

COAL AND PETROLEUM

Introduction

We use various materials for our basic needs. Some of them are found in nature and some have been made by human efforts.

Natural resources

Natural resources indicate the potential wealth of a country. The variety of substances that man gets from earth and nature to meet his basic needs are called natural resources. The word resource means a source of supplying a material generally held in reserve. Natural resources are both living and non living. Some of these resources are found in abundance,

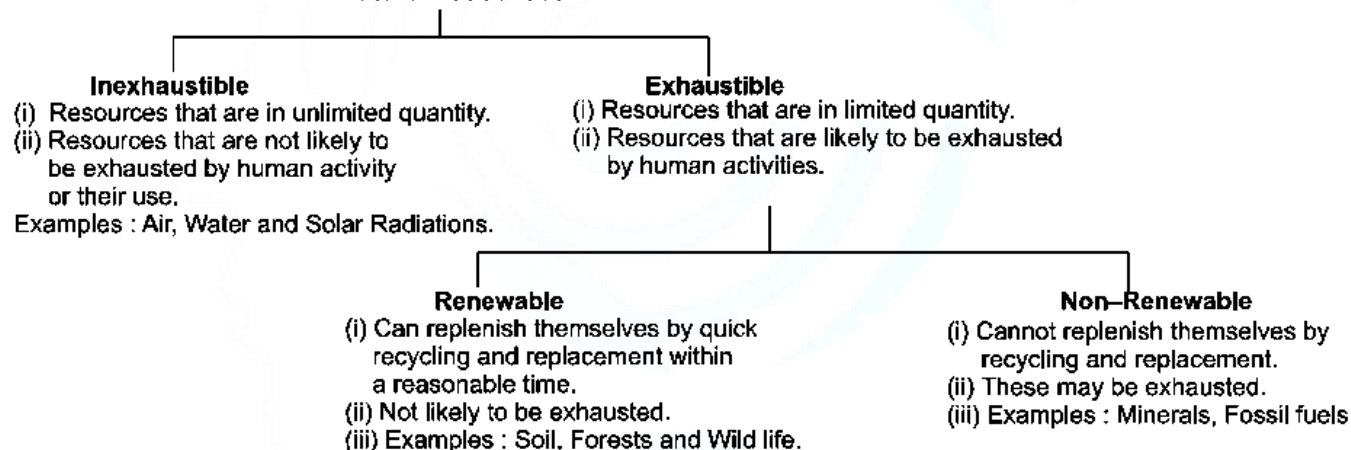
while others are found in limited quantities and that too in some restricted parts of our land. For this reason, the natural resources have to be systematically. However, in reality it is not so. They are being used indiscriminately.

1. Types of Natural Resources:

Depending upon the abundance and availability, the natural resources are categorized into two types, i.e.,

- (i) In exhaustible natural resources
- (ii) Exhaustible natural resources.

Natural resources



Fossil fuels

Exhaustible natural resources like coal, petroleum or natural gas were formed from the dead remains of living organisms(fossils). So, these are called fossil fuels.

Coal and petroleum are very important natural resources and play a vital role in modern society. They are found in the earth's crust. Their easy availability and specific characteristics make them very important in the growth of industry.

At present they are the chief sources of energy worldwide.

1. Coal:

Coal is a mineral of dark brown or black colour formed from the remains of plants buried in the earth's crust millions of years ago.

- (i) **Composition:** Coal is a very impure form of carbon. It mainly consists of atoms of carbon, hydrogen and oxygen. A small amount of sulphur is also present in it.
- (ii) **Deposits:** The distribution of coal deposits is not uniform in the earth's crust. To the total coal reserves in the world, Asia contributes about one third, whereas North and South America

contribute more than half. India has large deposits of coal. It is estimated that India has about 80 billion tones of proven coal deposits. The coal deposits are spread over in the states of Jharkhand, Madhya Pradesh and West Bengal.

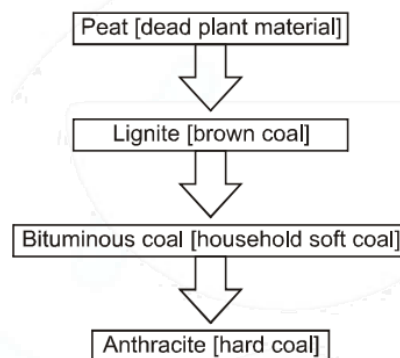
(iii) Formation: It is believed that millions of years ago, the ground below the forests was split open by natural forces such as earthquakes and volcanoes. The forests were buried in the chasms. Thus, the plants had no contact with oxygen. Successive layers of sediments sealed the buried plants. Over millions of years these deposits were subjected to tremendous pressure and heat which finally transformed them into coal. The chemical process involved in the transformation of plant matter into coal is called the carbonization of plant matter.

Note: Coal occurs in four main varieties viz., peat, lignite, anthracite and bituminous. Peat is the most inferior while Anthracite is the most superior quality of coal among various varieties of coal. The period during which this process of coal formation took place is called carboniferous age. So we have different varieties of coal on the basis of the carbon content and moisture present in it.

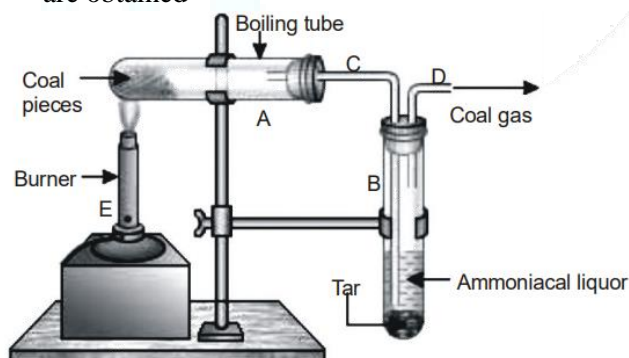
- 1. Peat** is the youngest variety of coal which is light brown in colour, has 50-60% of carbon and burns with a sooty flame.
- 2. Lignite** is the next stage of carbonisation of peat. It has 60-70% of carbon.
- 3. Bituminous** also called household coal which is grey black in colour and contains 70-80% of carbon. This is the most common form of coal used.
- 4. Anthracite** is the best variety of coal. It contains 90-95% of carbon and is used in industries as reducing agent for extraction of metals.

Type of coal	% of carbon content
Peat	50–60
Lignite	60–70
Bituminous	70–80
Anthracite	90–95

Flow Chart



(iv) Destructive Distillation of Coal: The process of heating coal in the absence of air is called the destructive distillation of coal. Coal contains a number of elements such as carbon, hydrogen, oxygen, nitrogen and sulphur. When coal is heated in the absence of air, a number of products are obtained



Experimental set up for the destructive distillation of coal

The main products obtained by the destructive distillation of coal are as follows:

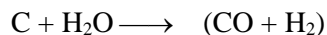
- (a) Coke (b) Coal tar
(c) Ammoniacal liquor (d) Coal gas

(a) Coke: Coke contains 98% carbon. It is porous, tough, black and the purest form of coal. Like charcoal, it is a good fuel and burns without smoke. But it is seldom employed as a fuel because it can be put to more valuable use. It is largely employed as a reducing agent in the extraction of metals from their ores. It is also used in making fuel gases like water gas and producer gas.


Note:

- Water gas is an equimolar mixture of carbon monoxide and hydrogen.

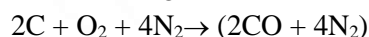
It is obtained by passing steam over red-hot coke.
[used in welding, glass making and other high temperature industrial application]



Coke Water gas

- Producer gas is a mixture of carbon monoxide and nitrogen.

It is obtained when air is passed over red-hot coke.
[used in firing coke ovens and blast furnace]



Coke Producer gas

- (b) Coal tar:** Coal tar is a mixture of different carbon compounds. It is a thick, black liquid with unpleasant smell. The fractional distillation of coal tar gives many chemical substances which are used in the preparation of synthetic dyes, perfumes, explosives, paints, synthetic fibres, drugs and pesticides. Some of these chemical substances are benzene, toluene, phenol and aniline. Naphthalene balls used to repel moths and other insects are also obtained from coal tar.

Note: Now-a-days, bitumen, a petroleum product is used in place of coal tar in making of roads.

- (c) Ammoniacal liquor:** The ammonia produced as a result of destructive distillation of coal is absorbed in water. The aqueous solution of ammonia, i.e., ammonium hydroxide solution, is called ammoniacal liquor. It is used in the preparation of fertilizers such as ammonium sulphate and ammonium superphosphate.

- (d) Coal gas:** Coal gas is mainly a mixture of hydrogen (H_2), methane (CH_4) and carbon monoxide (CO).

The gases present in coal gas are combustible, and hence it is an excellent fuel. It has high calorific value. It was used for lighting houses, factories and streets in Mumbai (Bombay) until 1950. It was also used for cooking until recently.

Note: Coal gas was used for street lighting for the first time in London in 1810 and in New York around 1820. Now-a-days, it is used as a source of heat rather than light.

(v) Uses of Coal:

- Coal is used as a fuel to convert water into steam to run thermal power plants for the generation of electricity. It is also used as a fuel in homes and factories and to run steam engines.
- Coal is used in the preparation of fuel gases, such as coal gas.
- Coal is used in the preparation of synthetic petrol.
- Coal is also used in preparation of synthetic natural gas.
- The destructive distillation of coal gives coke, coal tar, coal gas etc.
- Coal is the source from which a number of organic compounds such as benzene, toluene, phenol, aniline, naphthalene and anthracene are obtained.

Example 1: What is carbonisation?

Solution: The process of conversion of decomposed carbon based deposits of plant material into coal due to tremendous heat and pressure deep below the surface of earth is called carbonisation.

Example 2: List some important uses of coal in modern days.

Solution: Today, coal is mainly used to produce electricity and also coke, an essential raw material for the steel industry. When coal is heated in the absence of air, a porous, carbon rich material called coke is formed. During extraction of iron and manufacturing of steel coke is one of the constituents needed to heat the furnace. Seventy percent of steel production is done from iron made in blast furnaces using coal and coke. Gaseous by-products from coke ovens are also used. These include crude coal tar, light oils, and ammonia. Coal is used to heat boilers and ovens in industrial heating.

Example 3: Describe characteristics and uses of coke.

Solution: Coke is a porous black substance left after destructive distillation of coal. It is an almost pure form of carbon. It is used in the manufacture of steel and extraction of iron in the blast furnace.





Example 4: Name a few substances obtained from coal tar.

Solution: The fractional distillation of coal tar gives many chemical substances which are used in the preparation of synthetic dyes, perfumes, explosives, paints, synthetic fibres, drugs and pesticides, etc.

FUNDAMENTAL UNLOCKED- (FU#1)

Q.1 What is coal tar? Write its uses.

Q.2 What are the different types of coal. Describe briefly.

Q.3 Classify the natural resources on the basis of their availability.

Q.4 Name the gas which is produced when coal is heated in absence of air.

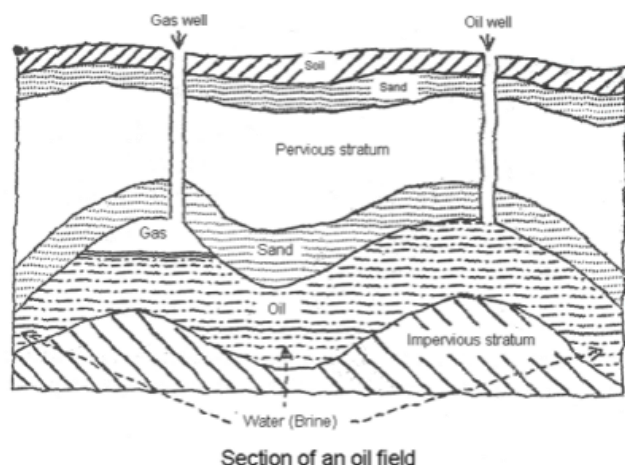
Petroleum

Petroleum is a naturally occurring oil that consists chiefly of hydrocarbons with some other elements such as sulphur, oxygen and nitrogen. The unrefined form of petroleum is called crude oil.

Note: Petroleum is also called rock oil i.e., *petra* = rock, *oleum* = oil.

1. Deposits:

The major reserves of petroleum are in Saudi Arabia (largest producer of petroleum), Kuwait, Iraq, Russia, China, USA, Libya etc. The oil is obtained by drilling an oil well. When a well is drilled, natural gas comes out with great force. The crude oil comes out on its own due to gas pressure. After the pressure has subsided, it is pumped out of the well.



2. Formation:

It is believed that petroleum was formed from organisms living in the sea. The remains of these organisms were deposited in shallow depressions in the sea bed long ago. These were covered by layers of sand and clay which compressed these remains. Over a period of millions of years, the organic matter present in the dead organisms underwent a series of processes before being finally transformed into petroleum. The petroleum so formed migrated from the source rock to be entrapped in large underground reservoirs beneath impermeable rocks. It often floats over a layer of water and is held in this position under pressure beneath a layer of natural gas.

3. Refining:

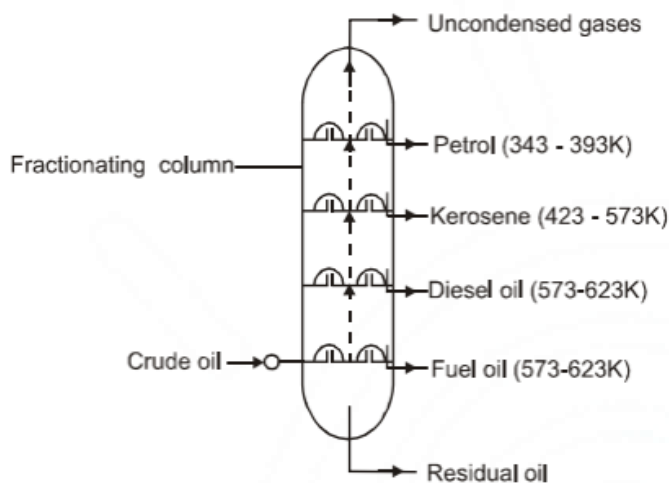
Petroleum is a mixture of several hydrocarbons. It is a foul - smelling brown black liquid. It also contains water, salt and rocky materials. It cannot be used in this crude form either as a fuel or as a basic material to produce other useful components. Before being put to use, it has to be purified or refined. The process of separating the various components of petroleum from one another is known as the refining of petroleum. This is done by a process called fractional distillation which is based on the fact that the different components of petroleum have distinctly different boiling points.

Note: The first oil well was found in Pennsylvania in USA in 1859. In India, first oil well was found in 1867 in Digboi, Assam.

The components of petroleum are separated in a large fractionating column. Crude oil is piped to the refinery from a well. It is washed with acid and alkali solutions to remove the basic and acidic impurities respectively. Crude oil is now heated to about 673K and fed at the base of fractionating column. All the components except asphalt are converted in the vapour state. As the mixture of hot vapours rises up in the column, it begins to cool. The component with the highest boiling point condenses first and is collected. Those with low boiling points condense



later. The residual gases escape uncondensed from the upper part of the column. The various components condensed at different heights of the column are collected separately. The components obtained at different heights in order from the bottom are asphalt, lubricating oil, paraffin wax, fuel oil, diesel, kerosene, petrol and petroleum gas.



Fractional distillation of petroleum

4. Products:

(i) **Residual oil:** The residual oil obtained from the primary distillation of petroleum is known as reduced crude. Reduced crude is distilled in vacuum to yield bitumen (asphalt) as residue. Bitumen is largely used in making road surfaces, and also for coating cables to provide electrical insulation.

(a) **Paraffin wax:** It boils at above 673K. It is obtained by the fractionation of residual oil. It is used for making candles, ointments, vaseline, grease, polishes etc. It is also used for waterproofing of paper cartons.

(b) **Lubricating oil:** Its boiling range is 623 K to 673 K. It is obtained by the fractionation of residual oil. It is used for lubricating machinery.

(ii) **Fuel oil:** The boiling range of fuel oil is 573 K to 623 K. It is used in industries to heat boilers and furnace. It is a better fuel than coal because it burns completely leaving behind no ash, whereas coal burns producing a large amount of ash which has to be removed regularly.

(iii) **Diesel oil:** Its boiling range is 573 K to 623K. It contains straight chain alkanes with the number of carbon atoms varying from 16 - 20. It is used in cars, trucks, buses and locomotives. It is also used to run pumps infields and in electric generators.

(iv) **Kerosene:** Its boiling range is 423 K to 573 K. It contains straight chain alkanes with 11 -16 carbon atoms. It is used for domestic purpose, for lighting petromax, lanterns, lamps, stoves, etc. It is also used for making oil gas. A special grade of kerosene is used as aviation fuel in aeroplane jet engines.

(v) **Petrol:** Its boiling range is 343K to 393 K. It is also called gasoline. It contains straight chain alkanes with 7 - 9 carbon atoms. It is used as a fuel in two - wheelers, three - wheelers and cars. It is also used as a solvent for the dry-cleaning of clothes.

(vi) **Petroleum Gas:** It is a mixture of ethane, propane and butane. Its main constituent is butane which burns by giving off a lot of heat. Butane is easily liquefied under high pressure. In the liquid form it is supplied in cylinders and is commonly known as Liquefied Petroleum Gas (LPG). It is a colourless, odourless and in flammable gas. A domestic gas cylinder contains about 14.2 kg of LPG. A strong smelling substance called ethyl mercaptan (C_2H_5SH) is added to LPG to detect the leakage of gas from the cylinder. On being lighted, it burns with a blue flame. One gram of LPG produces about 50 KJ of heat. LPG should be used with care. Any accidental leakage can cause an explosion. If there is any leakage of gas from the cylinder, the following precautions should be immediately taken

- Any open flame in the vicinity of the gas should immediately be extinguished.
- All doors and windows of the room in which the cylinder is kept should be opened to allow the gas to escape.
- The tube and joints attached to the cylinder should be systematically checked for defects.



Note: The Indian Petrochemical Corporation Limited (IPCL) in Vadodara (Baroda) is one of the largest petrochemical units in the world.

Natural gas

Natural gas is a naturally occurring mixture of gaseous hydrocarbons. It is found in porous sedimentary rocks in the earth's crust, usually in association with petroleum deposits.

In India, natural gas has been found in Tripura, Rajasthan, Maharashtra and in Krishna-Godavari delta.

1. Composition of Natural Gas

Natural gas consists mainly of methane (about 85%), ethane (up to about 10%), propane (about 3%) and butane. Carbon dioxide, nitrogen, oxygen, hydrogen sulphide and sometimes helium may also be present.

2. Formation of Natural Gas

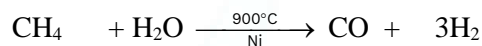
Natural gas may be obtained from the earth's crust by digging wells in prospective areas. There are some wells which give out only natural gas, but most wells produce natural gas as well as petroleum. In fact, natural gas is obtained as a co-product in petroleum mining. Natural gas is formed from the decomposition of organic matter buried under sea beds millions of years ago.

Uses of Natural Gas:

- (i) Natural gas is used as a domestic and industrial fuel. Natural gas burns readily to produce a lot of heat. So, in many areas, natural gas is used as the main fuel for domestic and industrial heating purposes. Natural gas is called a clean fuel because it burns without producing smoke and causes no air pollution. Natural gas also does not produce any poisonous gases on burning. Moreover, it does not leave behind any residue on burning.
- (ii) These days natural gas is being used as a fuel in automobiles (cars, buses and trucks) in place of petrol and diesel. Natural gas is used as Compressed Natural Gas (CNG) in vehicles. CNG is being used as a fuel in automobiles to reduce air pollution.

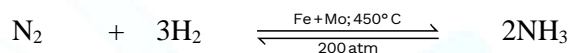
(iii) Natural gas is used for the manufacture of hydrogen gas (needed in fertilizer industry). This is done as follows:

- (a) Natural gas is heated with steam at a temperature of 900°C in the presence of nickel catalyst to form a mixture of carbon monoxide and hydrogen gas:



Methane Steam Carbon Hydrogen
(Natural gas) monoxide

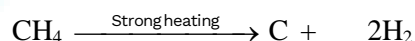
- (b) This hydrogen gas is heated with nitrogen under pressure and in the presence of finely divided iron and molybdenum as catalyst to make ammonia gas:



Nitrogen Hydrogen Ammonia

The combination of nitrogen and hydrogen to form ammonia is called Haber's process. The temperature required in this reaction is 450°C and pressure is 200 atmospheres. The ammonia thus produced is used for manufacturing nitrogenous fertilizers (like ammonium sulphate, ammonium nitrate etc.) by treatment with suitable acids.

- (c) Natural gas is used as a source of carbon needed in tyre industry. When natural gas is heated strongly, then methane present in it decomposes to form carbon and hydrogen:



Methane Carbon Hydrogen
(Natural gas)

The carbon thus formed is called 'carbon black' and it is used as a 'filler' in the manufacture of tyres.

Note: Natural gas is an almost ideal fuel. It produces large amount of heat (calorific value 55 KJ/g) when burnt.

Example 5: Why is petroleum refined?

Solution Petroleum or crude oil that is pumped out from oil wells is not pure. It is a mixture of several compounds. It is refined and converted into various components so that they can be used for various purposes.





Example 6: How is coke formed? Write its uses.

Solution When coal is heated in absence of oxygen, the process is known as destructive distillation. During destructive distillation, when the gaseous component (coal gas), liquid components (coal tar) and ammonia are removed, the black residue which is left is called coke. It is almost pure form of carbon. It is used in extraction of metals like iron in blast furnace and manufacture of steel by mixing it with iron.

Example 7: What are petrochemicals? What are their uses?

Solution Many useful substances are obtained from petroleum and natural gas. These are called petrochemicals. Petrochemicals are used in the manufacture of fibers, polythene, plastics, fertilizers, dyes and drugs etc.

Example 8: Are all natural resources inexhaustible?

Solution No, all natural resources are not inexhaustible. Those resources which are depleted at a faster rate than the rate at which they are replenished like, coal and petroleum are exhaustible. Those resources which are present in unlimited quantity in nature like sunlight, wind, etc. are inexhaustible.

FUNDAMENTAL UNLOCKED- (FU#2)

Q.1 Briefly explain the following:

- (a) Water gas (b) Producer gas

Q.2 What are the advantages of using CNG and LPG as fuels?

Q.3 Is coke a better fuel than coal?

Q.4 Where was the first oil well drilled.

Conservation of fossil fuels

Coal and petroleum are fossil fuels, which took millions of years to form, will last only a few hundred years. This is so because they are being used recklessly. Moreover, burning of these fuels is a major cause of air pollution. It is thus necessary to use these fuels only when absolutely necessary.

In India, the Petroleum Conservation Research Association (PCRA) has provided some tips to advise people how to save petrol/diesel. These tips are:

1. Drive at a constant and moderate speed as far as possible.
2. Switch off the engine at traffic lights or at a place where you have to wait.
3. Ensure correct tyre pressure.
4. Ensure regular maintenance of the vehicle.

Example 9: What is conservation?

Solution: To protect something useful from being overused or destroyed.

Example 10: What is full form of PCRA?

Solution Petroleum Conservation Research Association.

FUNDAMENTAL UNLOCKED- (FU#3)

Q.1 What are the guidelines provided by PCRA?

Q.2 Why there is a need to save petroleum?





ANSWER KEY

FUNDAMENTAL UNLOCKED- (FU#1)

Q.1 Coal tar is a thick black liquid formed during destructive distillation of coal. It is a mixture of about 200 substances which are mainly aromatic hydrocarbons.

Uses:

- It is used as a source of hydrocarbons.
- It is used to get naphthalene and many other useful products. Naphthalene is used as a moth and insect repellent.
- It is used in making road surfaces.
- It is used to manufacture synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, etc.

Q.2 Coal is mainly classified into three main types, depending upon the amount of carbon present in them. These are listed in the following table:

Type	Carbon content	Properties
Peat	50-60 %	Black and hard
Anthracite	90-95 %	Shiny black, very hard.
Bituminous	75-80 %	Black in colour, breaks very easily
Lignite	60-70 %	Brown in colour, softer

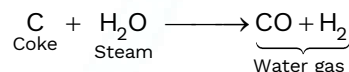
Q.3 On the basis of the availability, various natural resources can be classified in the following two groups:

- Inexhaustible natural resources like air, water, sunlight, etc.
- Exhaustible natural resources like forests, wildlife, mineral, coal, petroleum, etc.

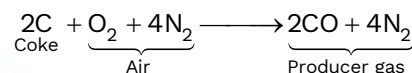
Q.4 The gas produced when coal is heated in the absence of air is coal gas.

FUNDAMENTAL UNLOCKED- (FU#2)

Q.1 (a) When steam is passed over red hot coke, it produces water gas which is a fuel gas. It is a mixture of carbon monoxide and hydrogen.



(b) When air is passed over red hot coke, producer gas, which is a mixture of carbon monoxide and nitrogen, is formed.



Q.2 The advantages of using CNG and LPG as fuels are as follows :

- CNG and LPG both are clean fuels.
- Their cost is low.
- They burn with a blue flame without any smoke. Thus, they do not blacken utensils and pollute air.
- They are very easy to handle, ignite and to put off.
- They have a very high calorific values.
- They are easily available.

Q.3 Yes. This is because coke does not produce smoke on burning and also coke produces more heat on burning as compared to coal.

Q.4 The world's first oil well was drilled in Titusville in Pennsylvania, the U.S.A. in the nineteenth century. On August 27, 1859.

FUNDAMENTAL UNLOCKED- (FU#3)

- Q.1**
- Drive at a constant and moderate speed as far as possible.
 - Switch off the engine at traffic lights or at a place where you have to wait.
 - Ensure correct tyre pressure.
 - Ensure regular maintenance of the vehicle.

Q.2 Petroleum is a fossil fuel which took millions of years to form but will last only for a few hundred years because of its reckless use. Burning of petroleum also causes pollution.



EXERCISE - I
SINGLE CORRECT TYPE QUESTIONS

1. Main constituents of coal gas are -
(A) H_2O , C_2H_6 , O_2 (B) CH_4 , CO_2 , O_2
(C) CH_4 , H_2 , CO (D) C_2H_6 , N_2 , O_2
2. Ammoniacal liquor is
(A) Ammonia absorbed in water.
(B) Ammonium hydroxide.
(C) Aqueous solution of ammonia.
(D) All of the above.
3. Which of the following products obtained by destructive distillation of coal is not properly matched?
(A) Coal tar - Dyes, explosives, paints.
(B) Coal gas - Fuel.
(C) Coke - Drinking purposes.
(D) Ammoniacal liquor- Fertilizers.
4. Which is the superior quality of coal?
(A) Anthracite (B) Peat
(C) Lignite (D) Bituminous
5. Maximum carbon containing coal is-
(A) Peat (B) Lignite
(C) Bituminous (D) Anthracite
6. Which of the following names represents the foul smelling, black, thick, viscous liquid obtained from destructive distillation of coal?
(A) Coke (B) Coal tar
(C) Coal gas (D) None of these
7. Formation of coal from plant matter is called:
(A) Destructive distillation
(B) Carbonization
(C) Both (A) & (B)
(D) None of these
8. Coal and petroleum are:
(A) Inexhaustible resources
(B) Fossil fuels
(C) Renewable resources
(D) All of these
9. Heating of coal in the absence of air is called:
(A) Destructive distillation
(B) Carbonization
(C) Both (A) & (B)
(D) None of these
10. Producer gas is a mixture of:
(A) CO and H_2 (B) CO and N_2
(C) Co and H_2 (D) None of these
11. The distillation of crude petroleum to obtain various commercially useful fraction is called
(A) Compression (B) Refining
(C) Mining (D) None of these
12. Which of the following is used for refining of petroleum?
(A) Steam distillation
(B) Distillation under reduced pressure
(C) Solvent extraction
(D) Fractional distillation
13. Which one of the following is not a petroleum product?
(A) Kerosene (B) Gasoline
(C) Asphalt (D) Bees wax
14. The amount of LPG in a domestic gas cylinder is about-
(A) 14.2 Kg (B) 13.2 KG
(C) 12.2 Kg (D) 11.2 Kg
15. CNG stands for:
(A) Conventional Natural Gas
(B) Coal and Natural Gas
(C) Compressed Natural Gas
(D) Commercial Natural Gas
16. The main constituent of natural gas is
(A) Butane (B) Ethane
(C) Propane (D) Methane
17. Largest producer of petroleum is:
(A) China (B) Saudi Arabia
(C) India (D) Japan
18. The substance added to detect the leakage of LPG is
(A) Methyl mercaptan (B) Ethyl mercaptan
(C) Both (A) and (B) (D) None of these
19. Which of the following is used as a household fuel?
(A) Gasoline (B) Paraffin wax
(C) Kerosene (D) All of these



20. Which of the following is not true for natural gas?
(A) It is generally found with petroleum deposits.
(B) It can be liquefied under pressure.
(C) It is a rich source of hydrogen.
(D) It has a low calorific value.
21. Which gas is produced when coal burns in air?
(A) Carbon dioxide (B) Oxygen
(C) Nitrogen (D) Hydrogen
22. Coke, coal gas and coal tar are products of
(A) destructive distillation of wood
(B) destructive distillation of coal
(C) Both (A) and (B)
(D) None of these
23. Ethyl mercaptan is added to LPG
(A) to give colour to it
(B) to give volume to it
(C) Both (A) and (B)
(D) to give smell to it
24. Which fraction of petroleum is used in making skin ointments and Vaseline?
(A) Lubricating oil
(B) Paraffin wax
(C) Bitumen
(D) Fuel oil
25. Besides the risk of air pollution, fossil fuels also pose a risk of
(A) Global warming
(B) Water pollution
(C) Leakage
(D) Explosion

VERY SHORT ANSWER TYPE QUESTIONS

1. Give an example of exhaustible natural resource.
2. What is the colour of coal?
3. What is the main constituent of coal?
4. What has replaced coal tar for road surfacing nowadays?
5. What is producer gas?
6. Which process is used for the refining of petroleum?

7. What is crude oil?
8. Name the main constituent of LPG and natural gas.
9. When was the first oil well drilled?
10. Which country is largest producer of petroleum?

SHORT ANSWER TYPE QUESTIONS

1. Write the products obtained by processing of coal.
2. What are natural resources?
3. What are fossil fuels?
4. Why should we use the fossil fuels economically and wisely?
5. Explain the term carbonisation?
6. How is Carbon Black obtained?
7. Why is petroleum called black gold?
8. Write two ways to conserve fossil fuels.
9. Write two uses of natural gas.
10. Define calorific value of fuels, giving two examples.

LONG ANSWER TYPE QUESTIONS

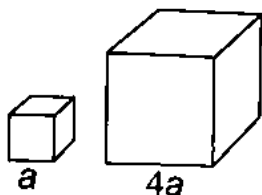
1. Differentiate between inexhaustible and exhaustible natural resources.
2. Give the uses of the following:
(i) Coke (ii) Coal tar (iii) Coal gas
3. Name and describe the different varieties of coal.
4. Write a short note on the formation of coal and petroleum.
5. Explain the term petroleum refining in detail.
6. Why should we conserve fossil fuels? Explain the tips how will you conserve them?
7. Name the petroleum product used for:
(i) Gaseous cooking fuel
(ii) Road surfacing
(iii) Solvent for dry cleaning
(iv) Cosmetic preparation
(v) Fuel for generators
8. How did petroleum originate and how was it formed?



EXERCISE - II

HOTS

1. A cube of side a , rests on the floor as shown in the given figure. Given that the pressure exerted by this cube on the floor is P , what is the pressure exerted by another cube of the same material of side $4a$? (Take $g = 10 \text{ N kg}^{-1}$)

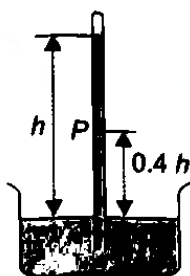


(A) P (B) $2P$ (C) $4P$ (D) $16P$

2. The surface area of the base of a brick X is 100 cm^2 . The surface area of the base of the brick Y is 250 cm^2 . Each brick weighs 100 N . Which of the following is correct if P_1 and P_2 are the pressures exerted by the bricks X and Y respectively?

(A) $P_1 = P_2$ (B) $P_1 > P_2$
(C) $P_1 < P_2$ (D) $P_1 = P_2 = 0$

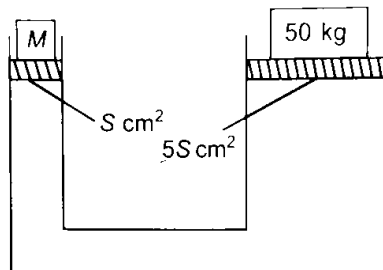
3. The diagram shows a simple mercury barometer. The mercury level is at a height h when the atmospheric pressure is 100000 Pa . What is the pressure at P ?



(A) 40000 Pa
(B) 60000 Pa
(C) 100000 Pa
(D) 140000 Pa

4. As we go higher up on mountains, our ears pop because
- (A) Air pressure outside our ears increases
(B) The pressure exerted by the blood near ears increases
(C) Air pressure outside our ears decreases
(D) None of these.

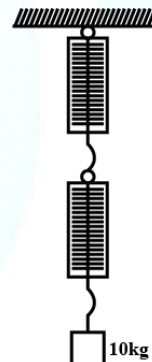
5. The diagram shows a hydraulic system in equilibrium. The cross-sectional areas of the smaller piston and the larger piston are $S \text{ cm}^2$ and $5S \text{ cm}^2$ respectively.



The mass M required to balance the load of 50 kg is

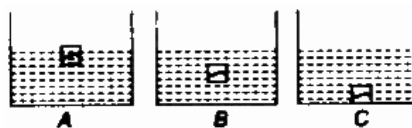
(A) 2 kg (B) 5 kg (C) 8 kg (D) 10 kg

6. A block of mass 10 kg is suspended through two light spring balances as shown in figure. Then (Neglect the mass of spring balance.)



(A) Both the scales will read 10 kg
(B) Both the scales will read 5 kg
(C) The upper scale will read 10 kg and the lower scale zero
(D) The individual reading may be anything but their sum will be 10 kg .

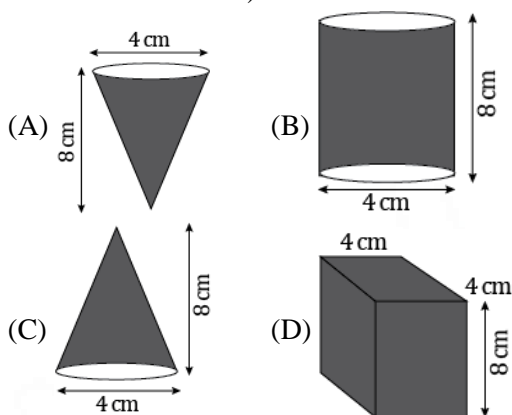
7. Three identical vessels P, Q and R contain same quantity of liquid. In each vessel, blocks with different densities but same masses are placed as shown in figure. If F_P , F_Q and F_R are the total forces acting on the base of vessels P, Q and R respectively, then



(A) $F_P = F_Q = F_R$ (B) $F_P < F_Q < F_R$
(C) $F_P = F_Q < F_R$ (D) $F_P > F_Q > F_R$



8. Which of the following objects exerts the maximum pressure on the floor? (All objects have the same mass.)

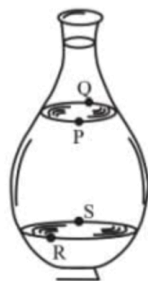


9. Match the following column:

Sr. No	Objects		Nature of force
1	Force on falling ball	A	Frictional force
2	Force on moving charge	B	Muscular force
3	Force on lifting objects	C	Electrostatic force
4	Force on sliding ball	D	Gravitational force

- (A) 1-D, 2-C, 3-B, 4-A
 (B) 1-A, 2-D, 3-B, 4-C
 (C) 1-B, 2-C, 3-D, 4-A
 (D) 1-C, 2-D, 3-A, 4-D

10. In the adjoining diagram, a pot is filled with water. P, Q, R and S are the points as shown in the diagram. About liquid pressure at P and Q which statement is correct from the following?



- (A) Liquid pressure at both points P and Q is equal.
 (B) Liquid pressure at points P and Q is different.
 (C) Liquid pressure at points P and Q is greater than the pressure at point R.
 (D) Liquid pressure at point S is less than the pressure of liquid at points P and Q.

11. What is the change in pressure if the force is doubled and the area on which force applied is halved?

- (A) Double (B) Remains same
 (C) Four times (D) Half

12. Select the correct group of units of pressure from the following:

- (P) Pascal
 (Q) N/m^2
 (R) dyne cm^2
 (S) bar
 (A) P, Q, S (B) P, R, S
 (C) P, Q, R (D) P, Q, R, S

13. In which of the following positions the person exerts minimum pressure on the earth?

- (A) Standing erect on head
 (B) Seating on the floor
 (C) Standing on one leg
 (D) Sleeping on the back

14. Select the correct factor on which the pressure exerted by a body on the surface does not depend?

- (A) Weight of body
 (B) Area of surface in contact
 (C) Volume of body
 (D) Nature of surface in contact

15. A piston applies a force of 36 N on a square area having length 12 cm. Find the pressure acting on this plate.

- (A) 25 Pa
 (B) 250 Pa
 (C) 2,500 Pa
 (D) 25,000 Pa



ASSERTION & REASON TYPE QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of reason (R).

- (1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
- (2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).
- (3) If Assertion is true statement but Reason is false, then mark (3).
- (4) If both Assertion and Reason are false statements, then mark (4).

1. **Assertion (A):** The net force acting on a body is zero, if it is moving in a straight line, with constant speed.

Reason (R): A force can change the state of motion of an object.

2. **Assertion (A):** A ball rolling on the ground gradually slows down and finally comes to rest.

Reason (R): The friction force opposes the relative motion of a body.

3. **Assertion (A):** Two charged bodies attract each other even when they are not in actual contact.

Reason (R): The force acting between two objects without any physical contact between them is called a non-contact force.

4. **Assertion (A):** Shoulder bags are provided with broad straps.

Reason (R): If the area of contact is increased keeping the magnitude of force constant, then the pressure decreases.

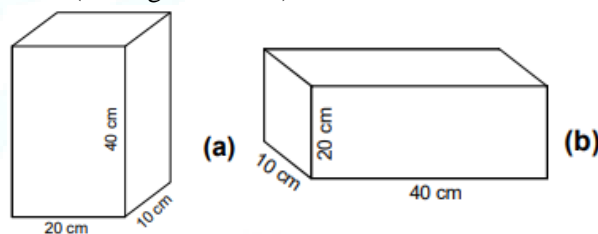
5. **Assertion (A):** Deep sea divers wear armored suits while diving.

Reason (R): The pressure below the ocean surface is much higher than the atmospheric pressure.

NUMERICAL TYPE QUESTIONS

1. When a force of 40 N is applied on a body, it moves with an acceleration of 5 ms^{-2} . Calculate the mass of the body.
2. It is required to increase the velocity of a scooter of mass 80 kg from 5 ms^{-1} to 25 ms^{-1} in 2 second. Calculate the force required.

3. A car of mass 1000 kg is moving with a velocity of 10 m/s and is acted upon by a forward force of 1000 N due to engine and retarding force of 500 N. Calculate the velocity after 10 seconds.
4. A car of mass 500 kg is starts from rest and is acted upon by a forward force of 200 N due to engine and retarding force of 50 N. Calculate the velocity after 5 seconds.
5. If a force of 100 dyne is applied over an area of 2 cm^2 . Calculate the pressure produced in Pascal.
6. In a hydraulic machines, a force of 2 N is applied on the piston of area of cross section 10 cm^2 . What force is obtained on its piston of area of cross section 100 cm^2 .
7. If the area of my head were $10 \text{ cm} \times 10 \text{ cm}$, how much weight of air would I be carrying on my head?
8. A block of wood is kept on a tabletop. The mass of wooden block is 5 kg. and its dimensions are $40 \text{ cm} \times 20 \text{ cm} \times 10 \text{ cm}$. Find the pressure exerted by the wooden block on the table top if it is made to lie on the table top with its sides of dimensions
(a) $20 \text{ cm} \times 10 \text{ cm}$ and (b) $40 \text{ cm} \times 10 \text{ cm}$.
(Take $g = 10 \text{ m/s}^2$)



9. Imagine a girl of mass 50kg standing on pencil heels, each of area of cross-section of 1 cm^2 , and an elephant of mass 2000 kg and foot area of 250 cm^2 standing on floor. Find the pressure exerted by each of them assuming acceleration due to gravity is 10 m/s^2 . Which of the two exerts more pressure on the floor?
10. A cubical block of mass 2.5 kg is kept on a levelled horizontal surface. If it exerts a pressure of 100 Pa on the surface, then find the volume of the block. [Take $g = 10 \text{ m/s}^2$]



EXERCISE - III

PREVIOUS YEAR QUESTIONS

1. When X is heated in the absence of air, Y is formed. Y is tough, porous and a black substance. X and Y are carbon-rich materials. What could X and Y be?

(A) X = Coal, Y = Coke
 (B) X = Petroleum, Y = Petrol
 (C) X = Coal, Y = Coal tar
 (D) X = Petroleum, Y = Diesel

2. In the oil wells, natural gas forms the top most layer, followed by oil and finally water. This is because

(A) oil and gas are heavier than water
 (B) gas and oil are lighter than water
 (C) oil and gas stick to each other
 (D) None of these

3. Match the items given in Column-I with Column-II.

Column-I		Column-II	
(P)	Petroleum gas in liquid form	(1)	Black gold
(Q)	Natural gas	(2)	LPG
(R)	Petroleum	(3)	CNG
(S)	Paraffin wax	(4)	Candles

(A) P-2, Q-3, R-1, S-4
 (B) P-4, Q-3, R-1, S-2
 (C) P-4, Q-3, R-1, S-2
 (D) P-3, Q-2, R-4, S-1

4. Petroleum is a mixture of various components. By which of the following processes are they separated?

(A) Fractional distillation
 (B) Sublimation
 (C) Decantation
 (D) Filtration

5. Sleeping in a closed room where coal is burnt is fatal for people because

(A) coal is a poisonous substance
 (B) poisonous gas, carbon monoxide, is produced due to the incomplete combustion of coal
 (C) burning of coal in a closed room evolves carbon dioxide and water vapour, which are harmful
 (D) None of the above



ANSWER KEY

EXERCISE-I

SINGLE CORRECT TYPE QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	D	C	A	D	B	B	B	A	B	B	D	D	A	C
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	D	B	B	C	D	A	B	D	B	A					

EXERCISE-II

HOTS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	D	D	C	A	A	C	C	A	B	B	C	C	A	D

ASSERTION AND REASON

Que.	1	2	3	4	5
Ans.	A	C	B	B	D

EXERCISE-III

PREVIOUS YEAR QUESTIONS

Que.	1	2	3	4	5
Ans.	A	B	A	A	B