

## UNIT 3

# Resources



### Unit Overview

- 3.1 Introduction
- 3.2 Classification of Resources
- 3.3 Mineral resources
- 3.4 The world distribution of minerals
- 3.5 Energy Resources
- 3.6 Conservation of Resources

### 3.1 Introduction

Have you heard about **Voyager 1** launched in 1977 still is travelling at the speed of **62140 km/hour or 17 km/sec.?** Do you know what fuel is used in it? It is **hydrazine**. What, do you think, would be the future fuel? It is certainly going to be **hydrogen**. Think about how hydrogen stands as an important future fuel.

A resource is a naturally occurring exploitable material that a society perceives to be useful to its economic and material wellbeing. Willing, healthy and skilled workers also constitute a valuable resource, but without access to materials such as fertile soil or petroleum, human resources are limited in their effectiveness.

Resources are the basis of the economic development of any nation. Different countries are at different levels of economic development



### Learning Objectives

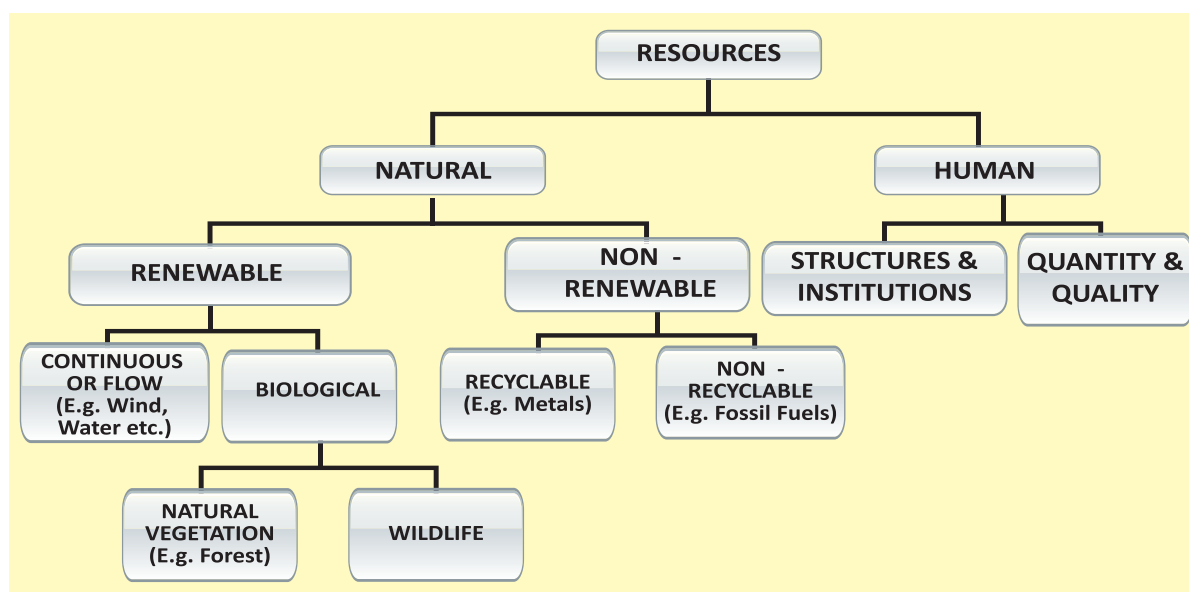
- Understand the classification of resources.
- Estimate the world reserves of the resources.
- Reason out why there is an uneven distribution of resources.
- Describe the methods of conserving the resources.



primarily because of the variation in the availability of natural resources. The US and west European countries are economically prosperous because they possess vast natural and human resources and technology. On the other hand, in most parts of Africa and Asia, though they are naturally rich in resources, due to their lack of knowledge, the resources are unutilised and they are not used in the service of man.

### 3.2 Classification of Resources

Resources are classified on various bases. Based on the continual availability, resources are classified in to **renewable** and **non renewable resources**.



The resources which can always be used again and again are known as **renewable resources**. It means these resources have natural regeneration and are inexhaustible. Air, water, solar energy etc are examples of renewable resources. **Non renewable resources** are available in finite quantities and cannot be obtained once if they are utilized. If these resources are used in large scale, they will get exhausted soon and as such these resources are called as **exhaustible resources**. Coal, oil and minerals are examples of this type.

On the basis of origin, the resources are classified in to **biotic** and **abiotic resources**. When a resource is originated from living organism, the resource is known as **biotic resource**. Coal, mineral oil and forests are examples of biotic resources. **Abiotic resources** are composed of non-living inorganic matter. Air, land, water and minerals are examples of this type.

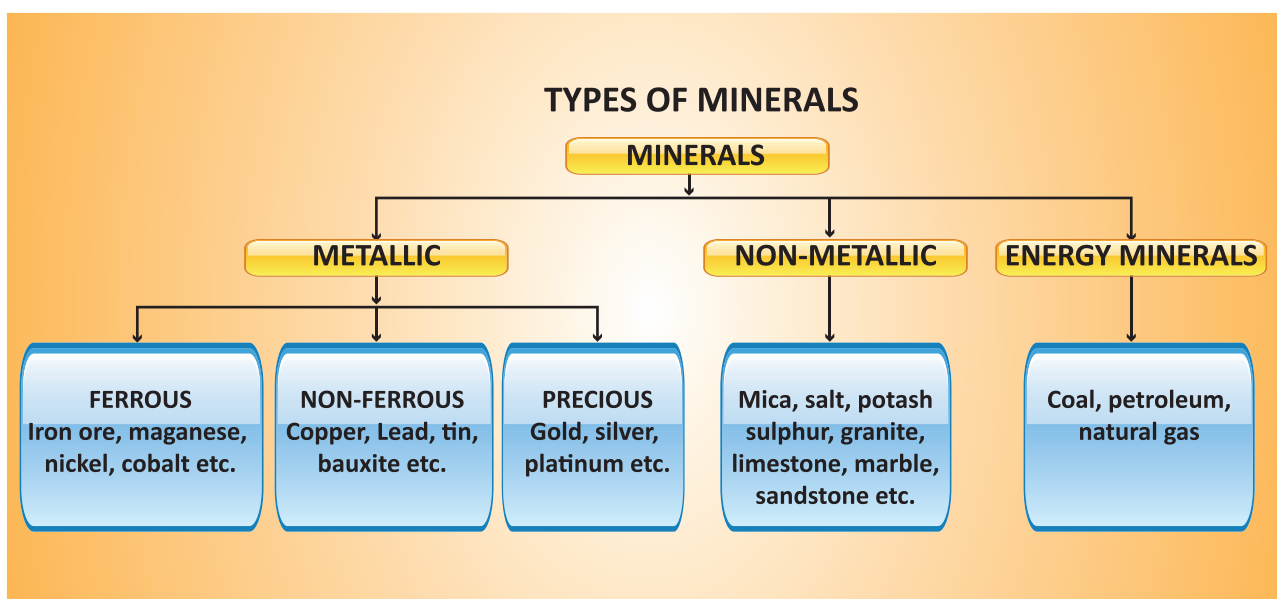
On the basis of status of development, the resources are classified in to **potential resources** and **developed resources**. Potential resources are those which are known to exist and may be used in the future. Until the resource is extracted and put in to use, it remains a potential resource. **Developed resources** are those which have been surveyed and their quality and quantity have been determined for utilisation. The development of resources depends on

technology and level of their feasibility. Petroleum resource from Mumbai High is an example of Developed resources.

Apart from the above classifications, the resources which are available in nature are known as **natural resources** and the one created by man is known as **man-made resource**. Similarly the air like resources which exist everywhere is called as **ubiquitous resources** and the resources which are concentrated only at specific places are known as **localised resources**. This kind of resource may exercise great influence on the economic development of the respective regions.

### 3.3 Mineral Resources

A homogeneous, naturally occurring substance which has a definite chemical composition is called a mineral. They can be identified by their physical properties and chemical components. Minerals exist in different types based on their formation. Almost everything we use, from a tiny particle to a huge building or a big ship all, is made up of minerals. Minerals are one of the most valuable resources of the earth. All the stages of human development or progress have been named after them. For example, stone age, copper age, bronze age and Iron Age.



They are exhaustible or non renewable. Besides, they are distributed very unevenly. They are generally found in the form of ores. The ore contains several impurities. Minerals are separated from the ores involving a number of distinct processes.

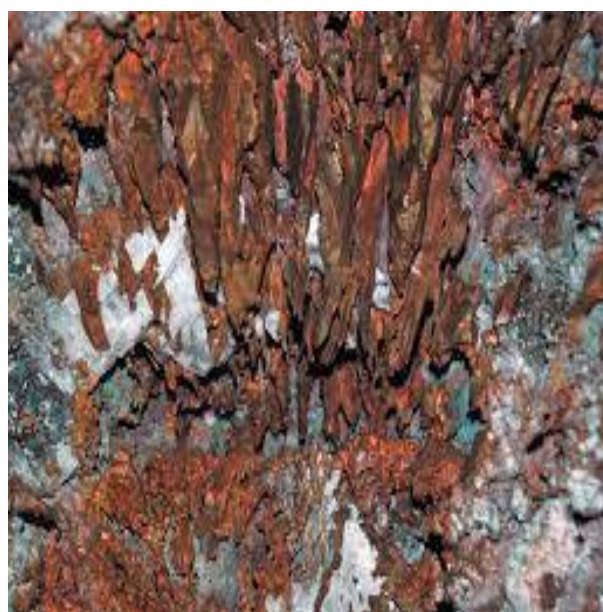
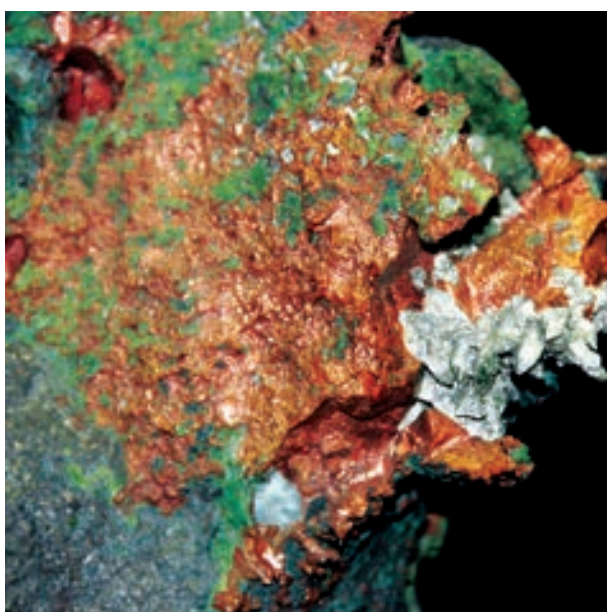
A country's economic development is depending on the minerals. There are several types of minerals, but according to their characteristics and commercial use they are classified as shown in above chart.

### Mode of Occurrence of Minerals

Minerals are generally found in 'Ores'. It is actually an accumulation of any mineral mixed with other elements. Minerals generally occur in many forms. They are

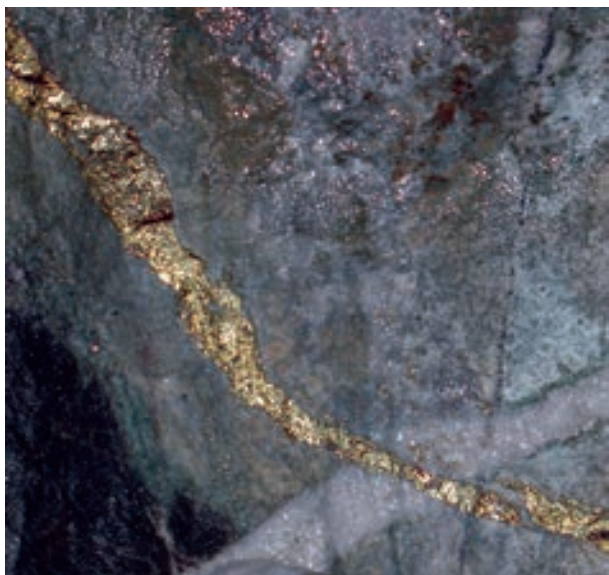
#### 1. Veins and lodes

Minerals generally occur in the cracks, crevices, faults and joints of the igneous and metamorphic rocks. Minerals in smaller occurrence are called a 'Vein' and a larger occurrence is called a 'lode, for example, Copper and Gold are found in lodes and veins.



**Copper Lodes**





Gold veins

## 2. Beds or Layers

Minerals that are formed as a result of deposition, accumulation and concentration generally occur in horizontal layers. E.g. Coal, Potash, etc.



Coal



Bauxite

### Residual mass of weathered particles

When the decomposed rocks are washed away by water, the soluble particles are removed, leaving a mass containing ores. Such occurrences are called **residual mass**. E.g. Bauxite

### 3. Alluvial deposits

These are the deposits found in the sands of valley floor and at the foot hills. These deposits consist of the minerals such as Gold, Silver and Platinum.



Platinum

## 3.4 The world distribution of minerals

### Metallic Minerals

The minerals which contain metal in them are called as metallic minerals.

#### Iron - Ore

It is the basic mineral and the backbone of industrial development of the world. Iron Ore is the most widely distributed element of the earth's crust and it rarely occurs in a free state. It is found as the composition of many rocks and minerals. Iron-ore makes up 4.6% of the earth crusts. Iron is found in the form of Iron - ore. They are classified into 4 categories.

- (i) **Magnetite:** It is red in colour and has 72% of pure Iron
- (ii) **Hematite:** It is black in colour and has 70% of pure Iron
- (iii) **Limonite:** Its colour varies from dark brown to yellow and has 50% of pure iron.
- (iv) **Siderite:** It is brown in colour and contains only 30% of pure iron is present.

The iron content of these ores is highly variable. If the iron content is less than 30% in an ore, it is considered to be uneconomical. Iron is mixed with fixed proportions of Manganese, Nickel, Chromium or Vanadium to make different varieties of steel.

### Distribution of Iron ore

Iron - ore is unevenly distributed in the world. Good quality Iron ore is found in Australia, Brazil, Russia, China, USA, Ukraine, Canada, etc. Russia has the largest reserves of iron ore in the world.

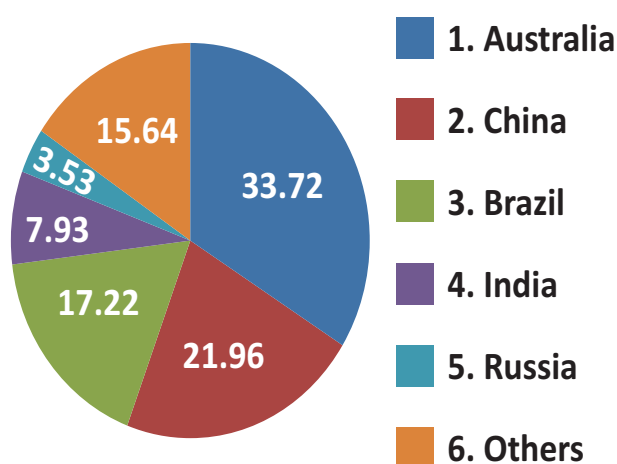
Australia is the largest producer of Iron ore in the world. Other leading producers are China, Brazil, India and Russia. The Majority of Iron ore is (84%) produced by 5 countries alone.

#### Iron ore

Rank	Country	Production (Metric Ton)	Share (%)
1	Australia	531,075,350	33.72
2	China	345,841,000	21.96
3	Brazil	271,275,900	17.22
4	India	124,852,650	7.93
5	Russia	55,550,000	3.53
	Others		15.64

SOURCE: World mining data -2018

### IRON ORE PRODUCTION - 2016 SHARE IN %



### Major Iron ore fields in the world

Country	Iron ore fields
Australia	Mt. Bruce, Mt. Goldsworthy, Mt. Whaleback, etc.
China	Manchuria Region, Shandong, Sinkiang region, etc.
Brazil	Itabira in south east region.
India	Chhattisgarh and Bastar region, Odisha, Chitradurg, Kudremukh, Mayurbhanj region, etc.
Russia	Ural region, Kuzbas, Angara, etc.
U.S.A	Mesabi range, Marquette range, Cornwall, Alabama, Appalachian region, etc.
Germany	Rhur basin.
Ukraine	Krivoi rog.

### Manganese ore

It is a kind of Ferro-alloy used to manufacture the special quality steel. A little manganese added to iron, removes gases and acts as a 'Cleanser' in the manufacturing process. Nearly 6 Kg of manganese is used for making one ton of steel.

Manganese is used for special quality steel making; it makes steel anti - corrosive, hard and clean. It helps to increase toughness, strength and durability to resist oxidation in blast furnaces. It is used to produce alloys with Copper, Bronze, and Nickel. It is used for producing heavy machinery, tools, bleaching powder, insecticides and paints.

### Distribution and production of Manganese ore

South Africa, Australia, China, Gabon, Kazakhstan, Brazil, India, Ghana, Ukraine and Mexico are the major countries possessing manganese ore. South Africa is the largest producer of manganese ore in the world, followed by Australia. The other leading manganese producers are China, Gabon and Brazil. India is the 8<sup>th</sup> largest producer of manganese in the world though it possesses the largest reserves of manganese in the world.

### Manganese -ore production in 2016

Rank	Country	Production (Metric Ton)	Share (%)
1	South Africa	4,754,560	30.84
2	Australia	2,388,500	15.50
3	China	2,150,000	13.95
4	Gabon	1,658,500	10.76
5	Brazil	1,141,684	7.41
	Others		21.54

SOURCE: World mining data -2018

### Copper

It is a non - ferrous, soft brown metal. It is a good conductor, with high luster, density and melting point. Copper occurs in three forms as native metal in its pure state, as oxides and as sulphide.

The chief ore of copper is copper pyrite. It yields nearly 76% of the world production of copper. Copper is extracted by the process of crushing, concentration, roasting, smelting and refining. It was discovered in the earliest stage of civilization. Copper is one of the first metals known and used by man. It is found in the igneous and metamorphic rocks. Copper is very soft, but by mixing with tin, bronze can be obtained and mixing with zinc, brass can be obtained which is harder and tougher than pure copper. Copper is used in

- (i) Electrical Engineering
- (ii) Metallurgical Industries
- (iii) Making of alloys and making tubes, pipes, pumps, radiators and boilers. They are also used in the production of a wide range of ornamental materials.

### Production and distribution of Copper

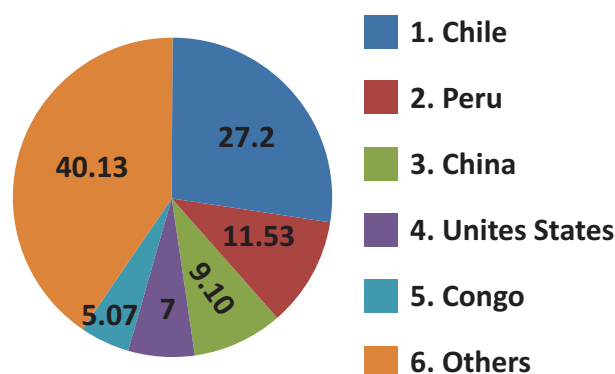
Copper deposits are found in almost every country. The main producers are Chile, Peru, China, USA and Congo. Chile is the largest producer of Copper in the world. It produces 27.20% of the world Copper, followed by Peru, which produces 11.53%. India holds 35<sup>th</sup> rank and it produces only 0.15% of the world's production.

### Copper

Rank	Country	Production (Metric Ton)	Share (%)
1	Chile	5,552,600	27.20
2	Peru	2,353,859	11.53
3	China	1,851,000	9.10
4	United States	1,430,000	7.00
5	Congo	1,035,631	5.07
	Others		40.13

SOURCE: World mining data -2018

### COPPER PRODUCTION SHARE IN %



### Bauxite

Bauxite is an important ore which is the main source of Aluminum. It is an impure raw material. It generally occurs as an ingredient of chemical compounds in highly complex minerals such as Cryolite, Corundum and Kaolin. Bauxite occurs quite near the surface and is generally mined by open cast method. It has a wide range of applications which include construction of buildings, utensils and airplane parts.

### Production and world distribution of Bauxite

The main Bauxite producers are Australia, China, Brazil, Guinea and India. The World's greatest Bauxite producers and exporters are the countries located in the tropical and sub tropical region. Australia is the largest producer of bauxite in the world. India is the 5<sup>th</sup> largest producer of bauxite in the world.



## BAUXITE (ORE)

Rank	Country	Production MT	Share in%
1	Australia	83,516,578	29.31
2	China	65,000,000	22.81
3	Brazil	39,244,200	13.77
4	Guinea	31,117,131	10.92
5	India	24,664,632	8.66
	Others		14.53

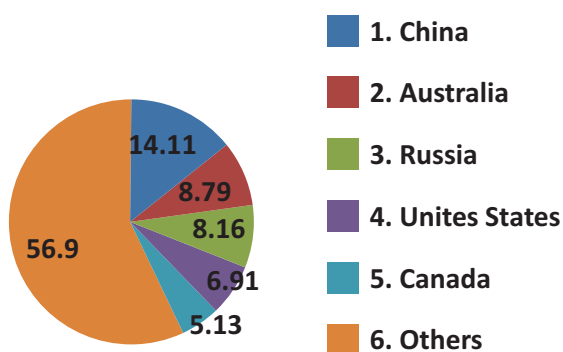
## Gold

Gold is a precious metal which occurs in alluvial or placer deposits or as reefs or lodes in the underground. Gold is used extensively for jewellery and also in dentistry, glass and porcelain dyes, in medicines and other industries. The purity of gold is expressed in terms of carat. China, Australia, Russia, USA and Canada are the leading producers of gold in the world. I

### Gold

Rank	Country	Production MT	Share in%
1	China	453,500	14.11
2	Australia	282,421	8.79
3	Russia	262,380	8.16
4	United states	222,211	6.91
5	Canada	165,034	5.13
	Others		56.90

**GOLD PRODUCTION  
SHARE IN %**



Fool's Gold refers to pyrite of Iron Sulphide because of its similarity in shape and colour to actual gold.

## Platinum

Platinum is a rare metal. It is costlier than gold. It has a very high melting point. It is a heavy, malleable, ductile, highly inactive, silverish, white transition metal. It is one of the densest metal almost twice as dense as lead. Platinum is found with other rare metals such as osmium, Palladium, Iridium and rhodium. Platinum is also used in industrial applications. South Africa is the largest producer of platinum in the world. The other leading producers are Russia, Zimbabwe, Canada and USA.

### Platinum

Rank	Country	Production Kg	Share in%
1	South Africa	133,241	71.75
2	Russia	21,860	11.77
3	Zimbabwe	15,110	8.14
4	Canada	9,300	5.01
5	USA	3,891	2.10
	Others		1.33

## Non-metallic minerals

The minerals which do not contain metal in them are called as non metallic minerals.

### Mica

Mica is a Latin word micare means to shine, to flash or to glitter. Mica has a crystalline and layered structure and can be split into very thin sheets. It does not react to water, acids, oil or solvents. It is lightweight, flexible and strong. It can resist extremely high temperatures or sudden changes in temperature and is able to withstand high voltages and insulate with low power loss. It can absorb or reflect light, which enables a decorative effect and protects against ultra-violet (UV) light.

## Major Uses of Mica

Mica has several applications. There are several main sectors where the use of mica is identified. They are the paint and coatings sector, Cosmetics and personal care companies, Plastics and printing ink manufactures, the electronics sector, the automotive sector, the construction industry and the oil industry.



Mica

## Phosphate

Phosphate occurs in the sedimentary rocks or as phosphate nodules. Another source is bird dropping of Guano. It is the most important source of phosphorus. It is mainly used in fertilizer. China is the largest producer of Phosphate in the world. The other leading producers are Morocco, USA, Russia and Peru. The Guano deposits are found in Peruvian and Chilean deserts in South America. India is the 20<sup>th</sup> largest producer of Phosphate in the world.

### Phosphate (2016)

Rank	Country	Production MT	Share in%
1	China	43,319,400	51.58
2	Morocco	8,601,000	10.24
3	USA	7,615,000	9.07
4	Russia	48,36,000	5.76
5	Peru	4,013,220	4.78
	Others		18.57



Agencies involved in the exploration of minerals in India. GSI, ONGC, MECL, NMDC, IMB, BGML, HCL, NALCO are the departments involved in mining in different states of India.

## 3.5 Energy Resources

Resources may be classified into renewable and non renewable resources. Mineral resources like coal, Petroleum and natural gas are the exhaustible or non renewable resources. They cannot be reused once they are consumed. Coal and petroleum are the fossil fuels, on which the modern culture relies so much.

Energy gives motion to our industrial machines and vehicles. It is the primary input in the production of goods and services. The wheel of progress moves with the flow of energy. The energy resources may be classified into two types.

### (i) Non renewable sources of Energy

Once these resources are used, they cannot be regained again. In other words, they are exhaustible. They are coal, Petroleum natural gas and atomic fuels.

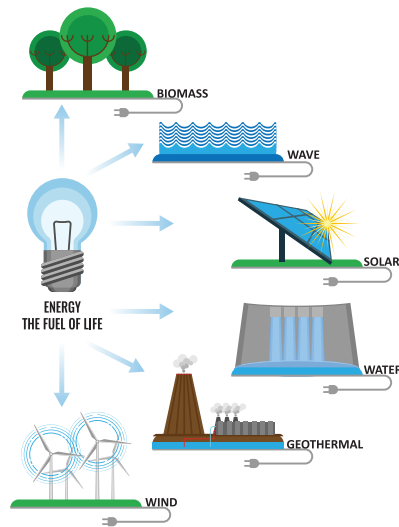
### Coal

Coal is a fossil fuel. It is a flammable, black or brown sedimentary rock and is mainly composed of carbon. The dense forest plants were converted into coal due to intense pressure and heat inside the earth by the process of carbonization. Most of the coal resources of the world were formed during the carboniferous period (280 to 350 million years ago). The quality of the coal is determined by its carbon content. The following types of coal have been identified on the basis of their physical properties. They are,

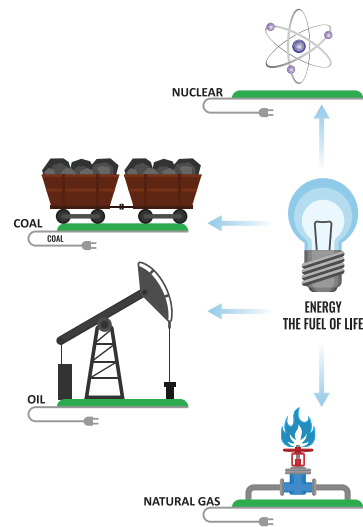


## ENERGY SOURCES

### RENEWABLE ENERGY



### NON-RENEWABLE ENERGY



- (i) **Peat** is the first stage of transformation of wood into coal and it has only 30% to 35% of carbon.
- (ii) **Lignite or Brown coal** is the inferior quality and contains 35%-45% carbon
- (iii) **Bituminous or coking coal** is the second best variety of coal and contains 70%-90% of carbon. It is the most widely spread and most widely used variety of coal. It is the most popular coal in commercial use.
- (iv) **Anthracite** is the best quality coal, which contains more than 95% of carbon. It is very hard but emits very less smoke and leaves very less ash. However its deposits are limited.

### Production and world distribution of Coal

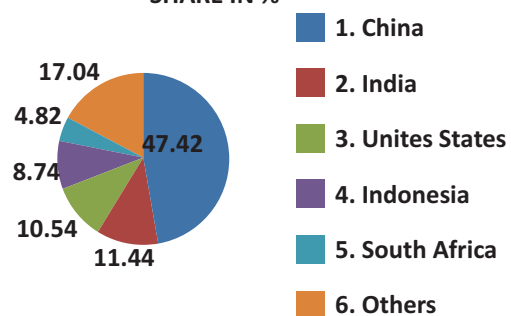
Coal reserves are found in more than 70 countries of the world but the major coal reserves occur in the USA, Russia, China and South Africa. China is the largest producer of steam coal in the world followed by India. The other leading producers of steam coal are USA, Indonesia, and South Africa etc.

Steam coal – It is used for producing steam and it has high sulphur content

### Steam Coal

Rank	Country	Production (Metric Ton)	Share in%
1	China	2,491,793,000	47.42
2	India	601,131,000	11.44
3	United States	553,936,000	10.54
4	Indonesia	459,469,000	8.74
5	South Africa	253,452,000	4.82
	Others		17.04

STEAM COAL PRODUCTION  
SHARE IN %



### HOTS

Why is hydrogen used as fuel in rockets?

China was the largest producer of coking coal in the world in 2016 followed by Australia. The other leading producers of coking coal are Russia, India and USA.

## Coking Coal

Rank	Country	Production MT	Share in%
1	China	591,998,000	54.67
2	Australia	189,302,000	17.48
3	Russia	83,800,000	7.74
4	India	61,661,000	5.69
5	United States	50,645,000	4.68
	Others		9.74

## Major coal mining centres

Country	Mining centres
China	Shansi, Shantung, Fushun, Shenyang, etc.
India	Bokaro, Jaria, Korba, Ranikanch, Singreni, etc.
U.S.A	Arkansas, Colorado, Illinois, Indiana, Michigan etc.
Australia	Bowen Basin, Brisbane, Canberra, Sydney, New-castle, Tasmania, etc.
Russia	Moscow-Tula region, Chokot Basin, Ob basin, etc.

## Trade

The main exporters of coal in the world are Australia, Indonesia, Russia, Colombia and South Africa and the main importers are China, India, Japan, Korea and Germany.

## Uses of Coal

Man has used coal for hundreds of years. But it has gained importance only after industrial revolution. It contributes about 25% of global energy demand. Coal is used for various purposes. It is used as a source of steam energy, electrical energy, domestic fuel, metallurgical coke, chemical industries and byproducts such as Ammonium sulphate, Naphthalene, Phenol, Benzene, etc.

## Petroleum (or) Mineral oil

Petroleum is a mineral that exists under the surface of the earth in liquid, solid and gaseous

forms. Liquid petroleum may be in the form of crude oil. The solid form may be mineral waxes or asphalts. The gaseous form is natural gas. It is a main source of energy in the World due to its multiple uses. The human activities are directly or indirectly depend on the use of petroleum or its sub products.

## Formation and occurrence of mineral oil

It is formed by residual chemical and bio chemical decomposition of the remains of organic matter in sedimentary rocks. It is found in the pores of the sedimentary rocks. Oil is lighter than water hence, floats over water. Drilling of oil wells is the hole drilled in the earth's crust and when it reaches the rock cap, the natural gas comes out first with a great pressure. When the pressure of gas subsides, petroleum starts flowing out when the pressure of natural gas is released.

## Petroleum reserves of the world

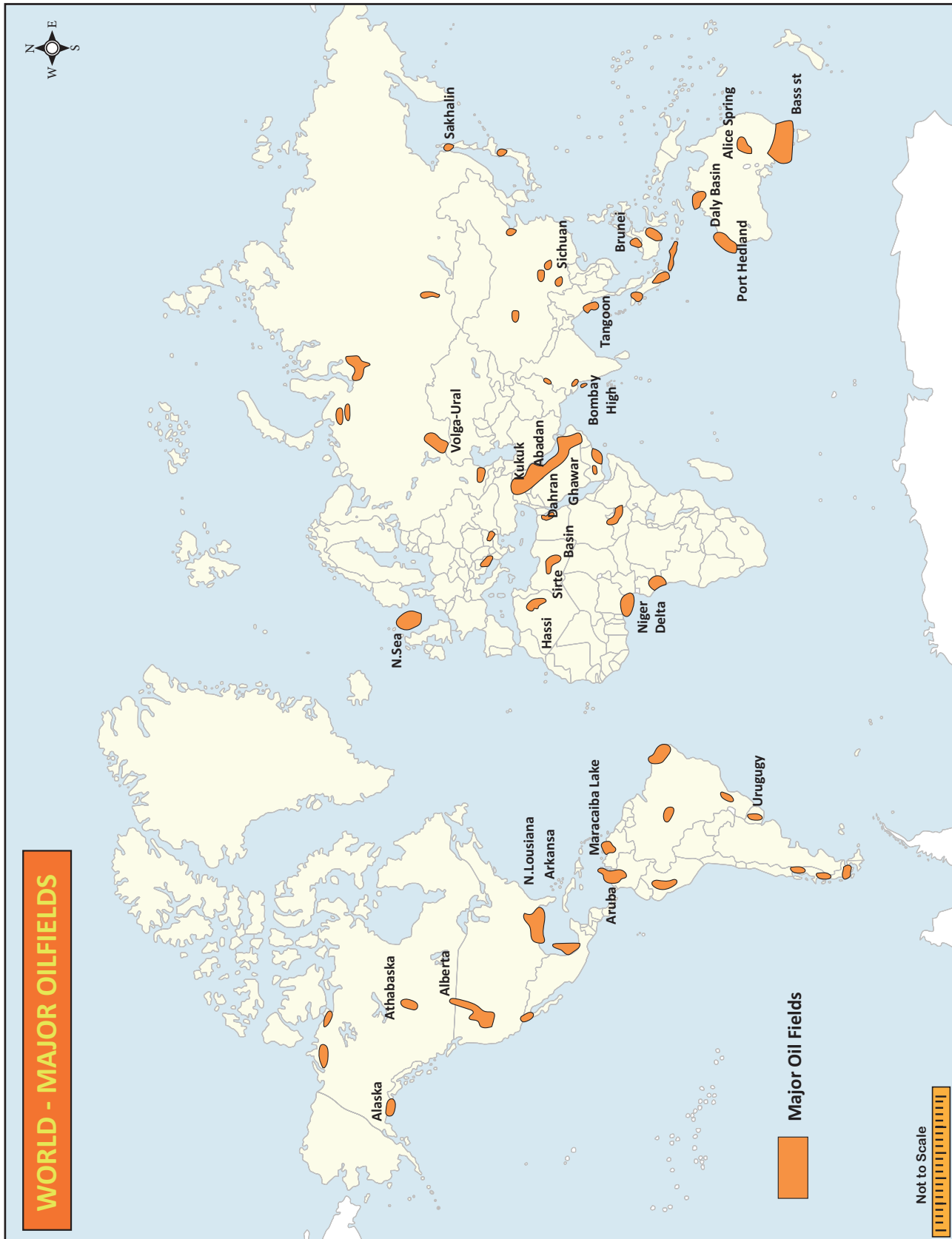
The west Asia or Middle East is has the largest petroleum reserves, which is about 60% of the world's oil reserve. The total estimated world's oil reserves in 2008 were 1,243 (10<sup>9</sup> bbl). Saudi Arabia, Canada, Iran, Iraq and Kuwait have large reserves of petroleum.

## Production and world distribution of petroleum

The petroleum producing countries of the world can be grouped in to five geographical regions:

- West Asia (or) middle East region
- American region
- Russian region
- East & south Asian region and
- African region

Saudi Arabia is the largest oil producer of the world with 13.62% of the world output of oil. Russia is the second largest producer in the world. India is placed at 24<sup>th</sup> position in petroleum production in the world. The distribution of oil is naturally uneven; Middle

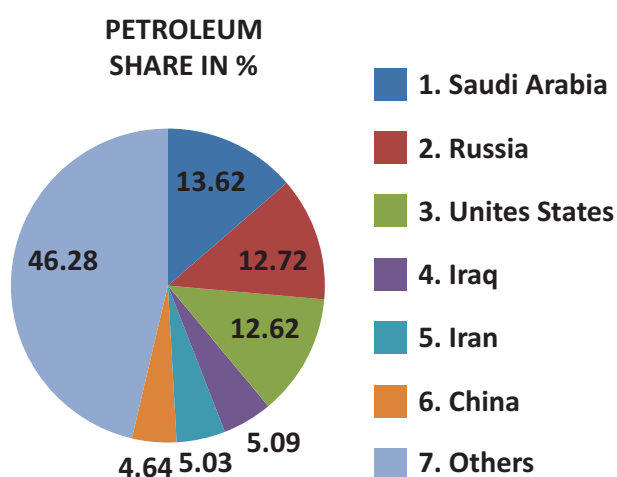




East contains 60% of global reserves and rest of the world only 40%.

## Petroleum

Rank	Country	Share in%
1	Saudi Arabia	13.62
2	Russia	12.72
3	USA	12.62
4	Iraq	5.09
5	Iran	5.03
6	China	4.64
	Others	46.28



## Trade

The world leading exporters of petroleum are Saudi Arabia, Russia, Iraq, UAE and Canada and the main importers are USA, China, India, Japan and Korea.



OPEC is the short form of the "Organisation of Petroleum Exporting Countries. It was formed in 1960 at Bagdad convention. Initially it comprised of Saudi Arabia, Iran, Iraq, Kuwait and Venezuela. Later on added in eight countries Libya, Algeria, Qatar, UAE, Nigeria, Ecuador and Angola, Indonesia left from OPEC in recently.

## Major Petroleum production centres

Country	Production centres
Saudi Arabia	Ghawar, Abquiaq, Abu Hadriya, etc.
Russia	Volga- Caspian region, Kamchatka- Sakhalin region, Ob – Lena basin.
U.S.A	Tennessee- New york, ohio, Indiana, Pennsylvania, Texas, Mississippi, Gulf of California, etc.
Iraq	Kirkuk, Mosul, Daura, etc.
China	Taching, Chinchou, yemen, South china sea, etc.

## Natural Gas

It is the cheapest source of energy. It is found along with or without petroleum. It is considered as an environment friendly fuel because of its low carbon dioxide emissions. Therefore, this is the only fuel for the present century and it is also called **green energy**. A powerful odorant, ethanethiol is added, so that leaks can be detected easily. It is prepared by refining petroleum or wet natural gas.

## Natural gas reserves and Production

The known natural gas reserves in the world is about 6254 trillion cubic feet. Most of these reserves are found in Russia, Iran, Qatar, UAE, Saudi Arabia, USA etc. USA has the largest reserve and is the leading producer of natural gas in the world. India is the 28<sup>th</sup> producer of natural gas in the world. It is widely used as a fuel in industries and domestic cooking purposes. Petrochemical industries use it as fuel and raw material. It is also used in chemical industries, artificial rubber, plastic, fertilizers, ink and carbon.

## Natural gas

Rank	Country	Production (Metric. Ton)	Share (%)
1	United States	755,010	20.56
2	Russia	641,000	17.45
3	Iran	202,440	5.51
4	Qatar	181,250	4.94
5	Canada	157,179	4.28
	Other		47.26

## Trade

Russia, Qatar, Norway, Canada and Algeria are the leading exporters of Natural gas in the world. Japan, Germany, China, Italy and Turkey are the leading importers of natural gas.

## Nuclear Energy

It is commonly said, this energy holds the key of future. Energy contained within the nucleus of an atom is called nuclear energy. Heavy metals like Uranium, Thorium, Radium, Plutonium and Lithium are the main sources of nuclear energy. However Uranium is the most important source of nuclear energy. The nuclear energy production was started first in USA in 1950. Nuclear energy now provides about 11% of the World's electricity. At present there are more than 450 operable fission reactors in the world. The world's first commercial nuclear power station Calder Hall at Wind scale, England was opened in 1956.

## Uranium ( $U_3O_8$ )

Rank	Country	Production (Metric. Ton)	Share (%)
1	Kazakhstan	29,113	38.89
2	Canada	16,666	22.26
3	Australia	7,352	9.82
4	Namibia	4,308	5.75
5	Niger	4,101	5.48
	Others		17.80



Most devastating nuclear accidents

1. Three mile Island- March 28, 1979 USA
2. Chernobyl - April 29, 1986, Russia
3. Fukushima Daiichi- March 11, 2011, Japan

## Renewable sources of Energy:

All regions of the world are facing the twin problems of fast increasing demand for energy and limited supplies and rapidly depleting conventional sources of energy. Under these circumstances, non conventional sources of energy are getting more importance. These sources are renewable, clean and non-polluting. They are solar, wind, geothermal, wave, tidal energy, bio-gas etc.

## Hydel Power

Hydro electricity is produced by using the potential energy of water falling from a certain height. The falling water spins the turbine blades and energy is produced. It is a clean eco friendly and renewable source of energy. It contributes nearly 7% of the world electricity production. China has the largest potential followed by Brazil, Indonesia, Canada and Zaire. China is the largest producer of Hydro electricity in the world, followed by Canada.

## Solar energy

It is based on mechanical conversion of solar energy into electricity. It is available in abundance but only in the recent period it gets more importance due to technological development. Solar energy is used for various purposes.



Noor Complex is the world's largest concentrated solar power (CSP) plant, located in the Sahara Desert.

## CASE STUDY

### Kamuthi, the World's largest single solar power plant!



Kamuthi Solar Power Project is a photovoltaic power station spread over an area of 2,500 acres (10 km<sup>2</sup>) in Kamuthi, Ramanathapuram district. The project was commissioned by Adani Power. With a generating capacity of 648 MW at a single location, The Kamuthi Solar Power Project was completed on 21 September 2016. Around 8,500 workers installed an average of 11 MW of capacity per day to complete the project within 8 months. The entire solar park is connected to a 400 kV substation of the Tamil Nadu Transmission Corp. The solar panels are cleaned daily by a self-charged robotic system.

USA is the major producer of solar cells at present. It is simply the energy provided by the sun, which makes production of solar electricity possible. **Solar power in India** is a fast developing industry. The country's solar installed capacity reached 26 GW as of 30 September 2018. India expanded its solar-generation capacity 8 times from 2,650 MW on 26 May 2014 to over 20 GW as on 31 January 2018. The country added 3 GW of solar capacity in 2015-2016, 5 GW in 2016-2017 and over 10 GW in 2017-2018, with the average current price of solar electricity dropping to 18% below the average price of its coal-fired counterpart.

### Wind Energy

The wind is a clean, free and readily available renewable energy source. Wind turbines are capturing the wind's power and converting it to electricity. Wind power has become a pillar in their strategies to phase out fossil and nuclear energy. Wind energy is now the second fastest growing source of electricity in the world. It fulfils about 5% of world's electricity demand. The world's largest wind farm is in Altamont pass in California. India is emerging as a major wind power producer of world. The important wind farms in India - (i). The largest wind farms





in India are Muppandal in Kanyakumari District of Tamil Nadu and Jaisalmer wind park in Rajasthan. They are the first and second largest wind farms of India. Based on the location of its generation it is classified into

1. Onshore wind energy and
2. Offshore wind energy

**1. Onshore wind energy** –Energy generated from the plants located on the land is known as onshore wind energy. Onshore wind has the advantage of being one of the most affordable renewable energy sources. It is cheaper than any other renewable source of energy but it requires more area to install than any other energy.

**2. Offshore wind energy** –It refers to the use of wind farms developed in seas and oceans. The largest offshore wind farms are currently in the U.K and Germany. These two countries installed 2/3 capacity. London Array is the largest offshore wind farm in the world. The first offshore wind farm is planned near Dhanuskodi in Tamil Nadu.

**Tidal energy** - It is a renewable energy powered by the natural raise and fall of ocean water. Its production is very small. The first tidal power station was located in La Rance in France. The largest tidal power station is at Sihwa Lake in South Korea and it is the largest tidal power producer in the world. There are three different category of sources from which the tidal energy is generated. The sources are tidal streams, barrages and tidal lagoons.

India's first attempt to harness tidal power for generating electricity would be in the form of a 3MW plant at the Durgaduani creek in sunderbans delta of West Bengal. The Gulf of Kutch and Cambay in Gujarat and the Ganges delta in sunderbans, the world's largest

mangrove, are the 3 sites identified as potential areas for tidal power generation in India.

## Geo Thermal Energy

Geo thermal energy is derived from the natural heat of the earth. The United States is the world's largest producer, and the largest geothermal development in the world is The Geysers north of San Francisco in California, the U.S.

In India, exploration and study of geothermal fields started in 1970. The GSI (Geological Survey of India) has identified 350 geothermal energy locations in the country. The most promising of these is in Puga valley of Ladakh. The estimated potential for geothermal energy in India is about 10000 MW. There are seven geothermal provinces in India: the Himalayas, Sohana, West coast, Cambay, Son-Narmada-Tapti (SONATA), Godavari, and Mahanadi.

## 3.6 Conservation of Resources

It takes millions of years for the formation of minerals. Compared to the present rate of consumption, the replenishment rate of minerals is very slow. Hence, mineral resources are finite and non- renewable. Due to this, it is important to conserve the mineral resources.



### Ways of Conserving Resources

- Controlling population growth will reduce the demand for resources.
- Creating social awareness regarding the importance of conservation of resources.
- Reusing and recycling of resources.



- Using the renewable source of energy as an alternative to non-renewable resources.
- Developing the usage methods which minimize the wastages.
- Propagating the environmental ill effects caused by various products.
- Choosing the products with less packaging.



## GLOSSARY

1. **Mineralogy:** The study of minerals.
2. **Ubiquitous resource:** resources which exist everywhere
3. **Alloy:** a metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion.
4. **Lodes:** a vein of metal ore in the earth.
5. **Exhaustible:** Resources of which a finite quantity is in existence.
6. **Mineraloids:** A rock with an aggregate of one or more minerals.
7. **Nuclear power:** The use of nuclear reactions that release nuclear energy to generate heat, produce electricity in a nuclear power plant.
8. **Silicon material:** Silicon is a chemical element with symbol Si and atomic number 14. It is a hard and brittle crystalline solid with a blue-grey metallic lustre.
9. **Odorant:** a substance used to give a particular odour to a product.
10. **Corrosive:** substance that will destroy other substances with which it comes into contact by means of a chemical reaction.



## Exercise

### I. Choose the correct answer



#### 1. Pick out the statement which is untrue about the renewable resources.

- a) The resources which can always be available for use after their usage.
- b) Resources have natural regeneration and are inexhaustible.
- c) Air, water, solar energy etc are examples for renewable resources.
- d) Available in finite quantities and cannot be obtained once if they are utilized.

#### 2. Identify the one which is untrue about the minerals.

- a) Minerals generally occur in the cracks, crevices, faults and joints of the igneous and metamorphic rocks.
- b) Mineral in smaller occurrence in the joints of the rocks is called a 'Vein'.
- c) Mineral in a larger occurrence in the joints of the rocks is called a 'lode'.
- d) When the decomposed rocks are washed away by water, the soluble particles are removed, leaving a mass containing ores. Such occurrences are called residual mass.

#### 3. Consider the following statements and choose the correct answer.

- i) Good quality Iron ore is found in Australia, Brazil, Russia, China, USA, Ukraine, Canada, etc.
  - ii) Russia has the third largest proven reserves of iron ore in the world.
  - iii) Australia is the largest producer of Iron ore in the world.
  - iv) The Majority of Iron ore is (84%) produced by 10 countries alone.
- a) i) and ii) only      b) i) and iii) only  
c) iii) and iv) only      d) i) and iv) only

#### 4. Which of the following is incorrectly stated?

- a) Saudi Arabia is the largest oil producer of the world.
- b) Russia is the second largest oil producer in the world.
- c) India is the 4<sup>th</sup> largest producer of oil in the world.
- d) The Middle East countries contain 60% of global oil reserves.





**5. Identify the incorrect statement from the following**

- a) Peat is the first stage of transformation of wood into coal and it has only 30 to 35% of carbon.
- b) Lignite or Brown coal is the inferior quality and contains 35-45% carbon.
- c) Bituminous or coking coal is the most popular coal in commercial use.
- d) Anthracite is very hard but emits more smoke and leaves very less ash.

**6. Consider the following and choose the correct option**

**Assertion (A):** Great dairying regions are located in the wet areas of the cool temperate region.

**Reasoning (R):** Cool temperate regions have nutritious grass and there is great demand for milk products.

- a) Both A and B are correct but R is not the correct explanation of A.
- b) Both A and B are correct and R is the correct explanation of A.
- c) A is true but R is false.
- d) R is true but A is false.

**7. The largest producer of Geo Thermal Energy in the world is**

<b>Mineral</b>	<b>Characteristics</b>
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- a) Russia
- b) The U.S.A
- c) Canada
- d) China

**8. Which of the following statements are incorrect?**

- i) Hydropower is a clean eco friendly and renewable energy.
  - ii) It contributes nearly 17% of the world electricity production.
  - iii) China has the largest potential of hydro power followed by Brazil, Indonesia, Canada and Zaire.
  - iv) Canada is the largest producer of Hydro electricity in the world, followed by China.
- a) i, ii, and iii only.
  - b) ii, iii and iv only.
  - c) ii and iv only.
  - d) i and ii only.





**9. Which of the following is not a method of conservation of minerals?**

- a) Controlling population growth to reduce demand for minerals.
- b) Creating social awareness regarding conservation of minerals.
- c) Reusing and recycling of minerals.
- d) Encouraging the use and acceptance of minerals which are not essential.

**10. Pick the Odd one out.**

- a) Choose products with less packaging.
- b) Choose products with recyclable or reusable packaging.
- c) Carry use and throw shopping bags or boxes.
- d) Say 'no' to unnecessary plastic bags and other packaging.

**II Very short answer**

- 11. Differentiate the mode of occurrence of particles of veins and lodes.
- 12. Why is the anthracite coal the best of its kind?
- 13. Name any four leading oil producing countries in the world.
- 14. Mention any two places of tidal energy production in India
- 15. Where is the world's largest wind farm located? Jaisalmer wind park is in which State?

**III Short answer**

- 16. What are the uses of Mica?
- 17. Write a note on hydel power.
- 18. State any three uses of copper.
- 19. Mention any three ways of conserving resources.
- 20. Where is the world's single largest solar power plant in the world? Write about the solar energy production in India.

**IV Detailed answer**

- 21. Classify and describe iron ore.
- 22. List out the methods of conservation of mineral resources.
- 23. In what different ways can resources be reused?
- 24. On the outline map of the world, show the petroleum production centres of the world and write a brief account of them.

## V Practice

1. Identify the alternate energy such as wind, solar, geothermal, hydroelectric, bio fuels.

<div>word</div> <div>symbol</div> <div>1. Energy generated in a way that does not use up natural resources</div>	<div>word</div> <div>symbol</div> <div>2. Resources that can be replaced over time</div>	<div>sun</div>
<div>word</div> <div>symbol</div> <div>3. Resources that are limited and can't be replaced</div>	<div>word</div> <div>symbol</div> <div>4. Energy from moving water</div>	<div>turbine</div>
<div>word</div> <div>symbol</div> <div>5. Energy from once living material</div>	<div>word</div> <div>symbol</div> <div>6. Energy from the heat in Earth's core</div>	<div>biofuel or biomass</div>
<div>word</div> <div>symbol</div> <div>7. Energy from moving air</div>	<div>word</div> <div>symbol</div> <div>8. Energy from the sun</div>	<div>renewable resources</div>
<div>word</div> <div>symbol</div> <div>9. Machine that produces energy (power) when it is moved by water, wind, or steam</div>	<div>word</div> <div>symbol</div> <div>10. Source of Earth's energy</div>	<div>alternative energy</div>
		<div>wind energy</div>
		<div>hydroelectric</div>
		<div>geothermal</div>
		<div>nonrenewable resources</div>
		<div>solar energy</div>



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