Минобрнауки России

федеральное государственное бюджетное образовательное учреждение
высшего профессионального образования
«Санкт-Петербургский государственный технологический институт»
(технический университет)
(СПбТИ(ТУ))

Кафедра иностранных языков

Н.А.Степанова

Химическая технология природных энергоносителей и углеродных материалов

Методические указания
(английский язык)

Санкт-Петербург

2014

УДК 802.0

Степанова Н.А. Химическая технология природных энергоносителей и углеродных материалов : методические указания/Н.А.Степанова Н.А.- СПб.: СПб ГТИ (ТУ), 2014.- 36с.

Методическое пособие включает профессионально-ориентированные тексты для чтения и контрольные лексико-грамматические задания на освоение и закрепление пройденного материала и направлено на развитие навыков чтения и понимания специальной литературы, а также формирование базового запаса общенаучной и профессиональной лексики.

Учебное пособие предназначено для студентов, заочной формы обучения, обучающихся по направлению ”Химическая технология природных энергоносителей и углеродных материалов”, и способствует формированию общекультурной компетенции (ОК) в рамках, предусмотренных учебной программой курса при подготовке бакалавров ОК-14.

Рецензенты: Рябухина Ю.В.,
кандидат филологических наук,
профессор кафедры иностранных языков
института Холода и Биотехнологий НИУ ИТМО

Утверждено на заседании учебно-методической комиссии факультета экономики и менеджмента « 1 »октября 2014

Рекомендовано к изданию РИСоСПбГТИ(ТУ)

Содержание

1-st term

Text 1
Renewable and Non-renewable Sources of Energy

Fossil fuels (coal, oil, gas) result from a transformation of plant and animal material over millions of years. The solar energy originally stored in the plant or animal is eventually converted into energy stored in the plant or the fossil fuel. The fuels are being used at an enormously rapid rate.

Fossil fuels and fuels like uranium are "spent" once they are used to obtain energy. These are called non-renewable sources of energy.

Although new plants can be planted that eventually turn to coal, the process takes millions of years and that is why coal and other fossil fuels are considered non-renewable.

Solar and wind energy arrive and circulate air on the Earth everyday. These sources are called renewable. Wood and trees used as fuel are called renewable, because they can be replanted.

Energy availability and use are good indicators of the standard of living. In the USA the "average consumption" per head is 55 barrels of oil per year, in poorer countries the consumption is 6 barrels.(844)

1. Match English words with their Russian equivalents.

a. consumption	1. нефть
b. renewable	2. уголь
c. source	3. доступность
d. average	4. на душу населения
e. availability	5. сохранять
f. solar	6. подобный
g. oil	7. в конечном счете
h. fossil fuel	8. потребление
i. per head	9. возобновляемый
j. eventually	10. средний
k. coal	11. источник
l. rapid	12. ископаемое топливо
m. store	13. солнечный
n. like	14. быстрый

2.Mach the terms with their definitions.

1. fossil fuel	a. the act of using something
2. renewable resources	b. power obtained from sun's light and heat
3. fossil fuels	c. resources replacing themselves and therefore do not become used up

4. consumption d. fuels like coal, oil and natural gas

3. Fill in the gaps using words from the box.

solar	power	electricity	fossil fuel	consumption	heat
sources	scarce	amount	cause	energy	

Sources of _____ energy are becoming _____ and expensive. They also _____ pollution. Scientists are studying _____ of energy such as _____ .There are two ways to use the sun's _____ Thermal systems produce _____. Photovoltaic systems make _____. _____ of fuel or energy is the _____ of it that is used.

4. Define the part of speech.

Cirrular,circulate,circulation,consider,considerable,consideration,use,usage,useful,useless,indidator,indicate,energy,energetic,energize,consume,consumption, availability,available,rapid,rapidity,renewable,renew,enously,enomous, transform, transformation

5. Find out words with the opposite meaning.

renewable	to spend
rapid	to result in
transformation	in contrast to
to arrive	non-renewable
result from	to lose
to convert into	slow
ingredient	stability
available	to leave
like	originally
eventually	less
over	to stay the same

6. Answer the following questions.

1.What are the main types of fossil fuels?
2. What processes lead to formation of fossil fuels?
3. How much time do those processes take?
4. What are renewable and non-renewable sources of energy?
5. What are the good indicators of standard of living?

*7. Translate into Russian***.**

1.Потребовались миллионы лет для того, чтобы создать ископаемые виды топлива.
2.Ископаемые виды топлива являются не возобновляемыми источниками энергии.
3.Уровень жизни зависит от доступности энергоносителей.
4.В бедных странах потребление нефти в несколько раз меньше, чем в США.

Text 2

Combustion and Energy Release

Combustion involves combinations of the fuel with oxygen. Thus,

$$\mathbf{C + O_2 \longrightarrow CO_2}$$

$$\mathbf{CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O}$$

The basic reaction of our burning of carbon is the basis of our largest energy source ─fossil fuels of various types, including coal , natural gas, and oil. Recall the energy in these bonds came originally from the solar energy captured by plants an then "processed" for millions of years (transformed over millions of years) under the pressure in the Earth.

Coal is mainly carbon, water some hydrogen, and oxygen. There are many different kinds of coal. In addition to hydrogen and oxygen, coal also contains some small amounts of nitrogen, sulfur, and some other minerals. Most of the carbon in coal is bound so that here is only one C-C bond for every C atom. Thus, for calculating the energy release of $C + O_2 \longrightarrow CO_2$ in the case of coal, one assumes only the breaking of one C-C bond.(895).

As coal contains other ingredients ,it works out that the actual yield of 1 Kg of coal is about 700 kcal. The contribution of CO_2 to global change is one of fundamental problems of our fossil fuels.

Aliphatic hydrocarbons are the basis of oil and natural gas. All saturated hydrocarbons react with oxygen at high temperatures to form carbon dioxide and water, and give off energy. This oxidation reaction is the basis of internal combustion engine. Gasoline normally contains hydrocarbons from C_6 to C_{18} , a mixture of over 100 compounds.

An example reaction of the combustion of a hydrocarbon is:

$$C_7H_{17} + 11\,CO_2 \longrightarrow 7\,CO_2 + 8\,H_2O + \text{energy}$$

1.Match English words with their Russian equivalents.

combustion	природный газ
the basis	связь
bond	разрыв
plant	компонент
breaking	углеводород
ingredient	насыщенный
yield	растение
aliphatic	горение
saturated	основа
hydrocarbon	выход

2.Match the words with similar meaning from column A and B.

A	**B**
combustion	to include
type	link
various	quality
to capture	to combine
kind	burning
amount	in the event
every	to absorb
to give off	different
in addition to	hence
to react	each
amount	to liberate
in case	to change
to transform	largely
mainly	besides

3.Fill in the gaps using words from the box and then translate the sentences into Russian.

combustion oil reserves source bond fossil fuels hydrocarbon

1. Natural gas is composed of mixture of the four short _____ molecules.

2. _____ include coal, natural gas, and oil.

3. Burning(or a _____ reaction) consists of combining with oxygen at high temperatures.

4. The amount of energy released when a _____ is formed between atoms is called bond energy.

5. It has taken about 600 mln years for the world's oil _____ to be formed.

6. It is probable that _____ production is currently at or very near its peak.

7. Crude oil can be used as an energy _____ or as chemical feed stock.

4.Translate the following sentences from English into Russian paying attention to the meaning of the word one.

1.There is only one C-C bond for every carbon atom in coal.
2.One assumes the breaking C-C bond in the case of coal.
3.One of the fundamental problems of fossil fuels is air pollution.
4.One must know that combustion involves combination of fuel with oxygen.
5.One can consider aliphatic hydrocarbon as the basis of oil and natural gas.
6. One should distinguish different types of coal.
7. This reaction is also exothermic as that one
8. One fifth of air by volume is oxygen.

5.Define the part of speech.

Nature, natural, pressurize, pressure, difference, differ, different, add, additional, addition, amount, calculate,(the) calculating, break,(the) breaking, actual,actuality,gaseous,saturate,saturation,oxidation,oxidize,oxide,reaction,reactive,react.

6. Complete the expressions with correct form of the word in bold.

1. **various** types	_____ of methods
2.sources of **energy**	an _____ person
3. under **pressure**	_____ water
4. the **basis of** the theory	the _____ argument
5.**natural** gas	the laws of _____
6.**saturated** hydrocarbons	_____ of market
7.**react** with oxygen	_____ of combustion
8.**different** kind	_____ in properties

9.**burning** of fuels _____ black
10.**breaking** of chemical bonds coffee _____
11.**calculating** the energy a result _____
12.to **form** carbon dioxide the _____ of a new compound

7. Answer the following questions.

1. Due to what reaction all saturated hydrocarbon are used for supplying energy?
2. What are our largest energy source?
3. What can you say about the process of creation energy sources?
4. What is the chemical composition of coal?
5. What compounds are the basis of oil and natural gas?

8. Translate into Russian.

1.Ископаемые виды топлива включают уголь, нефть и природный газ.
2.Помимо водорода и азота уголь также содержит небольшое количество азота, серы и других минеральных веществ.
3.Разрыв связи C-C сопровождается выделением энергии.
4.Вклад CO_2 в глобальное изменение климата является одной из основных проблем ископаемого топлива.
5.Бензин (Gasoline) обычно содержит углеводороды от C_6 до C_{18} и представляет собой смесь, содержащую больше, чем 100 соединений.

Test-papers for the first term

№ 1

1.Translate into Russian

Petroleum

The world petroleum comes from the Greek language. Petro means rock, and oleum means oil. In it strictest sense, petroleum includes only crude oil. However, in usage petroleum includes both crude oil and natural gas. The two most important elements in both crude oil and natural gas are carbon and hydrogen. Due to that fact crude oil and natural gas are called hydrocarbons.

The difference between crude oil and natural gas is the size of the hydrocarbon molecules. Under surface temperature and pressure, any hydrocarbon molecule that has one, two, three or four carbon atoms occurs as a gas. Any hydrocarbon molecule with five or more carbon atoms occurs as a liquid. Crude oil is a mixture of more than 1000 hydrocarbon molecules that range in size from 5 to more than 60 carbons in length. The hydrocarbon molecules in oil form straight chains, chains with side branches, and circles.

Sulfur is an undesirable impurity in fossil fuels such as crude oil, natural gas, and coal.(982)

№2

1.Translate into Russian

Crude Oil Grades

Crude oils are classified as sweet and sour on the basis of their sulfur content. Sweet crudes have less than 1% sulfur by weight, whereas sour crudes have more than more 1 % sulfur. The refiner usually pays a US $1 to $3 per barrel premium for sweet crude. In general, heavy oils tend to be sour, whereas light oils tend to be sweet. At a refinery, low sulfur crude has 0 to 0.6% sulfur. Intermediate sulfur crude has 0.6 to 1.7%sulfur, and high sulfur crude has above 1.7% sulfur.Most of the sulfur in crude oil occurs bonded to the carbon atoms.A very small amount can occur as elemental sulfur in solution and as H_2S gas. In general, the smell varies from gasoline(sweet crude) to foul(sour crude) to fruity(aromatic crude). During the refining process, the refiner must remove the sulfur as the crude oil is being processed. If not, the sulfur will harm some of the chemical equipment in the refinery. (907)

Устная тема

St-Petersburg State Institute of Technology (Technical University)

St -Petersburg State Institute of Technology was founded on November 28, 1828. It was the first, and for a long time the only technological institute in Russia training technical specialists, engineers and managers of factories.

The growth of the Institute was closely connected to development in industry and science. It played a great role in the training of specialists for rapidly growing industry.

In 1972 the Institute became the Technical University. The Institute confirmed its status in 1993 after formation of Russian Federation. Since then it has been training engineers according to individual programmes and curricula.

In 2011 a new structure was established at the Institute. At present St.Petersburg Institute of Technology trains specialists at 6 full time faculties: chemical substances and materials, chemical and biochemical technology, mechanical, information and control systems, engineering, economics and management. The Institute offers also extra-mural education.

Now in accordance with new demands the Institute has a multilevel structure of studies and is engaged in training Bachelors, Masters and Specialists.

A Bachelor's degree is the first university level which is equivalent to a B.Sc. in Western Europe and the USA.A Master's degree is postgraduate higher education which is equivalent to a Master's degree in Western Europe and the USA. The Bachelor's degree programmes last four years of full-time university-level study. The Bachelor's degree is awarded after defending a Diploma project prepared under the guidance of a supervisor and passing the final exams. Having obtained the Bachelor's degree, students are admitted to enter the Master's programme or continue their studies in the framework of the Specialist Diploma programmes. The Master's degree is awarded after successful completion of two years's full-time study. Students must carry out a one-year research including practice and submit and defend a thesis which is original research and pass final exams. The programmes are elaborated in accordance with the State Educational Standards which regulate about 80% of their content.

The Institute offers as well post-graduate courses for would be Candidates of Science in the following specialties: organic and analytical chemistry, physical and colloid chemistry, biotechnology, automation of technological processes ... etc. Faculties have specialized counsels to confer Candidate degrees.

Many famous scientists worked and took part in the education of engineers and technologists at the Institute, among them the creator of Periodic System of the Elements D. E Mendeleev, the founder of the modern science of metals D. K.Chernov. At the Institute museum one can see original documents of D.I. Mendeleyev and D.F. Chernov, books and articles by outstanding scientists which were published during their life.

Today the Institute is a large educational and scientific centre. Anyone who has a secondary education may apply to the Institute. The applicants used to take entrance examinations, but they don't do it any more. According to the new rules the applicants have to submit a certificate of passing Unified State Exam in several subjects.

Among the teaching staff are academicians and associate members of Russian and international Academies, state prizewinners, honored workers of science and technology, professors, doctors of science, assistant professors and candidates of science. The Institute is headed by the Rector, Professor Lisitsyn N.V., a Doctor of technical science. Dr. Lisitsyn is also the head of the department of resource-saving technologies. There are also several prorectors. They take care of the administrative activities necessary for the efficient functioning of the Institute.

The academic year is divided into two terms. During the term the students attend lectures, practical and laboratory classes, seminars, etc. At the end of the term they take written and oral tests and examinations. There is a winter and a summer vacation period. The Institute has many well-equipped auditoriums, numerous research and educational laboratories. The management of our Institute is responsible for providing the laboratories with up-to-date equipment.

The Institute library is our pride. It is one of the best in the country among technical universities — light, spacious, comfortable halls, qualified personnel, a rich collection of books including indispensable journals on chemistry and chemical technology and a wide selection of fiction literature at the disposal of the students and research workers. The total collection of the library numbers around one million volumes and now they are available in electronic form. There is free of charge access to the Internet at the Institute’s library. Undergraduate and postgraduate students spend a large amount of time in the library.

The undergraduates are involved in research work at different departments of the Institute and some of this work is highly estimated and recommended for practical application and publication in scientific journals. Due to their education, in a wide range of subjects, the graduates of the Institute may work in different branches of chemical industry and at research institutes. The best students have the possibility to become postgraduate students.

2- nd term

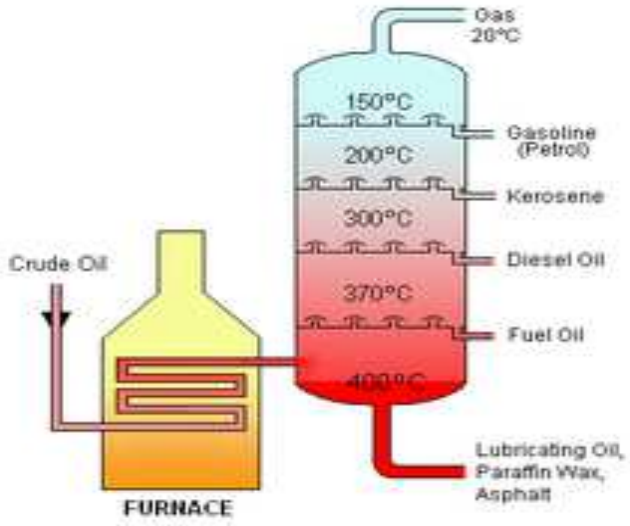
Text 1

Refining

During the refining process, various components of crude oil are separated by their boiling points. In general, the longer the hydrocarbon molecule, the higher its boiling temperature

At the refinery oil is first heated in a furnace until most is vaporized. The hot vapour is then sprayed into a distilling column. Gasses rise in the distilling column and any remaining liquid falls. In the distilling column bubble trays are filled with liquid. The rising vapours bubble up through the trays and are cooled. The cooling vapours condense into liquid on the trays where they are then removed by sidedraws. Each liquid removed by cooling is called a cut. Heavy cuts come out at high temperatures, whereas light cuts come out at low temperatures.

In order of cooling temperatures, the cuts are heavy gas oil, light gas oil, kerosene, naphtha, and straight run gasoline. Gasoline is the refining product in most demand.)Gasoline is composed of short molecules with 5 to10 carbon atoms.(820)



1.Match English words with their Russian equivalents.

refining	нефтеочистительный завод
oil refinery	колпачковая тарелка
crude oil	печь
distilling column	температура кипения

sidedraw	ректификационная колонна
cut	испаряться
furnace	конденсироваться
whereas	боковой погон
boiling point	сырая нефть
vaporize	поскольку
condense	перегонка
bubble tray	фракция

2.Complete the list of nouns and their relative adjective forms.

Adjective	Noun
various — carbon — bubble — hot — crude —	— point — temperature — cut — column — refinery

3.Complete the sentences using a word combination from the list. Use a plural form of nouns where it is necessary.

1. _____ may be referred to as sweet(десульфированная) if it contains relatively little sulfur.
2. Gasses rise in_____ and remaining liquid moves down.
3. Gasoline is composed of short molecules with 5 to _____ .
4. The hydrocarbons that have only single bonds between_____are called saturated.
5. Safety measures are very at _____.
6._____ come out at low temperatures.
7._____ is produced after heating crude oil in a furnace.

8. Gasoline has lower _____ than diesel and fuel oil(горючее).
9._____ is used for separating oil components in accordance with their boiling temperatures.

10. In the refining column _____are filled with liquids.

4.The odd word out.

1. refine	distil	contaminate
2. cool	warm	heat
3. crude	raw	refined
4. condense	liquefy	vaporize
5. remove	remain	transfer
6. separate	divide	combine
7. furnace	oven	refrigerator
8. cut	fraction	compound
9. vaporize	spray	solidify
10. product	reactant	distillate
11. gasoline	petrol	kerosene
12. rise	go up	fall
13. light	heavy	easy
14. bubble	boil	freeze

5.Complete the expressions with correct form of the word in bold.

1. a **distilling** column	_____water.
2.hot **vapour**	_to_____ oil.
3.to be **composed** of hydrocarbons	the _____of oil
4.boiling point	to make smb's blood _____
5.refining process	to _____ plans
6.the **rising** vapours	to_____ in the world
7.to **separate** by boiling	_____ of reaction products
8.to **condense** into liquid	steam _____
9. high temperature	to reach a _____

6.Answer the following questions.

1. What is refining?
2. What principle does distilling column work on?
3.What does the boiling temperature depend on?
4.Why a furnace is a indispensable part of any refining process?
5. What are bubble trays filled with?
6.What are the main refining products?
7.What are the main heavy cuts?
8. Which refining product is in most demand?

7.Translate into Russian.

1. В ректификационной колонне сырая нефть разделяется на различные компоненты в соответствии с их температурой кипения.
2. На нефтеперерабатывающем заводе первой стадией является нагревание нефти в электрической печи, при этом большая ее часть переводится в парообразное состояние.
3. Затем горячий пар распыляется в ректификационную колонну.
4. Ректификационная колонна содержит несколько тарелок.
5. Пары поднимаются в верхнюю часть колонны и охлаждаются.
6. Охлаждающиеся пары конденсируются в жидкость на тарелках и выводятся из колонны.
7. Легкие фракции собираются вверху колонны и выводятся при более низких температурах.
8. Керосин конденсируется при температуре 200°С,а бензин при температуре 150°С.
9. Бензин является продуктом перегонки нефти, который пользуется наибольшим спросом.

Text 2

Cracking Process

A process called cracking is used to make gasoline from heavier cuts. The longer, less valuable molecules of other cuts are used as cracking stock. Cracking stock is put into cracking towers at the refinery where high temperatures and pressures and caustic chemicals split the longer molecules to form gasoline. There are several types of cracking, each giving different products:

- Steam cracking: The feedstock is preheated , vapourized and mixed with steam and then converted at 1250-1400°C to give high yields of low molecular mass alkenes.
- Catalytic cracking : The use of a silica/alumina catalyst enables the cracking to take place at the relatively lower temperatures of about 1000°C.
- Hydrocracking: The feedstock is mixed with hydrogen at a pressure of about 80 atm and cracked over a platinum or silica/alumina catalyst. This process has a high yield of branched alkanes, cyclic alkanes and aromatic compounds for use in unleaded gasoline(petrol).(943)

1.Match English words with their Russian equivalents.

cracking stock	пар
caustic	выход
split	каталитический
hydrocracking	исходное крекинг-сырье
alkenes	ароматический
molecular mass	неэтилированный (бензин)
branched	Циклический
aromatic	непредельные (ненасыщенные)
cyclic	углеводороды,
unleaded (gas)	Олефины
yield	Едкий
steam	расщеплять
catalytic	разветвленный
	молекулярная масса
	едкий

2. Match the words from column A and B to form word collocation.

A	**B**
cracking	chemicals
molecular	yield
high	compounds
branched	gasolin
aromatic	alkenes
unleaded	cracking
steam	stock
bubble	trays
caustic	catalyst
platinum	mass

3.The odd word out

1.split	form	separate
2. valuable	useful	useless
3. mix	stir	part
4.enable	allow	prevent
5.to take place	occur	put off
6. caustic	corrosive	inert

7.steam vapour liquid
8.relatively in relation to irrelative of

4.Fill in the gaps using words from the box and then translate the sentences into Russian.

feedstock catalyst yield cracking

1.Gasoline can be produce from heavier cuts due to process called _____.

2.Using _____enables the cracking to occur at relatively lower temperature.
3. Hydrocracking includes mixing the _____ with hydrogen at a pressure of about 80 atm and then cracking it over a suitable catalyst.

4.Hydrocracking gives a high _____ of branched alkanes, cyclic alkens and aromatic compounds for use in unleaded gasoline.

5.Answer the following questions

1. What definition for cracking process can you suggest?
2. What is cracking stock?
3. What types of cracking process do you know?
4. What is distinctive features of steam cracking?
5. Describe catalytic cracking.
6. Describe hydrocracking.
7. What are the principal products of hydrocracking?

6.Translate into Russian.

1. Тяжелые фракции подвергаются крекингу с целью получения более легких, более полезных продуктов.
2. Известны три основные методы проведения процесса крекинга: паровой, каталитический и гидрокрекинг.
3. Указанные методы различаются по условиям необходимым для их осуществления.
4. Проведение гидрокрекинга требует высокое давление около 80 атм и использование катализатора.
5. Наиболее широко используемым является процесс каталитического крекинга.

Test-papers the second term

№ 1

1.Translate into Russian

The Crude Oil Distillation

The crude oil distillation unit (CDU) is the first processing unit in virtually all petroleum refiners. The CDU distils the incoming crude oil into various fractions of different boiling ranges, each of which are then processed further in the other refinery processing units.

The CDU is often referred to as atmosphere distillation unit because it operates at slightly above atmospheric pressure.

Below is a schematic flow diagram of a typical crude oil distillation unit. The incoming crude oil is preheated by exchanging heat with some of the hot, distilled fractions and other streams. It is then desalted to remove inorganic salts(primary sodium chloride).

Following the desalter, the crude oil is further heated by exchanging heat with some of the hot, distilled fractions and other streams. It is then heated in a fuel-fired furnace (fired heater) to a temperature of about 398° C and routed into the bottom of distilled unit.

The fractions removed from the distillation column at various points between the column top and bottom are called sidecuts. Each of the sidecuts (i.e. the kerosene, light gas and heavy gas oil) is cooled by exchanging heat with the incoming crude oil. All of the fractions are sent to intermediate storage tanks before processed further. (1000)

№ 2

1.Translate into Russian

Oil

Oil is usually found in porous rock under a layer of impermeable rock which prevents it from escaping. It can then be reach by drilling .The initial gushing of oil out of a drill pipe is caused by pressure of the gas trapped and compressed immediately above the oil deposits. In time, this pressure decreases and the oil has to be pumped to the surface. The crude oil raised directly from the wells is not yet ready for use. It has to be refined. The first stage in this process is fractional distillation in a fractionating column. Those fractions, such as petrol and kerosene, which are lighter and more volatile, move towards the top o the column before condensing. The heavy residual fuel at the base of the column is extremely impure.

But distillation does not produce enough high grade petrol to meet today's high demand. The petrol offered for sail motorists is blend of straight distilled petrol produced by chemical modification from certain of other distillates. (805)

3-d term

Text 1

Steam reforming

Steam reforming is a method for producing hydrogen or other useful products from hydrocarbon fuels such as natural gas. Steam reforming of natural gas sometimes referred to as steam methane reforming (SMR) is the most common method of producing commercial bulk hydrogen as well as the hydrogen used in the industrial synthesis of ammonia.

At high temperatures (700-1100°C) and in presence of a metal-based catalyst (nickel) ,steam reacts with methane to yield carbon monoxide and hydrogen.
This is achieved in a processing device called a reformer in which steam reacts with fossil fuel at high temperature. The steam methane reformer is widely used in industry to make hydrogen.

There is also interest in the development of much smaller units based on similar technology to produce hydrogen as feedstock for fuel cells. Small-scale steam reforming units to supply fuel cells are currently the subject of research and development typically involving the reforming of natural gas but other fuels are also being considered such as propane and others. (880)

*1.Match English words with their Russian equivalents***.**

steam reforming	паровой реформинг
to achieve	достигать
reformer	реформинг-установка
development	разработка
unit	установка
fuel cell	топливный элемент
small-scale	небольшой
currently	в настоящее время
typically	типично
research	исследование
commercial	промышленный
hydrogen	водород
supply	поставлять
methane	метан
carbon monoxide	монооксид углерода
residue	осадок

2.Match the words with similar meaning from column A and B.

A	**B**
supply	investigation
to yield	extensively
to reform	small
to produce	to crack
industrial	alike
common	typical
use	theme
small-scale	valuable
natural	to reach
to achieve	to apply
subject	to provide
useful	typical
similar	artificial
research	to make

3.Fill in the gaps using words from the box and then translate the sentences into Russian.

steam reforming	development	methane	reformer

1._____ is widely used in industry to produce hydrogen ,it is also the least expensive method.

2.Research and_____ concerning with small-scale steam reforming units to supply fuel cells is under way now.

3. At high temperatures and in presence of a catalyst steam reacts with _____ to form carbon monoxide and hydrogen.

4.This reaction is carried out in a processing device called a_____.

5.Additional _____ can be recovered by lower temperature reaction of carbon monoxide with steam.

4. .Answer the following questions

1. What is steam reforming?
2. What is the main product produced by steam reforming?
3. What can you say about required conditions for steam reforming?
4. What chemical reaction is steam reforming based on?
5. What is the other name for steam reforming?
6. What processing device is applied in steam reforming?
7. Why is there some interest in developing much smaller unit based o the same technology?
8. What other hydrocarbons can besides used besides methane to supply fuel cells?

*5.Translate into Russian***.**

1.Паровой реформинг широко используется в промышленности для получения водорода.
2.При высокой температуре и давлении в присутствии катализатора пар реагирует с метаном с образованием моноокиси углерода и водорода,
3.Установка реформинга работает при высокой температуре(700-1000°C).
4. Небольшие установки, работающие на том же принципе, могут представлять интерес для использования в топливных элементах.

Text 2

Shale Oil Processing

Shale oil extraction process decomposes oil shale and converts its kerogen into shale oil─ a petroleum –like synthetic crude oil. The process is conducted by pyrolysis ,hydrogenation, or thermal dissolution.
The oldest and the most common extraction method involves pyrolysis(also known as destructive distillation).In this process oil shale is heated in the absence of oxygen until its kerogen decomposes into condensable shale oil vapours and non- condensable combustible oil shale gas. Oil vapours and oil shale gas are then collected and cooled causing
the shale oil to condense .in addition, oil shale processing produces spent oil shale, which is a solid residue. Spent shale consists of inorganic compounds and char─carbonaceous residue formed from kerogen. Burning the char off the spent shale produces oil shale ash. Spent shale and shale ash can be used as ingredients in cement or brick manufacture. (800)

1.Match English words with their Russian equivalents.

shale oil	включать
extraction	разлагать на составные части
convert	гидрирование, гидрогенизация
kerogen	термический
pyrolysis	древесный уголь
hydrogenation	горючий, битуминозный сланец
thermal	кероген
dissolution	отработанный сланец
involve	извлечение
decompose	превращать
char	разложение
spent shale	пиролиз

2.Fill in the gaps using words from the box and then translate the sentences into Russian.

oil shale	kerogen	residue	extraction	spent shale

1.The composition of the _____ may lend added value to the extraction process through the recovering of by-products including ammonia, sulfur, aromatic compounds, pitch, asphalt, and waxes.
2.The most common _____method involves pyrolysis.
3.In this process _____ decomposes into volatile products.
4.Oil shale processing also produces spent oil shale, which is solid _____.
5._____ can be used in production of cement and brick manufacture.

3.Odd word out.

1. extraction	dissolution	decomposition
2. ingredient	residue	component
3. common	typical	exclusive
4. condense	concentrate	dilute
5. consist of	include	exclude
6. produce	form	decay
7. heat	warm	cool
8. decompose	dissolute	combine

4.Answer the following questions

1. What is shale oil processing?
2. What are the main methods of shale oil processing?
3. Which method is the oldest and the most common?
4. What can you say about pyrolysis related to shale oil processing?
5. What is by-product of shale processing?
6. What can you say about composition of spent shale?
7. How can oil share ash be produced?
8. Where can spent shale and shale ash be used?

5.Translate into Russian.

1.Процесс извлечения горючего сланца основан на его разложении и превращении его керогена в продукт похожий на синтетическую сырую нефть.
2.Пиролиз,гидрогенизация и термическое разложение используются в процессе переработки горючего сланца.
3.Самый распространенный метод основан на пиролизе.
4.Этот процесс включает нагревание горючего сланца в отсутствии кислорода.
5.В этих условиях кероген разлагается на конденсирующиеся пары горючего сланца и неконденсирующийся горючий сланцевый газ.
6.Затем они собираются и охлаждаются.
7. Отработанный сланец представляет твердый осадок.

Test-papers for the third term

№ 1

1. Translate into Russian

Oil composition

The hydrocarbons in crude oil are mostly alkanes, cycloalkanes and various aromatic hydrocarbons. While the other organic compounds contain nitrogen, oxygen and sulfur,

And trace amounts of metals such as iron, nickel, copper and vanadium. The exact molecular composition varies widely from formation to formation, but the proportion of chemical elements vary over fairly narrow limits. Four different types of hydrocarbon molecules appear in crude oil. The relative percentage of each varies from oil to oil, determining the properties of each oil.

In the reservoir it is usually found in association with natural gas, which being lighter forms a gas cap over the petroleum, and saline water which being heavier then most forms of crude oil, generally sinks beneath it. Crude oil may also be found in semi-solid form mixed with sand and water. These oil sands resources are called unconventional oil to distinguish them from oil which can be extracted using traditional oil well methods. (834)

№2

1.Translate into Russian

Grades of oil

Petroleum is used mostly, by volume, for producing fuel oil and petrol, both important **"**primary energy**"** sources.84 percent by volume of the hydrocarbons present in petroleum is converted into energy- rich fuels (petroleum-based fuels),including petrol, diesel, jet, heating, and other fuel oils, and liquefied petroleum gas.

Crude oil varies greatly in appearance depending on its composition.

The lighter grades of crude oil produce the best yields of useful products .But as the world's reserves of light and medium oil are depleted, oil refineries are increasingly having to process heavy oil and bitumen, and use more complex and expensive methods to produce the products required. Because heavier crude oils have too much carbon and not enough hydrogen, these process generally involve removing carbon from or adding hydrogen to the molecules, and using fluid catalytic cracking to convert the longer, more complex molecules in the oil to the shorter simpler ones in the fuels. (830)

4-d term

Text 1
Fluid Catalytic Cracking

Fluid catalytic cracking (FCC) is one of the most important conversion processes used in petroleum refineries. It is widely used to convert the high-boiling, high-molecular weight hydrocarbon fractions of petroleum crude oils to more valuable gasoline, olefinic gases, and other products.

Cracking of petroleum hydrocarbons was originally done by thermal cracking, which has been almost completely replaced by catalytic cracking, because it produces more gasoline with higher octane rating. It also produces by product gases that are more olefinic, and hence more valuable, than those produced by thermal cracking. The feedstock to a FCC is usually that portion of the crude oil that has an initial boiling point of 340°C or higher at atmospheric pressure and average molecular weight ranging from 200 to 6000 or higher.

The FCC process vaporizes and breaks the long-chain molecules of the high-boiling hydrocarbon liquids into much shorter molecules by contracting the feedstock, at high temperature and moderate pressure, with a fluidized powdered catalyst.(900)

1.Match English words with their Russian equivalent.

conversion process	побочный продукт
olefinic	порошкообразный
powered	часть
ranging	перегонка
portion	олефиновый
fluidize	сырье(для промышленности)
byproduct	помещать твердые частицы в быстрый
distillation	поток жидкости или газов, чтобы
feedstock	обеспечить их быстрое перемещение
	уменьшаться (в объеме, размере)
petroleum refinery	
	процесс переработки
	октановое число
contract	находящийся в диапазоне
	нефтеочистительный завод
octane rating	

2.Fill in the gaps using words from the box and then translate the sentences into Russian

powered	fluids	crude oil	ranges

1.In effect refineries use fluidized _____ catalytic cracking to correct the imbalance between the market demand for gasoline and the excess of heavy, high boiling range products resulting from the distillation of crude oil.

2.The crude oil distillation unit distills the incoming crude oil into various fractions of different boiling _____ each of which are then processed further in other processing units.

3.Oil refineries are typically large, sprawling industrial complex with extensive piping running through carrying steams of _____ between large chemical processing units.

4.Most _____ contain small amounts of hydrogen sulfide.

3.Odd word out.

because	for	into
thus	hence	nevertheless
boil	distill	liquefy
contract	decrease	increase
conversion	change	stability
fraction	bulk	portion
lso	almost	nearly
rating	grade	growth
initial	original	final
fluidize	solidify	liquefy
replace	use instead of	apply
produce	manufacture	break

4. Match words with similar meaning from column A and column B .

A	B
distill	extensively
widely	aliphatic
convert	raw
fraction	liquid
olefinic	transform
crude	portion
fluid	reasonable
contract	transform
moderate	confine

5.Answer the following questions.

1.What conversion process is used at the majority of petroleum refineries?
2.What is feedstock of such a process?
3.What are the products of fluid catalytic cracking?
4.What type of petroleum cracking was used originally?
5. What is the reason is behind replacing thermal cracking by fluid catalylic cracking?

6.Translate into Russian.

1.Различные температуры кипения позволяют разделить углеводороды с помощью дистилляции.
2.Нефть может быть использована различным образом, поскольку она содержит углеводороды различных молекулярных масс, видов и длины углеродной длины таких как парафины, ароматические соединения, циклоалканы, алканы, диены и алкины.
3.Октановое число можно увеличить с помощью каталитического реформинга.
4.Конечной стадией производства бензина является смешивание топлива с различным октановым числом.
5.Нефтеочищающие заводы являются крупными(large scale) предприятиями, которые перерабатывают до сотен баррелей сырой нефти в день.

Text 2

Reactor and Regenerator

The reactor and regenerator are considered to be the heart of the fluid catalytic cracking(FCC) unit. A typical modern is based upon the “side-by side” configuration.

The preheated high-boiling petroleum feedstock(at about 315 to 430C) consisting of long-chain hydrocarbon molecules is combined with recycle slurry oil from the bottom of the distillation column and injected into the catalyst riser where it is vaporized and cracked into smaller molecules of vapour by contact and mixing with very hot powered catalyst from the regenerator.

All of the cracking reactions take place in the catalyst riser within a period of 2-4 seconds. The hydrocarbon vapours “fluidized” the powdered catalyst and the mixture of hydrocarbon vapours and catalyst flows upward to enter the reactor at a temperature about 535 °C and a pressure of about 1.72 barg. The reactor is a vessel in which the cracked product vapours are separated from the so-called spent catalyst by flowing through a set of two stage cyclones within the reactor.(856).

1.Match English words with their Russian equivalents.

slurry oil	ступень
configuration	суспензия в нефтепродукте
recycle	вертикальная труба, по которой поднимается катализатор
inject	течь
catalyst riser	сосуд, емкость
regenerator	конфигурация
flow	вдувать, вводить
vessel	регенератор
stage	перерабатывать

2.Odd word out

inject	emit	introduce into
crack	break	unite
powered	divided	bulk
mixture	blend	grade
consider	assume	reject
consist of	contain	consume
recycle	use repeately	waste
base upon	work on the principle	take into consideration
spent	used	heated
vapour	gas	liquid
flow upward	rise	fall

3.Fill in the gaps using words from the box and then translate the sentences into Russian

vapour	fractions	configurations	liquefied	regenerator

1.The spent catalyst flows downward through a steam stripping section to remove any hydrocarbon _____ before the spent catalyst returns to the catalyst regenerator.

2. The flow of spent catalyst to the _____ is regulated by a slide valve in the spent catalyst line.

3._____ petroleum gas is made from propane gas.

4.There are many process _____ other than depicted above.

5.The vacuum distillation products may also produce _____ that can be refined into end products such as : spindle oil used in textile industry ,light machinery oil, motor oil, (веретенное масло)and various waxes.

4.Answer the following questions

1.What is the core of fluid catalytic unit?
2.What can you say about typical modern design of the unit of fluid catalylic cracking ?
3.What mixture is injected into the catalyst riser?
4. What can you say about the mode of operation of the reactor in the fluid catalytic cracking unit?
5. What for two stage cyclones are used within the reactor?
6. How much time does it take cracking reactions to occur?
7. n what principle is fluid catalytic cracking based on?

*5. Translate into Russian***.**

1. Емкости (vessels) для хранения сжиженного газа используются для хранения пропана и другого газового топлива при давлении достаточным для сохранения(to maintain) их в жидком состоянии(form).
2. Установку дистилляции сырой нефти часто называют установкой дистилляции при атмосферном давлении так, как она работает при давлении чуть(slightly) выше атмосферного давления.
3. Все реакции крекинга проходят в течение 2-4 секунд.
4. Катализатор поступает в реактор при температуре около 535 °C.
5. В реакторе нефтяные пары, полученные в результате крекинга, отделяются от отработанного катализатора.

Test-papers for the fourth term

№ 1

1.Translate into Russian

Catalysts

Modern FCC catalysts are aтy powers with bulk density of 0.80 to 0.96 g/cm ^{3} and having a particle size distribution ranging from 10 to 150µm and average particle size of 60 to 100 µm. The design and operation of an FFC unit is largely dependent upon the chemical and physical properties of an FFC catalyst are:

- Good stability to high temperature and to steam
- High activity
- Large pore sizes
- Good resistance to attrition
- Low coke production.

A modern FFC catalyst has four major components: crystalline zeolite, matrix, binder and filler. Zeolite is the primary active component and range from about 15 to 50 weight percent of catalyst. The zeolite used in FCC catalysts is composed of silica and alumina tetrahedrons with each tetrahedron having either an aluminum or a silicon atom at the corners. It is a molecular sieve with a distinctive lattice structure that allows only a certain size range of hydrocarbon molecules to enter the lattice. The catalytic sites in the zeolite are acidic sites providing by the alumina tetrahedrons. (867).

№2

1. Translate into Russian

Increasing Efficiencies for Hydrocarbon Activation

Hydrocarbons derived from fossil fuel are the main source of energy and raw material for petrochemicals in the industrial world. When not used in combustion to generate power and heat , fossil fuels are refined in various petrochemical transformation processes into purer and higher-valued products.

There are different ways to increase hydrocarbon conversion efficiency to minimize carbon oxide emission. In a chemical transformation process to form a desired product, carbon oxides can be emitted as a by-product in the chemical reaction, as a result of the generation of the power needed to effect the desired chemical transformation or in generation of reactants needed for the reaction .Increased efficiencies in any of these aspects would reduce carbon emission.

At present research is under way to reduce carbon-containing wastes, hydrogen consumption or wastes, energy required for chemical transformation. (800)

№3

1. *Translate into Russian*

Natural Gas Processing

Natural gas processing consists of the various hydrocarbons and fluids from the pure natural gas, to produce what is known as ‘pipeline quality” dry natural gas. Major transportation pipelines usually impose restrictions on the make-up of natural gas that is allowed into the pipeline. That means that before the natural gas can be transported it must be purified. In fact associated hydrocarbon known as natural gas liquids (NGLs) can be very valuable by-products of natural gas processing. These NGLs are sold separately and have a variety of different uses, including enhancing oil recovery in oil wells, providing raw materials for oil refineries or petrochemical plants, and as sources of energy.

Actual practice of processing natural gas to pipeline dry gas quality levels taking place at a processing plant can be quite complex, but usually involves four main processes to remove the various impurities:

- Oil and condensate removal
- Water removal
- Separation of natural gas liquids
- Sulfur and carbon dioxide removal.(895)

Устная тема

Russia

Russia is the largest country in the world. It is almost the size of the USA and Canada combined. It is about 8,000 klm from East to West and crosses eleven time zones. Its total area is about 17 mln square klm. Russia is situated both in Europe and Asia. The Urals are not very high mountains. Russia's largest mountains, the Caucasus, are on its southern borders. The country is washed by 12 seas of 3 oceans: the Pacific, the Arctic and the Atlantic. In the South Russia borders on China, Mongolia, Korea, Kazakhstan, Georgia and Azerbaijan. In the West it borders on Norway, Finland, The Baltic States, Belarus, Ukraine. It also has a sea-border with the USA. There is hardly a country in the world where such a variety of scenery and vegetation can be found, there are steppes, plains and forest tundra and taiga, mountains and hills. There are over 2 mln rivers in Russia: The Volga, the Ob, the Amur and others. On the vast territory of the country there are various types of climate from arctic in the North to subtropical in the South. In the middle of the country the climate is temperate and continental.

Russia is very rich in oil, iron ore, natural gas, copper, nickel and other mineral resources.

Russians make up the large majority of the population and Russian is the official language, but there are more than a hundred other nationalities, and languages .The population of Russia is about 145 mln people.

Russia is semi-presidential republic. The three branches of state power are legislative, executive and judicial. Each of them is controlled the President who is the head of the state.

The legislative power is vested in the Federal Assembly. It consists of two Chambers. The Upper Chamber is The Council of Federation. The Lower Chamber is the State Duma. The two Chambers make laws which must be signed by the President. The President may veto the bill.

The executive power belongs to the government which is headed by the Prime Minister.

The Crimea became the part of Russia after all people referendum for reuniting with Russia in March 2013.Now Russia is in complicated economic and political situation due to the sanctions laid on the country by the USA and members of the European Union because of the Crimea and condemnation of Ukraine aggressive policy toward insurgents on the South-East of Ukraine.

Литература

1. Шевцова Г.В. Английский язык для технических вузов: учеб.пособие/ Г.В.Шевцова, Л.Е. Москалец .- М.: Флинта, Наука,2009. ─ 392 с.
2. Изучение иностранного языка студентами заочной формы обучения: методические указания/ В.П.Дубровина, В.М.Зинченко, Н.А.Степанова, С.Б.Миронова; СПбГТИ(ТУ). Каф. иностранных языков – СПб., 2007. – 43 с.
3. Neuss Geoffrey. Chemistry Course Companion/ Oxford University Press, 2008.─400p.
4. Macmillan English Dictionary for Advanced Learners. - International Edition, 2002. ─ 1687p.

Кафедра иностранных языков

Методические указания
английский язык

Химическая технология природных энергоносителей и
углеродных материалов

Наталия Алексеевна Степанова

Отпечатано с оригинал-макета. Формат 60×90. 1/16
Печ.л. 2.2 Тираж экз.

Санкт-Петербургский государственный технологический институт
(Технический университет)

190013, Санкт-Петербург, Московский пр., 26
Типография издательства технологического института,
тел. 49-49-365