

COAL AND PETROLEUM

INTRODUCTION

There are number of naturally occurring materials in the environment that are called natural resources.

These are air, water, soil, coal, petroleum, ground water, minerals(ores), forests and wild life etc.

Wind energy and solar energy are also natural resources because the energies contained in them are used to do many useful things.

CLASSIFICATION OF NATURAL RESOURCES :

Natural resources can be broadly classified into two kinds.

(a) **Renewable** (or) **Inexhaustible**

(b) **Non-Renewable** (or) **Exhaustible**

a) **Renewable resources** : These resources are present in unlimited quantity in nature and are not likely to be exhausted by human activities.

Ex : Sun light, air

b) **Non-renewable resources** : These resources are present in limited amount in nature. These can be exhausted by human activities.

Eg : Forests,Coal, Petroleum, wild life, minerals, natural gas.

➤ Coal and Petroleum are very important natural resources and play a vital role in modern society. They are found in earth's crust in coal mines and petroleum mines.

➤ Here we will learn about some exhaustible natural resources like coal, petroleum and natural gas. These were formed from the dead remain of living organisms (fossils). So, these are all known as fossil fuels.

COAL :

Occurrence : Coal is found deep under the surface of the earth. The major coal mines in India are located in west Bengal, Orissa, Madhya Pradesh.

How is coal formed ?

Coal was formed in prehistoric times (200–250 million years), when huge forest areas got buried under the surface of earth. Under hot conditions they were attacked by anaerobic bacteria which progressively removed hydrogen and oxygen leaving behind carbon. Due to very high temperature and pressure of Earth, the carbon got compacted to form stony residue called **Coal**. **The Slow biochemical Process of conversion of dead vegetation into coal is called "carbonization"**. Coal mainly contains **carbon**. Nitrogen , sulphur , hydrogen, and oxygen are also present but in very small quantities.

➤ **TYPES OF COAL :**

Coal is as hard as stone and black in colour. Coal is mainly made up of carbon.

Different types of coals are

- 1) **Peat-** 45-60% carbon. It is initial stage of formation of coal. Very soft produce lot of smoke during combustion. This has very less calorific value. Brown in colour.
- 2) **Lignite-** 60-75% carbon. This is termed as soft coal. Comparatively less smoke is produced during combustion. High calorific value than peat. Dark brown in colour

- 3) **Bituminous-** (House hold coal) 75 - 85% carbon. It is harder than lignite. Produce very smoke. Highly abundant in earth crust. Most widely used in industries as well as domestic fuel. Calorific value is very high compared to peat and lignite . Black in colour.
- 4) **Anthracite-** (Hard coal) more than 90% carbon. It is the hardest coal. Mainly used in metallurgy industries. And coke is mainly obtained by destructive distillation of anthracite coal. Very high calorific value and least polluting coal.

➤ **PRODUCTS FORMED ON DESTRUCTIVE DISTILLATION OF COAL !**

- 1) When heated in air coal burns and produces mainly carbon dioxide gas
- 2) Coal is processed in industry to get some useful products such as coke, coal tar and coal gas.
- 3) Coal on destructive distillation produces **coke, coal tar, coal gas, ammonical liquor. Heating the coal strongly in the absence of air is called destructive distillation or pyrolysis**

A) Coke :

- i) It is almost purest form of carbon. It is a solid residue left after distillation. .
- ii) Used in the extraction of metals like iron, copper, tin and zinc, as it is an excellent reducing agent. And used in steel manufacture

B) Coal Tar

- i) It is a thick black viscous liquid with a disagreeable smell
- ii) It is a mixture of about 200 substances.
- iii) It is used in the manufacture of synthetic dyes, drugs, explosives, perfumes, plastics, paints etc.
- iv) Naphthalene , Anthracene , benzene, toluene are also obtained from coal tar

C) Coal gas :

- i) It mainly consists of low molecular mass alkanes and alkenes. Contains methane as the main constituent (85%)
- ii) The coal gas is purified and used as house hold fuel. And used as fuel on industries close to distillation plants.

D) Ammonical liquor :

- i) It is a solution of ammonia gas in water.
- ii) It is used to manufacture of nitrogenous fertilizers.

USES OF COAL :

- 1) Coal is used as fuel for cooking food.
- 2) It was used in railway engines to produce steam to run the engine
- 3) Used in thermal power plants to produce electricity

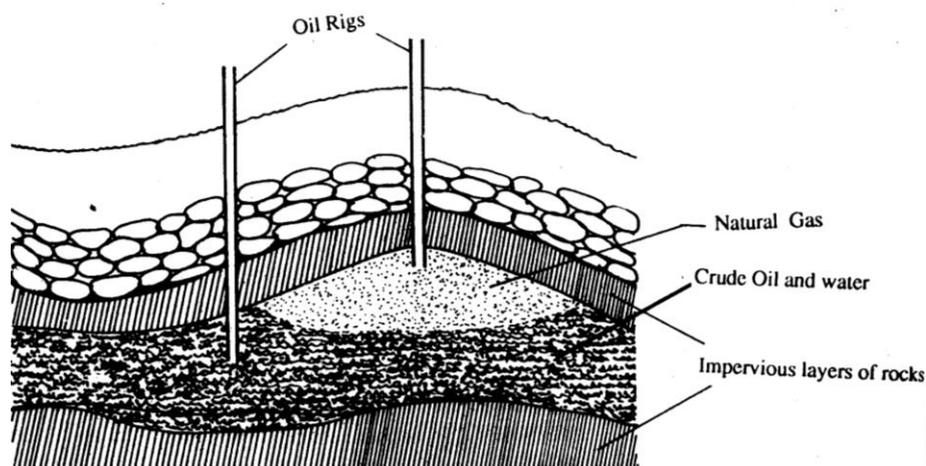
PETROLEUM :

Petroleum is a fossil fuel. It is a dark coloured viscous and foul smelling liquid. The word "Petro" means rock and "Oleum" means oil. The name indicates that this oil is obtained from rocks. Petroleum is present in between two layers of impervious rocks deep in the earth. A hole is drilled from the surface of the into the rock & petroleum flows out of the hole. This is called crude petroleum or simply **crude oil**.

How is petroleum formed ?

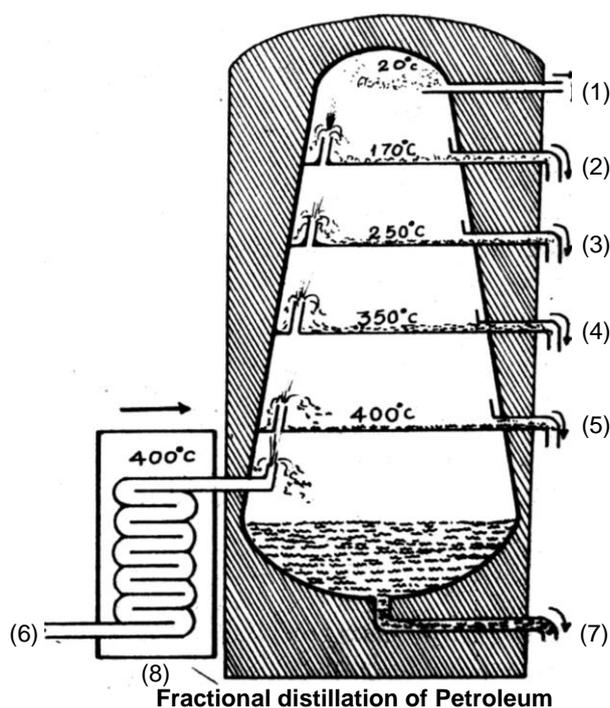
Million years ago, a large number of microscopic plants & animals lived in sea. They died because of some calamity & this bodies sank to the sea bed. These dead bodies got covered with sand and clay. Thus the bodies of dead animal decayed in the absence of air under high temperature & pressure of earths. The product of decay was petroleum & natural gas.

Note : It is believed that petroleum is formed by the anaerobic decomposition of extremely small sea animals & plants which got buried in the sea bed million years ago.



Refining of Petroleum.

- Crude oil is a mixture of several different types of solid, liquid and gaseous hydrocarbons mixed with water, salts and earth particle.
- The process of separating the various constituents of petroleum is known as **refining**. It is carried out in a petroleum refinery.
- The petroleum is refined by subjecting the crude oil to **fractional distillation**.
- Due to its commercial importance petroleum is also called as **black gold**.
- Crude Petroleum is refined by fractional distillation. Following are main products of refining.
 - (1) Petroleum gas
 - (2) Petrol (or) gasoline
 - (3) Kerosene oil
 - (4) Diesel oil
 - (5) Fuel oil
 - (6) Residue oil
- Residual oil subjected to fractional distillation above 400°C the following products are obtained.
 - (i) Lubricating oil
 - (ii) Paraffin wax
 - (iii) Asphalt or Bitumen
- Several products obtained from petroleum are there fore called as "Petro chemicals". Petro chemicals, are used in several. Industries.



- 1) Fuel Gas (LPG)
- 2) Petrol
- 3) Kerosene oil
- 4) Diesel oil
- 5) Fuel oil
- 6) Crude oil
- 7) residual oil
- 8) Furnace

Various Constituents of Petroleum and their Uses

S.No.	Constituents of Petroleum	Uses
1.	Petroleum Gas in Liquid form (LPG)	Fuel for home and industry
2.	Petrol	Motor fuel, Aviation, Solvent for Dry cleaning
3.	Kerosene oil	Fuel for stoves, Lamps and for Jet aircrafts
4.	Diesel oil	Fuel for heavy motor vehicles, Electric generators
5.	Lubricating oil	Lubrication
6.	Paraffin wax	Ointments, candles, Vaseline etc.
7.	Bitumen	Paints, road surfacing

NATURAL GAS

1. Natural gas is also an important fossil fuel. Natural gas occurs along with petroleum in the impervious rock layers of earth.
2. Natural gas consists mostly of methane(95%) and some amount of ethane and propane.
3. Natural gas is stored under high pressure as compressed natural gas (CNG)
4. CNG is used for power generation. It is now being used as fuel for transport vehicles because it is less polluting, because on burning it produces only carbon dioxide and water. Thus CNG is termed as **cleaner fuel** .
5. Coal when burnt leaves a residual of ash, and coal or petrochemicals when burnt along with carbon dioxide and water, oxides of nitrogen and sulphur are produced which are highly polluting and harmful. But natural gas does not leave any ash and is easy to supply through pipes and is less polluting.

ASSIGNMENT

SUBJECTIVE

1. Explain the process of formation of petroleum ?
2. Name the petroleum product used for surfacing of roads.
3. What are the advantages of using CNG and LPG as fuels ?
4. What is refining of Petroleum ?
5. Name the products formed, when coal is subjected to destructive distillation ?
6. Name one use of each of the products obtained by the destructive distillation of coal ?
7. Name the method for refining crude petroleum ?
8. (i) State the composition of natural gas.
(ii) State two uses of natural gas
9. What is coal ? How is it formed? Name the main varieties of coal.
10. When coal is subjected to destructive distillation, name :
(a) a gas product (b) liquid product (c) solid product.
11. What is carbonization ?

OBJECTIVE

I. Fill in the blanks: with suitable words given below :

- (a) Carbonisation (b) Refining of petroleum (c) Fractional distillation
 (d) Fractional distillation (e) candles (f) Methane (g) anaerobic
 (h) 170°C–250°C (i) fuel (j) Petroleum (k) CNG (l) Petrochemicals

1. The slow process of conversion of dead vegetation into coal is called _____
2. Paraffin wax is used in preparation of _____
3. Process of separation of different constituents from petroleum is called _____
4. Least polluting fuel for vehicles is _____
5. Purified coal gas is used as a house hold _____
6. Coal is formed due to removal of hydrogen from the buried forests by the _____ bacteria.
7. The fractions obtained by the _____ of residual oil are asphalt, paraffin wax and lubricating oil.
8. Natural gas consists of 98% _____ and 5% of other hydrocarbons.
9. Crude oil is refined by a process called _____.
10. Chemicals derived from the fractions of petroleum are called _____
11. During fractional distillation of petroleum kerosene oil separates at a temperature between _____.
12. Natural gas is formed along with _____

III. State whether the following statements are True or False :

1. Peat, lignite, bituminous and anthracite are different varieties of petroleum. []
2. Petroleum is formed by anaerobic decomposition of marine plants and animals. []
3. Petroleum deposits are usually mixed with muddy water []
4. During fractional distillation of petroleum the petrol separates at a temperature between 170°C to 250°C []
5. Asphalt is used for making candles. []
6. Coke is almost pure form of carbon. []
7. Coal tar is a mixture of various substances. []
8. Kerosene is not a fossil fuel []
9. Fossil fuels are inexhaustible resources. []
10. CNG is more polluting fuel than petrol. []
11. Coal is used in thermal power plant to produce electricity []
12. Coke is used for metalling of the roads []
13. Bitumen is a petroleum product []
14. Fossil fuels can be made in laboratory []
15. Coal is formed by destructive distillation of dead plants. []

MULTI CORRECT

1. The resources present in un limited quantity in nature and are not exhausted by human activities are _____ resources
 (A) Exhaustible (B) Inexhaustible (C) Natural (D) None of the above
2. Fossil fuels are
 (A) Coal (B) Petroleum (C) Natural gas (D) all
3. Coal is _____
 (A) Metal (B) Non-metal (C) fuel (D) metalloid
4. Slow process of conversion of dead vegetation into coal is called
 (A) Carbonisation (B) Neutralisation (C) Liquification (D) None of the above
5. Coal is processed in industry to get
 (A) coke (B) coal tar (C) coal gas (D) all
6. _____ is used in the preparation of explosives, perfumes plastics, Paints etc.
 (A) Coke (B) coal tar (C) coal gas (D) petroleum
7. Petroleum was formed from organisms living in
 (A) Sea (B) Land (C) Cement (D) Sand
8. Separating various constituents of petroleum is known as
 (A) Purification (B) Cleaning (C) Refining (D) Transforming
9. Paraffin wax is used in
 (A) Ointments (B) Candles (C) Vaseline (D) All
10. Fossil fuels are _____ Natural Resources
 (A) Exhaustible (B) inexhaustible (C) Both A & B (D) Artificial
11. Natural gas stored under high pressure is _____
 (A) LPG (B) CNG (C) NG (D) Petrol
12. The gas that we use at our home for cooking is in _____ state.
 (A) solid state (B) liquid state (C) Gaseous state (D) None
13. When heated in air, coal burns and produces mainly _____ gas
 (A) Carbon monoxide (B) Carbon dioxide (C) sulphur dioxide (D) none
14. Coal tar is a
 (A) Hard soil (B) transparent liquid (C) thick liquid (D) Jelly state
15. Lubricating oil is produced from
 (A) Residual oil (B) Diesel oil (C) Fuel oil (D) Petroleum gas
16. Natural gas is a mixture of
 (A) Methane and oxygen (B) Methane & oxygen
 (C) Methane, ethane and propane (D) methane, ammonia & oxygen
17. Residual oil subjected to fractional distillation to obtain
 (A) Lubricating oil (B) Paraffin wax (C) Asphalt (D) All the above

18. Which of the following is a non-renewable resource
 (A) Sunlight (B) Air (C) Water (D) Coal
19. Which of the following is not petroleum origin
 (A) Petrol (B) Diesel (C) Coke (D) LPG
20. Nephelene balls are obtained from
 (A) Coke (B) coal tar (C) coal gas (D) bitumen
21. Coal burns in air to produce
 (A) CO₂ (B) N₂ (C) H₂O (D) All of the above
22. Petroleum is also called
 (A) American gold (B) Black gold (C) Black diamond (D) America diamond
23. Gasoline is the name of
 (A) crude oil (B) The gaseous constituent of petroleum
 (C) The mixture of un condensed gases produced in the distillation of crude oil
 (D) The mixture of the residue and gas oil obtained in the distillation of crude oil
24. Which of these is not a fossil fuel ?
 (A) Coal (B) LPG (C) Biogas (D) Natural gas
25. The residue left in destructive distillation of coal is
 (A) charcoal (B) coke (C) coaltar (D) coal gas
26. The main constituent of LPG is
 (A) Methane (B) Ethane (C) Propane (D) Butane
27. The fraction of petroleum used as jet fuel is
 (A) Petrol (B) Kerosene (C) diesel (D) alcohol
28. Coal with largest "carbon" content is
 (A) anthracite (B) Peat (C) lighite (D) bituminous
29. The chemical added to LPG to help detect its leakage is
 (A) iso butane (B) ethyl amine (C) methyl mercaptan (D) ethyl mercaptan
30. Which of the following are not obtained on fractional distillation of petroleum
 (A) Paraffin wax (B) Asphalt (C) Coal gas (D) None of the above
31. Compounds of carbon and hydrogen are called
 (A) hydrocarbon (B) Petrol (C) carbondioxide (D) carbohydrates

IV. Match the following

Column – I		Column – II	
(i)	Bituminous	(a)	Fraction distillation of residual oil
(ii)	Paraffin wax	(b)	Fossil fuel
(iii)	Sun light	(c)	In exhaustible resource
(iv)	Naphthalene	(d)	Petroleum product
(v)	Coal	(e)	Fraction of coal tar
(vi)	Lubricating oil	(f)	Type of coal

V. Fill in the blank

- 1) _____ is the almost pure form of carbon
- 2) Least polluting fuel for vehicles is _____
- 3) _____ are exhaustible resources
- 4) The process of conversion of dead vegetation into coal is called _____
- 5) In exhaustible resources are _____ , _____

ANSWERS

OBJECTIVE

I.

- | | | | |
|------|-------|-------|-------|
| 1. a | 2. e | 3. b | 4. k |
| 5. l | 6. g | 7. d | 8. f |
| 9. c | 10. l | 11. h | 12. j |

II. TRUE (OR) FALSE

- | | | | |
|-------|-------|-------|-------|
| 1. F | 2. T | 3. F | 4. F |
| 5. F | 6. T | 7. T | 8. F |
| 9. F | 10. F | 11. T | 12. F |
| 13. T | 14. F | 15. T | |

III. MULTI CORRECT

- | | | | |
|-------|-------|-------|-------|
| 1. B | 2. D | 3. C | 4. A |
| 5. D | 6. B | 7. A | 8. C |
| 9. D | 10. A | 11. B | 12. B |
| 13. B | 14. C | 15. A | 16. C |
| 17. D | 18. D | 19. C | 20. B |
| 21. A | 22. B | 23. B | 24. C |
| 25. B | 26. D | 27. B | 28. A |
| 29. D | 30. C | 31. A | |

IV Match the following :

- (i) f (ii) d (iii) c (iv) e (v) b (vi) a

V Fill in the blanks :

- | | | |
|------------------|-------------------|-----------------|
| 1. Coke | 2. CNG | 3. Fossil Fuels |
| 4. Carbonisation | 5. Sun light, air | |