему. Виды письменных сообщений: эссе и аннотация.

2.3.1 Эссе.

Эссе (письменное изложение) - форма организации оцениваемой деятельности обучающегося, заключающаяся в написании им сочинения небольшого объема и свободной композиции, выражающего индивидуальные впечатления и позицию автора по конкретному поводу или общественно значимой проблеме.

Проработайте учебный материал и изучите дополнительную литературу к теме. Будьте готовы на иностранном языке в письменном сообщении раскрыть следующие аспекты содержания изученной темы:

1. Переработка, хранение и транспортировка нефти.
2. Трубопроводная арматура: ее классификация и основные части.
3. Основной принцип перегонки нефти.
5. Экологическая, промышленная и экономическая безопасность, охрана труда на производстве.
6. Основные элементы системы трубопроводов. Каким образом обеспечивается безопасность трубопровода?
7. Основные международные классификации запасов нефти и газа.
8. Цели и основные этапы определения справедливой рыночной стоимости нефтегазового объекта.
9. Понятия «скважина» и «ствол скважины».
10. Предназначение фонтанной арматуры, ее составные части.
11. Внешние и внутренние компоненты устьевого оборудования.
12. Оборудование устья и конструкция скважины.

Целями написания письменного сообщения являются:

- обучение правилам составления и написания докладов;
- развитие навыков изложения своих мыслей и идей в письменной форме;
- увеличение словарного запаса английского языка, необходимого для оформления различных типов письменных сообщений;
- развитие навыков написания тезисов, конспекта сообщения, в том числе и на основе работы с предложенными текстами;
- наращивание лексического запаса в области профессиональной терминологии на английском языке;
- насыщение лексики идиоматическими оборотами;
- развитие навыков грамотной письменной речи с использованием правильных конструкций английского языка.

Требования к выполнению данного задания:

При подготовке к письменному изложению одного из аспектов изученной темы важен творческий подход, а также умение обрабатывать и анализировать информацию. Студент должен продемонстрировать умения делать самостоятельные выводы,

обосновывать целесообразность и эффективность предлагаемых рекомендаций и решений проблем, а также чётко и логично излагать свои мысли.

Порядок выполнения задания:

- Изучить информацию по теме;
- Повторить грамматический и лексический материал;
- Продумать план работы;
- Письменно логически и грамматически верно оформить работу.

При написании работы соблюдайте следующую структуру изложения: введение, основная часть (раскрывающая поставленную проблему), заключение.

Форма контроля: оценка подготовленного письменного задания (эссе).

Требования к оформлению задания: задние предоставляется в письменной форме

Рекомендуемые источники (см. Список информационных источников п.1-11)

Задание: Подготовить эссе (письменное изложение).

2.3.2Аннотация.

Аннотация - сжатая характеристика содержания и особенностей какого-либо произведения; аннотация может быть написана на курсовые, выпускные квалификационные и другие работы

Проработайте учебный материал и изучите дополнительную литературу к теме. Будьте готовы на иностранном языке в письменном сообщении раскрыть следующие аспекты содержания изученной темы:

1. Подготовка, транспортировка и хранение нефти.
2. Трубопроводная арматура.
3. Переработка нефти.
4. Обеспечение безопасности производства.
5. Международный аудит запасов нефти и газа. Анализ риска геологоразведочных работ. Оценка рыночной стоимости нефтегазовых объектов.
6. Оборудование устья и конструкция скважины.

Целями написания аннотации являются:

- обучение правилам составления и написания аннотаций;
- развитие навыков изложения своих мыслей и идей в письменной форме;
- увеличение словарного запаса английского языка, необходимого для оформления различных типов письменных сообщений;
- развитие навыков написания тезисов, конспекта сообщения, в том числе и на основе работы с предложенными текстами;
- наращивание лексического запаса в области профессиональной терминологии на английском языке;
- насыщение лексики идиоматическими оборотами;
- развитие навыков грамотной письменной речи с использованием правильных конструкций английского языка.

Требования к выполнению данного задания:

При подготовке к аннотации одного из аспектов изученной темы важен творческий подход, а также умение обрабатывать и анализировать информацию. Студент должен продемонстрировать умения делать самостоятельные выводы, обосновывать целесообразность и эффективность предлагаемых рекомендаций и решений проблем, а также чётко и логично излагать свои мысли.

Порядок выполнения задания:

- Изучить информацию по теме;
- Повторить грамматический и лексический материал;

- Продумать план работы;
- Письменно логически и грамматически верно оформить работу.

При написании работы соблюдайте следующую структуру изложения: введение, основная часть (раскрывающая поставленную проблему), заключение.

Форма контроля: оценка подготовленной аннотации

Требования к оформлению задания: задние предоставляется в письменной форме

Рекомендуемые источники (см. Список рекомендуемой литературы п.1-11)

Задание – составить аннотацию текста.

Рекомендуемая литература

1. Фёдорова О.В., Григорьева М.А., Нурмухамбетова С.А. Английский язык в сфере нефтяной и газовой промышленности: учебное пособие/ Астрахан. гос. техн. ун-т. – Астрахань: Изд-во АГТУ, 2021. – 212с.

2. Григорьева М.А., Кочегарова Н.А., Нурмухамбетова С.А. Английский язык для студентов химико-технологического профиля: учебное пособие/ Астрахан. гос. техн. ун-т. – Астрахань: Изд-во АГТУ, 2016. – 162 с.

3. *Байдикова, Н. Л.* Английский язык для технических направлений (B1–B2) : учебное пособие для вузов / Н. Л. Байдикова, Е. С. Давиденко. — Москва : Издательство Юрайт, 2023. — 171 с. — (Высшее образование). — ISBN 978-5-534-08832-8. — Текст : электронный // Образовательная платформа Юрайт [сайт]. — URL: https://urait.ru/bcode/516946

4. Основы нефтегазового дела: Профессиональный иностранный язык (английский) : учебное пособие / составители А. А. Сыскина [и др.]. — Томск : ТПУ, 2020. — 249 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/246275

5. Профессиональный иностранный язык (английский) : учебное пособие : в 2 частях / составители Е. В. Швагрукова [и др.]. — Томск : ТПУ, 2019 — Часть 1 — 2019. — 182 с. — ISBN 978-5-4387-0860-5. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/246323

6. Профессиональный иностранный язык (английский) : учебное пособие : в 2 частях / составители Д. А. Терре [и др.]. — Томск : ТПУ, 2019 — Часть 2 — 2019. — 210 с. — ISBN 978-5-4387-0861-2. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/246326

7. *Левченко, В. В.* Английский язык. General & Academic English (A2-B1) : учебник для вузов / В. В. Левченко, Е. Е. Долгалёва, О. В. Мещерякова. — 2-е изд. — Москва : Издательство Юрайт, 2023. — 304 с. — (Высшее образование). — ISBN 978-5-534-16156-4. — Текст : электронный // Образовательная платформа Юрайт [сайт]. — URL: https://urait.ru/bcode/530541

8. Иностранный язык для академического общения: базовый уровень : учебное пособие / составители Е. А. Захарчук, И. П. Кривко. — Курск : КГУ, 2021. — 45 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/219452

9. Английский язык для академических целей. English for Academic Purposes : учебное пособие для вузов / Т. А. Барановская, А. В. Захарова, Т. Б. Поспелова, Ю. А. Суворова ; под редакцией Т. А. Барановской. — 2-е изд., перераб. и доп. — Москва : Издательство Юрайт, 2023. — 220 с. — (Высшее образование). — ISBN 978-5-534-13839-9. — Текст : электронный // Образовательная платформа Юрайт [сайт]. — URL: https://urait.ru/bcode/511748

Перечень ресурсов информационно-телекоммуникационной сети "Интернет"

http://www.englishforum.com - онлайн-ресурсы для изучающих и преподающих английский язык
http://www.bbc.co.uk - информационные материалы, предоставляемые Британской Телерадиовещательной Компанией
http://learnenglish.britishcouncil.org/en/topics - обучающие материалы, авторами которых
http://www.greatachievements.org/ - информационные англоязычные тексты о крупнейших достижениях в области
http://lingvopro.abbyyonline.com - онлайн-словарь
http://www.videojug.com/ - информационные и обучающие видеоматериалы на английском языке
http://videourokionline.ru/load/video_uroki_obuchenie_yazykam/ - онлайн-видеоуроки по обучению английскому
http://www.den-za-dnem.ru/school.php?item=306 - ресурсы по английскому, немецкому и французскому языкам