Mineral Resources and Industrialisation

What are minerals?

There are many definitions of minerals. In science, minerals are solid, naturally occurring, crystalline, inorganic elements or compounds. You might have learned this definition in your science class. But minerals have a much wider definition in geography and Indian law. All natural substances that can be obtained by mining, digging, drilling, dredging, quarrying, or by any other operation are called minerals. They include stones, special types of soil, sand, coal, metal ores, other ores, precious stones such as diamonds, and mineral oils, which include natural gas and petroleum. (Reference: The Mines Act, 1952)

If we look around us we notice that most things we use in our daily life are made from minerals. Our houses are made of mud, lime, cement, steel etc - which are made from minerals. Most metals are made from metal ores. Jewellery made from gold, silver, precious stones etc are also made from minerals. The fuel we use - petrol, diesel, kerosene - are made by processing petroleum, which is made from mineral oil. Other fuels such as coal and gas are also minerals. So, from the perspective of geography, we can define minerals as substances that are naturally found under the earth's surface and can be extracted by mining.

Mineral wealth is formed by geological processes. It is present in limited quantities on earth and cannot be renewed. Hence, all minerals will be exhausted one day. That's why they should be used in a sustainable manner so that they are available to future generations in adequate quantities.

Give it a thought:

Is groundwater a mineral?

Is the sand on the banks of a river a mineral?

Are buried ornaments that are unearthed minerals?

If all the copper on earth is mined, what effect will it have? What can we do to prevent this situation?

If all the coal mines on earth are exhausted, what effect will it have? What can we do to prevent this situation?

Who do minerals belong to?

Suppose a limestone deposit is discovered under the land in a village. Who owns the mineral - the landowners, the village, the state or the country? Different countries have different laws about ownership of minerals. For example, in Britain and the United States of America, the limestone belongs to the landowner. But in countries such as Germany, it belongs to the government. In India, minerals found under the surface of the earth belong to the country and the central government makes laws for their extraction and use. But there are some minor minerals for which the respective state governments make the laws. A person can mine a mineral only after getting permission from the government and paying a royalty. The person also has to pay rent for the land.

So all minerals are public property. That means they belong to all Indians and must benefit all Indians. The central and state governments regulate the utilization of minerals on behalf of all the citizens and use the income from these activities in the public interest.

Sukhwinder cultivates paddy on his land and earns a living by selling the harvest. A coal deposit was discovered under his land. Sukhwinder thought he would mine the coal, sell it in the market and earn a lot of money. Can he do this? Explain with reasons.

Mineral Policies

India's development and industrial policies determine the policies regarding the use of the country's mineral wealth. The government keeps several factors in mind when formulating mineral policies. The first is the role of minerals in India's development and industrialization. So the industrial policy of the time influences the mineral policy.

Prior to 1990 most countries in the world wanted their own companies to mine minerals for the use of their own citizens. They didn't want foreign companies to mine their minerals. But all this started to change in the 1990s, which, if you remember, was the time the new phase of globalization began. Mineral rich countries like Australia, Canada, South Africa, Indonesia and China began to change their policies. They opened up mining to private companies and multinational corporations, bringing in capital and new technology to exploit their mineral resources and speed up their industrial development. Intensive mining boosted the international market and trade in minerals. Industrialists could buy as much minerals as they needed in the international market, regardless of where they were located. Today, few governments explore or mine minerals. They have handed out these activities to private companies. They now limit themselves to three activities. First, they collect and share scientific information about the mineral wealth of their country. They make this information about the quantity and location of different minerals public so that mining companies can bid for the mining rights. Second, they regulate the mining industry in their country. It is the government's responsibility to ensure that mining is done in accordance with the country's laws and does not violate the environment or neglect the security of the mine workers. The government permits companies to explore and mine minerals and ensures that they operate within the specified conditions. Third, they collect fees and taxes. The government has to ensure that it receives an adequate share of the income from mining through the fees and taxes it levies, which it can then spend on development activities. In keeping with the global trends, India, too, made changes in its mining policy.

Economic liberalization began in 1991. The government announced a new mining policy in 1993 under which the mining of minerals reserved for the public sector enterprises was thrown open to the private sector. The government's stand was that it did not have adequate capital to invest in mining nor did it have the required technical expertise. As a result, the mining sector in the country was stagnant and couldn't take advantage of the growing demand for minerals in the international market. Hence, the government decided to open up the mining sector to private and foreign companies. The mining acts were amended in 1994, 1999 and 2008 to allow private and foreign companies to invest in mining in India.

However, concern about the impact of privatization of mining in the country has been growing over the past 20 years. First, the share of mining in India's GDP (gross domestic product) declined from 3% in 2000 to 2.3% in 2014. Employment and wages in mining have remained stagnant in these 14 years. On the other hand, production has increased. However, the government's income from mining has not increased proportionately. The main reason is the low royalty levied for the mining contracts.

The third impact is the destruction of the environment. Once a mine is exhausted, mining companies are supposed to carry out reclamation work, but they seldom do so. India has hundreds of abandoned mines that tell the story of the destruction of the environment. How can we conserve the environment while carrying out mining activities? How can private companies, which are driven by the profit motive and are not interested in protecting the environment, be made to invest in conservation? These are issues that are still being debated.

Mineral wealth in India is found in regions with good forest cover that are the source of rivers. They are also areas where our *adivasi* communities live. Mining destroys forest cover. It is estimated that 186,000 hectares of forest have been destroyed by mining operations since 1981. Washing of minerals also pollutes the local water sources. Such environmental degradation threatens the livelihood of the local people. The law stipulates that mining can be undertaken only after obtaining the consent of the communities living in the area. But these legal provisions are not properly implemented. As a result, the tribal communities are dispossessed and deprived. You read the example of the Niyamagiri tribals of Odisha in the political science chapters.

Mines should be exploited keeping in mind the post-closure objectives. These include restoring the land to its pre-mining condition or reclaiming it for some other productive activity like agriculture. The first step is to restore the top soil, which is essential for reforestation once the mines are abandoned. Afforestation should be taken up in small plots to maintain the biomass of the area and rehabilitate the ecosystem. Grass cover should also be provided to prevent soil erosion. Hence, policies to utilize mineral resources should ensure a balance between increasing production, protecting the environment and securing the needs of the local people.

Should private companies be allowed to mine? What are the advantages/disadvantages for society? Give your views.

Should foreign companies be allowed to mine in our country and export the minerals? What are the advantages/disadvantages for society? Give your views.

What steps should be taken to limit the environmental damage caused by open cast mining?

Mining companies abandon their mines after making a profit. What long term impact does this have on the tribal population that has been living in the region for generations? How can this problem be resolved?

The Mining Process

The Geological Survey of India (GSI) and the mining department of country/ state collect information on which minerals are found in which place and also assess the size of the deposits. Based on these GSI surveys, the government auctions areas with mineral deposits. Many companies participate in the auction. The company that wins the lease gets the right to mine the mineral deposit on that land.

Some important minerals and their uses

The earth contains more than 3,000 minerals. All these minerals are important in our lives. In India, the Mines and Minerals (Development and Regulation) Act 1957 classifies minerals into four categories:

- 1. Atomic minerals: uranium, thorium
- 2. Mineral oil and natural gas
- 3. Major minerals: iron ore, coal, bauxite, chromite, manganese, copper, limestone, gold, silver, diamonds, etc
- 4. Minor minerals: minerals needed for constructing buildings such as granite, marble, sand, masonry stone

Minerals can be divided into two categories on the basis of their properties and structure - metallic minerals and non-metallic minerals. Metallic minerals can be sub-divided into two categories - those that contain iron ore, such as manganese, chromite, pyrite, tungsten, nickel and cobalt; and those that do not have iron ore such as gold, silver, copper, lead, bauxite, tin and magnesium. Non-metallic minerals do not have metals in them, such as limestone, mica, gypsum etc.

Distribution of minerals

India's main mineral resources are iron ore, coal, chromite, manganese, tungsten, bauxite, copper, lead, petroleum, uranium etc.

Iron ore

Iron ore is used to manufacture crude iron and several types of steel. It would not be an over statement to say that the iron is the basis of modern development. One just needs to look at the numerous uses of iron and steel in modern life, agriculture, industry, construction and transport. This is why iron is produced in much greater quantities than other metals. Iron's strength and hardness can be altered by mixing with other metals. Pure iron ore is never found in nature. In nature, iron ore is mixed with sulphur, phosphorous, aluminium, lime, magnesium, silica, titanium etc. Iron is separated from this mixed ore by chemical processes.

Based on the percentage of iron in the ore, iron ore can be divided into four types: haematite (contains 70% iron), magnetite (contains 70.4% iron), limonite (contains 59.63% iron) and siderite (contains

48.2% iron). The majority of deposits in India are haematite and magnetite. India has 1,788 crore tonnes of estimated iron ore reserves (as on April 1, 2010).

Hematite ore is chiefly found in the peninsular plateau. The major deposits of high quality haematite ore are in the Bailadila region of Chhattisgarh, Bellari-Hospet area in Karnataka and Singhbhum-Sundarban in Jharkhand-Odisha. Magnetite is found in Karnataka, Goa, Kerala, Andhra Pradesh, Tamil Nadu, Rajasthan and Jharkhand. The decision to locate



Figure 4.3 : An open cast mine

steel plants in Chhattisgarh, Jharkhand and Odisha was influenced by the rich and economically valuable iron ore deposits in these states.

Chhattisgarh has 26,476 million tonnes of iron ore reserves, which is 18.67% of India's total reserves. The state is the country's third largest iron ore producer. The high quality iron ore of Bailadila is said to be the world's largest iron ore reserve. Other deposits are concentrated in Dantewada, Durg, Kanker and Rajnandgaon.

Manganese

Manganese is mixed with iron to produce steel. Hence its major use is in the iron-steel industry. Steel contains 12-14% manganese, so almost all the manganese that is mined is used to produce steel. Steel alloyed with manganese is stronger and harder. This steel is used to manufacture equipment such as crushers, which are used to break rocks into different sized gravel. Other important uses of manganese are to manufacture glass, clay utensils, plastics, floor tiles, glass, varnish and dry cell batteries.



Figure 4.2 : Manganese

India has 43 crore tonnes of estimated manganese reserves estimated (as on April 1, 2010). The maximum deposits are found in Odisha, Karnataka and Madhya Pradesh.

In Chhattisgarh, Bilaspur district has 516.66 million tonnes of high quality manganese reserves. Other deposits in the state are located in Mulmula, Semra and Kolihatola.

Chromite ore

Chromite is the only ore of chromium. Like manganese, it is chiefly used as an alloy of iron in the ironsteel industry. Steel alloyed with chromium is more heat resistant. Small quantities (3%) of chromium also toughens steel and makes it suitable to manufacture files, axes and hammers. Alloying slightly higher quantities (12 to 15%) makes steel heat tolerant and friction and corrosion resistant. This steel is suitable for manufacturing kitchen utensils, cutlery, machine bearings etc. If nickel is alloyed along with chromium, the steel is more resistant to abrasion by steam, water, humidity and acids. Alloying tungsten, cobalt and molybdenum along with chromium produces stellite, which strengthens steel. This alloy steel is used to make components of high speed machines. Chromite is also used in high temperature furnaces and in the dyeing, leather and textile industries.

India has 20.3 crore tonnes of estimated chromium reserves (as on April 1, 2010). The biggest deposits are found in the Sukinda valley, Cuttack and Jhanjpur districts of Odisha.

Problems in Mining

- 1. Mine workers are exposed to large dust clouds raised by mining operations, which makes them susceptible to lung disease
- 2. The land in the mining area is left degraded when the lease-holder abandons the mine after the mineral deposit is exhausted, endangering human and animal life. Children, adults and animals suffer injuries and even die after falling into the mine shafts that could be several hundred feet deep.
- **3.** Mining alters the groundwater structure and drainage pattern of the area. So, apart from the land and forests, the rivers and streams are also affected. The debris after extracting minerals is dumped in the river valleys, obstructing the flow of rivers and causing floods that destroy the forests.

Deposits of iron ore deposits in Goa and Karnataka, bauxite in Chhattisgarh and Odisha, coal in Madhya Pradesh and the open cast limestone mines in Uttarakhand are located mountain slopes or on river sources. Many minerals are found in river basins. 80% of the coal found in Jharkhand and West Bengal's Raniganj are located in the Damodar River Valley. The Mahanadi and Brahmini river valleys contain large coal deposits. Mica is found in Rajastan's Sambhar, Looni and Chambal river valleys.

5. Rapid urbanisation over the last decade has increased the demand for sand and building stones. Sand mining in rivers causes sedimentation in river beds, affects river flow and erodes river banks. Excessive sand mining has caused heavy sedimentation in Karnataka's Bhadra River and Chhattisgarh's Shankhini River.



Map 4.1 : Conventional Energy Resources in India



Map 4.2 : Important Minerals in India

Tungsten

Tungsten is important in the modern metal industry for making alloy steel. It gives steel strength and hardness and enhances its abrasion and crash-resistance. Tungsten-alloyed steel is used to manufacture high quality cutting and stone drilling equipment. Tungsten, cobalt and cromium mixed **stellite** is used to make armour plates, guns, armour-piercing shells etc. Tungsten is also used to make filaments for bulbs and tubes because of its high electrical resistance. No alternative has yet been found to match the tungsten filament's ability to turn electricity into light. Tungsten deposits are found in Rajasthan, West Bengal, Maharastra and Karnataka.

Copper

Humans have been using copper since ancient times. Bronze was made by alloying copper with tin. Copper alloys were also used to make brass, which is used to mint coins etc. After the invention of electricity in the 19th century, the importance of copper grew manifold. It is a good conductor of heat and electricity and is resistant to chemical erosion. More than half the copper produced is used in the energy industry. Copper-mixed alloys are used to manufacture telephone, radio and rail equipment; refrigerators and other household items; airplanes and ships as well as other war materials.



Figure 4.3 : Copper

Copper reserves are being explored in many parts of the country. India has an estimated 155 crore tonnes of copper reserves (as on April 1, 2010). But copper production is lower than the demand, so copper is imported. The largest copper deposits are found in Jharkhand, Madhya Pradesh and Rajasthan. Small deposits are also found in Gujarat, Karnataka, Andhra Pradesh, Odisha, Uttar Pradesh, Sikkim, Meghalaya, Maharastra and West Bengal. 37% of India's copper deposits are in Jharkhand. The Malajkhand copper mines in Balaghat district of Madhya Pradeh are famed in India.

Lead

Lead is used in transport, communication and electricity generation. It is heavy, soft and malleable. It is largely used in storage batteries and electrical wires. The chemical industry is another important consumer, using lead to manufacture **tetraethyl lead**, colours, plastics and insecticides.

India has 1 crore tonnes of estimated lead reserves (as on April 1, 2010). Rajasthan has the largest lead deposits.

Bauxite

Bauxite is the main source of aluminium. India has abundant reserves of bauxite. The Geological Survey of India estimated the bauxite reserves at 348 crore tonnes in 2010.

About half these reserves are in Odisha. Andhra Pradesh, Gujarat, Chhattisgarh and Maharashtra also have bauxite deposits. Large deposits are to be found in Kalahandi, Koraput, Sambalpur, Bolangir and Keonjhar districts of Odhisa, Vishakhapatnam district of Andhra Pradesh, Shahdol, Mandala and Balaghat districts of Madhya Pradesh, and Sarguja and Korba districts of Chhattisgarh.

Coal: Coal is the most important energy source in India. Initially, coal was used as fuel. It formed the base of industrialization in the 18th century. Its industrial use led to many significant changes. In the 18th century, it was used to smelt iron ore and produce steel. Steam engines powered by coal were used to pull trains, propel ships and run machines. Today, coal is mainly used for electricity generation.



Figure 4.4 : Coal

The Geological Survey of India estimated in 2006 that the country had 23,500 crore tonnes of coal reserves up to a depth of 1200 metres. This is only one percent of the world's total estimated coal reserves. Hence, India has to import 15-20 crore tonnes of coal annually. India mainly has bituminous coal, which is not of very high quality because their carbon content does not exceed 55% and they have a high content of vapourising material and ash.

The coal producing areas in India are located in the following four river basins in the eastern portion of the Deccan Plateau:

- 1. Damodar Valley: Coal belt of Jharkhand and West Bengal
- 2. Son Valley: Coal belt of Madhya Pradesh, Chhattisgarh and Uttar Pradesh
- 3. Mahanadi Basin: Coal belt of Chhattisgarh and Odisha
- 4. Godavari Basin: Coal belt of south-west Madhya Pradesh, Maharashtra and Andhra Pradesh.

Petroleum

Petroleum is the most important energy source in the modern world. It is also extensively used in the plastics and fertilizer industries. India produced 4 crore tonnes of petroleum in 2015. This was less than quarter of our total consumption. Hence, the country has to import large quantities of petroleum and petroleum products. In 2015, 19 crore tonnes of petroleum and petroleum products were imported. We spend about 5% of our GDP on petroleum imports, which is a huge sum.



Figure 4.5 : Digboi: India's oldest petroleum well and oil refinery plant

Oil exploration in India began in 1866 when the first oil wells were drilled in the Upper Assam Basin. However, the first reserves were found only in 1890 at Digboi, where a refinery was set up in 1893. The Assam Imports Company was set up in 1899. Subsequentl, explorations were also undertaken in other locations. A reserve was discovered in Naharkatiya in 1953.

Production began in the Ankleshwar area (Vadodara) of Gujarat in 1960. Intensive exploration efforts were undertaken after 1961 and many reserves were identified in the state. New areas were identified in Assam as well. As a result, production increased rapidly from 5,13,000 tonnes in 1961 to 63,11,000 tonnes in 1975. Offshore drilling began in 1970 in Gujarat's Aliyabet. Bombay High was discovered in 1975 and production began the following year. Constant efforts led to identification of potential reserves in the Kaveri and Krishna-Godavari basins on the east coast. Production was initiated in these areas too. Large reserves have also been found in Rajasthan's Barmer district.

India's petroleum reserves are estimated at 1,700 crore tonnes. This includes land and offshore reserves. The reserves are in four regions: (1) North-east region (Upper Assam basin, Arunanchal Pradesh and Nagaland); (2) Gujarat (Cambay basin and Gujarat plains); (3) Bombay High offshore area; and (4) East coast region (Godavari-Krishana and Kaveri basins).

Uranium and Thorium

Both elements are the main source of atomic or nuclear power. Uranium sources are very limited in India hence the mineral has to be imported. However, large reserves have been found in the Tummalpalle and Bhima river valleys in Karnataka in the past few years. Similarly, thorium has been found along the Kerala coast. Since thorium reserves are abundant, India is trying to produce more nuclear power using thorium. The government has full control over all sources of nuclear power and these minerals can only be mined by public sector enterprises.

Industrialisation

Till about 200 years back, most people used to be employed in agriculture and maximum production used to come from agriculture. In the developed nations today most people work in industries and related services and very few are part of agricultural activities. In India, while 60 percent of the people are engaged in agriculture its contribution to GDP (Gross Domestic Product) is just 18 percent. 26 percent is of industries and 56 percent of service sector.

Industrial revolution began in England in the 18th century and gradually the nature or industrial production began to change all across the world. This is called industrialization. Post industrialization production process has been constantly changing.

Factors impacting establishment of Industries

One of the features of modern industries is that they are extremely mobile and constantly keep changing their location. Many regions, which got industrialized, where hundreds of factories were established and lakhs of labourers settled, are deserted today because the industries have migrated. In the 1970 most important cities in India such as Mumbai, Delhi, Chennai, Indore etc. had huge cloth mills. In the 1980 almost all of these closed down and power looms that produced at a much faster rate came up in absolutely new locations. Similarly in America factories in areas which had huge car production facilities have closed down. Today's industries are divided into small units and spread across the world. What are the factors which determine the location of industries? There are many factors, but the determining factor is profit. At any point of time a capitalist will invest in setting up a factory in a location that is most profitable for them and will continue do so only as long as it is still more profitable that other locations. Which location will yield high profit depends on a number of factors - production techniques, raw material availability, market, transportation facilities, industrial and taxation policy of the state and most importantly availability of skilled and low paid labour.

Transport resources were much less developed in the 18th and 19th century. Huge quantities of iron ore and coal were used to prepare small quantities of steel. So steel plants were set up near the mines, so that raw material need not be transported to far off places. But with time high quality ore in the mines got depleted and had to be procured from far off places. In this situation the steel industry began to shift to more suitable locations. When transportation facilities began to develop, the industries began to shift to places were skilled and cheap labour was available. Industrialists found that workers in older locations had become organised and had fought for higher wages and better facilities. Under pressure from workers in those areas many new laws in favour of workers had been enacted too, which ensured that workers were compensated if laid off, or government regulated minimum wages, and regulated work hours etc. The industrialists began to set up their industries in colonies or countries where because of poverty labourers were ready to work at low wages, where laws for labour welfare were not in place and labour was not organized. This became possible because of rapid expansion of fast transport that was cheap. For example iron ore mined in Dantewada is transported 250 kms away to Visakhapatnam port through a pipeline in slurry form. There the slurry is made into pellets and exported. It is called the Kirandol - Visakhapatnam Slurry Pipeline. A similar pipeline project exists in Odhisa too.



Figure 4.6 : Part of Dantebada-Visakhapatnam Slurry Line - Here the iron ore solution is made

Raw Material

Industries are generally set up near sources of raw material, so that expenses on transport can be reduced. If we buy Rs 100 worth of iron and raw cotton, you can guess which will be lighter. Iron, aluminium, bauxite, limestone etc. are heavy ores. Establishing industries that use these ores far from the mining areas will greatly increase production cost. Which is why these industries are set up near the source of raw material. Aluminium factory at Korba, steel plant in Bhilai, cement plant in Jamul near Durg are located close to mines that produce the raw material. However, the cost of transportation for cotton or cotton yarn is much less therefore the factories are often far away from the raw material sources.

Can you tell the advantages of producting jagerry near to sugarcane fields?

Find out where and to whom sugarcane farmers of Chattisgarh sell their crops?

Transport

Today production is done in many different parts. Production of different parts of a product are done in different places, quite often in locations across the globe and then brought together and assembled in a location. This makes trasnportaion an essential part of production. This is why other than raw materials, transportation is also very important to decide the location of industries. Water, road and rail modes of transport are all used to transport goods. They help transport raw material to production facility and produced goods to the market.

Power or Energy

Electric power to keep the machines in a factory going. Electricity is produced from coal, hydel power

stations, wind, solar energy, nuclear energy etc. Coal is a heavy material. Also large amount of ash is produced when coal is burned in power plants burned to generate energy. The substitute for coal is diesel. But not only does it pollute the environment, it is available in nature in limited quantities. Therefore, alternate sources of energy are now being explored. Solar energy, hydel power, wind energy, energy from waste are some of the examples. Of these the most cost effective source is hydel energy which is generated by water stored in dams. But, the problem of this dam based power generation is that valuable forests, agricultural land and villages get submerged. Small and medium dam or hydel power stations on mountain slopes could be an alternative. States where electricity is continuously available have a higher chance of industrialization. Electricity has to be available round the clock for 24 hours a day in the factories.

Market

A product is consumed through the market. So all produce has to be taken to the market. The constantly changing nature of markets also impacts the setting up of industries. When we say market, it just does not relate to reducing transportation cost, but also increasing consumption of new products and ensuring consumer's interest in the product is retained by making the produce attractive and ensuring quality. Expansion of the market requires standardisation so that a product is demanded and consumed over a large area. To sell the product across the world, people need to have a similar thought, interests and consumption pattern throughout the world. To underatnd we can consider the example of mobiles in the last 25 years. In 1990-91 very few companies use to manufacture mobile sets and very few people owned them because they did not have access. Today a number of companies manufacture mobiles sets. To keep themselves afloat in the competitive market they constantly introduce new features and designs at cheaper rates than before. This keeps the consumers attracted and the companies maintain their position in the market.

E - Commerce

Till sometime back you could only have imagined that you can buy mobiles, watches, clothes, books, toys etc. sitting at home. Today it is a fact. You can order from your mobile or computer anything and pay through your ATM Card card or pay when the goods are delivered. This is what is called E - Commerce. The increasing number of internet users in India has boosted E - Commerce. As per a report E - Commerce market is increasing by 50% each year. On the other hand E - Commerce market in China is increasing by 18% and that of Japan by 11%. 75% of all those making purchase on the internet in India are in the age group of 15 to 34 years.

Labour

Skilled and trained labor is needed to work in industries. One also needs skilled managers, secretaries, computer programmers etc. Industrialization also mandates for a few people to think out of the box, make new discoveries, find solutions to problems and think differently from the crowd.

Developed countries have a large pool of skilled workers but wage levels are high as the workers are organised and fight for their rights. The problem of labor is very different in developing countries. In these densely populated countries, there is pressing problem of unemployment. So people are ready to work for lower wages. But, they are also lacking in skills. They are poorly educated and often unlettered too and are unable to meet the needs of modern industries. Many workers have had to be sent abroad for training.

A significant change in employment pattern in recent times is of companies hiring much lesser permanent employees. They keep contractual staff, hire workforce through contractors, and outsource work. This helps companies save in labor costs. The situation is very different from developed countries.

If there are trade unions in your area, find out about them.

What are the efforts being made to develop skills of workers in your area?

Capital

The most important need for industrialization is capital. To make available capital many institutions need to be established. Share market, banks, insurance companies are some of the examples. These institutions help industrialists to access capital to set up factories. Institutions such as banks exist so that people do not let their wealth lie idle, but invest them to earn profits.

Private capital is invested solely for the purpose of earning profit. Such capital is invested only in places where profits can be maximised. Investment of private capital in textile mills in Mumbai had happened for the same reason. Investment by government does not follow the same logic. Development of backward regions, utilization of natural resources and balanced development are factors that drive government investments. The steel plant at Bhilai is a case in point.

If there were no banks how would one access capital?

Technology

The more modern the technology the cheaper and easier it becomes to produce in larger quantities. Availability of modern technology has led to higher industrialization of developed countries, whereas the lack of development of modern technology has led to slower industrialization in developing countries. Industrialization requires new research and new technology so that production increases. High quality steel from high quality iron ore is a possibility. But high quality steel from poor quality iron ore is possible only through research. Technology development for new automatic machines that help produce quality products in large quantity is very important.

Making effort to find out about other countries using communication methods has become very vital and helps industrialization. Today there is lots of competition between companies, which makes imperative the use of latest technology to ensure quality and scale. For this many companies tie up or enter into partnership with companies that have new technology. For example India's Hero Company tied up with Honda Company of Japan and produced Hero Honda motorcycles.

Try and found out which Indian companies have tied up with companies from other countries for production?

Industrial Policy

Establishment of industries is related to government policy too. If the industrial policy does not have liberal terms for industry, industrialists will not choose to set up industries in that country. Industrialists invest in countries where the policies are flexible, where government interference is minimum and where basic facilities such as labor, electricity and transport is organized.

Impact of the new Industrial Policy

Three main policies have been made which are as follows:

Liberalization: Liberalizations means making easy the rules and processes and reducing licenses and permits, so that foreign companies set up factories in India using new technology. This step was taken to boost industrial development in the 7th five year plan. It was further promoted in the 8th five year plan.

Privatization: Selling public enterprises to private players by the government is privatization. Because of declining profit of public sector in the last few years, demands arose to increase the share of private players as also to close down public enterprises chronically in loss. To resolve the constant problems in the public sector enterprises government adopted the policy of disinvestment for public sectors. As part of the process government began to sell of parts of the public enterprise. As a result participation of private sector in management increased and additional resources could be generated.

Globalization: As a result of the process of globalization since the 1980s and 1990s, not just capital but services, labour and resources began to freely move from one country to another. The main stress of globalization was on increasing competition between national and international firms. We can understand globalization in two ways:

- An economic and political process under which production and distribution become international. Barriers in movement of produce, capital, labor, thoughts and culture were reduced so that all these could be exchanged across the world without hindrance.
- 2 Policies to enhance industrialization, which we also call liberalization policy.

Major Industrial Regions of India

One of the features of industrial development is that once few industries develop in a place, then many others get attracted to the same location. This is because skilled labor, transportation, spare parts, trade facilities etc. become available at the location. As a result industrial centers turn into large cities and spread into nearby areas. This is how industrial regions develop. The government policies help develop such regions.

When a particular industry develops at a fast pace keeping in mind the locally available resources, then that area is called an industrial region. The following are the major industrial regions of India:

- 1. Mumbai-Pune Industrial Region
- 2. The Hugli Industrial Region
- 3. Bangalore-Tamil Nadu Industrial Region
- 4. Gujarat Industrial Region
- 5. Chotanagpur Industrial Region
- 6. Vishakhapatnam-Guntur Industrial Region
- 7. Gurgaon-Delhi-Meerut Industrial Regio
- 8. Kollam-Thiruvananthapuram Industrial Region

1. Mumbai-Pune Industrial Region

This region extends between Nashik and Solapur of which Mumbai, Thane, Pune, Nashik, Solapur, Kolaba, Ahmednagar, Satara, Sangli and Jalgoan districts are a part. Industries have grown at a rapid pace in this region. Mumbai is the commercial capital of India and a very important port. This region is also known as India's largest textile industry region.

The seeds of its growth were sown in 1774 when the British began construction of a port in Mumbai. The second phase of development began in 1854, when Kavas ji Dabar set up the first modern cotton textile mill. Soon Mumbai became India's largest cotton textile producing centre of India.

In 1955, Indias first atomic power plant was set up at Trombay near Mumbai. Its objective was to make available electric power. In 1961-66, as part of India's 3rd five year plan. Asia's largest nuclear reactor was set up at Tarapur. The chemical industry began to develop in 1967. Petroleum production began at Mumbai High petroleum field IN 1976. Establishment of these industries led to the establishment of many other industries. The region today has a number of industries such as engineering goods, petroleum processing, petrochemicals, leather, plastic, medicines, fertilizers, electrical, ship-building, electronics, soap, vegetable oil, automobiles, garments, television, refrigerators, cycles, software etc. The large and famous hindi film industry called Bollywood is located in Mumbai.

2. The Hugli Industrial Region

The industrial growth of this region has been much slower than Mumbai-Pune Industrial Region, But it is India's first industrial zone. This region extends as a narrow belt running along the river Hugli with Kolkata-Howrah as its nucleus. Hugli is the spine of this region.

Industrial development began in this region between 1962-94 when an inland river port was developed on river Hugli. Development of this river port made Kolkata a leading industrial centre in this region.

The main industrial centers in this region are Haldia, Serampur, Rishra, Howrah, Kolkata, Shibpur, Naihati, Titagarh, Sodepur, Budge Budge, Birlanagar, Bansbaria etc. Many types of industries developed in this region but jute was the most import industry. 70 percent of jute products are found in this region. After partition of India in 1947, the region faced, for some years, the problem of shortage of jute as most of the jute-growing areas went to Bangladesh (then East Pakistan). The problem was solved by gradually increasing home production of jute. Kolkata and Titagarh have 25 factories that produce high end fine cotton textile. This is also considered by many as the best region for engineering goods industry in India. Diesel and electric pump sets, electrical motors, fans, cars, petrochemicals, ship building, electronics and computers are manufactured here.

Indias earliest car manufacturing unit, 'Hindustan Motors Limited' was located at Uttarpada. Garden Reach Ship Building Company makes a avariety of warships, cargo ships, fishing trawlers etc. Haldia is being developed as India's largest Oil refinery centre and Petrochemical centre.

Compare Mumbai Pune region and Hugli region and tell what are the similarities and differences between the two?

3. Bangalore-Coimbatore Industrial Region

Bangalore is the capital of Karnataka and Coimbatore is the chief industrial centre of Tamil Nadu. Industrial development has taken place in a long strip between the two cities. This region is the chief producer of cotton. Small garment units have sprung up in towns and villages of this region. Cotton textile is the prime industry of this region. 20% of all yarn produced in India is produced in Tamil Nadu. Coimbatore alone has 91 cotton textile mills. Bangalore is known for many of its industries – Hindustan Aeronautic Limited (HAL), Hindustan Machine Tools (HMT), Hindustan Telephone Limited (HTL), Hindustan Power Equipment, Infosys and Wipro Limited. Bangalore has developed as India's chief computer and communication technology centre. Other than these industries, the region has bus body building, glass products, china crockery, cotton garments and rail coach industry. India's largest Oil refinery centre and Petroleum processing unit is located in Chennai in this region. Salem has a large steel plant and fertilizer producing unit.

Communication Technology : has become very important today. The information technology companies work round the clock. How does this happen? Companies from New York, USA have tied up with companies in Bangalore, India to work together on a software development. When it's daytime in Bangalore it is midnight in America and when its daytime in New York it is nighttime in Bangalore. People work in shifts to resolve this problem of time difference. Communication Technology makes it possible to work and communicate simultaneously. It's like working from a next door office, when you are actually half way round the globe. This industry has become totally globalized. This has become possible because of technology, polity, socio-economic change. The main factors that decide location is availability of resource, cost and infrastructure.

4. Gujarat Industrial Region

The nucleus of this region lies between Ahmedabad and Vadodara as a result of which it is also known

as Ahmedabad-Vadodara industrial region. The main industrial centers are Rajkot, Surat, Vadodara, Khera, Anand, Bharuch and Godra. Ahmedabad has the most number of cotton textile mills. Surat has diamond cutting, gold and silver jewelry and textile industry. Dairy is the most prominent industry in Anand. Ahmedabad also has engineering goods, electronics, software, medicine and other industries.

5. Chotanagpur Industrial Region

This region spans from West Bengal through Damodar Valley, Singhbhum and Odhisa. Which is why it is also called the Rourkela – Jamshedpur Industrial Region. Singhbhum is abundant in iron-ore, copper, uranium, manganese etc. and the Damodar Valley in coal. Which is why steel plants were set up in Jamshedpur, Bokaro, Durgapur, Rourkela and Burnpur. The region has heavy engineering industries (Ranchi), cement (Dalmiya Nagar and Japla) and fertilizers (Sindri).

6. Vishakhapatnam-Guntur Industrial Region

This industrial region extends from Vishakhapatnam to Prakasham districts. The industrial development of this region mainly depends on the two ports - Vishakhapatnam and Machilipatnam. Petroleum and coal reserves were found in the Godavari basin. This is why the region has a large steel plant. Hindustan Shipyard Ltd. at Vishakhapatnam produces warships. The region also has textiles, jute, paper, fertilizer, and engineering goods industry. Vishakhapatnam, Vijayawada, Vijaynagar, Rajamundry, Guntur, Eluru etc. are the main industrial centers.

7. Gurgaon-Delhi-Meerut Industrial Region

This region is spread in towns around Delhi – Gurgaon, Faridabad, Modinagar, Meerut, Ambala, Mathura, Saharanpur, Noida, Kurukshetra, Karnal, Panipat etc. The region is located far away from the mineral and power resources, and therefore, the industries are electronics, mobiles, sports goods, electrical, hosiery, tractors, cycles, agriculture equipments. Agra area has glass and leather industry, Mathura has oil refinery, Faridabad has engineering goods industry, and Saharanpur has paper industry. The main industries in Gurgaon are automobile, garment, electronics and BPO (Business Process Outsourcing).

8. Kollam-Thiruvananthapuram Industrial Region

This region is located in the coastal belt of Kerala. It is spread over Thiruvananthapuram, Kollam, Allapuzha, Ernakulam and Thrichur districts. The region is located far away from the mineral belt of the country as a result of which the industrial scene here is dominated by agricultural products processing. Cotton textile, sugar, rubber, paper, fish processing, coconut fibre processing industries are the main industries of the area.

Durg-Raipur-Bilaspur-Korba Industrial Region

This industrial region in Chhattisgarh has mining and mine dependent industries. The Bhilai Steel Plant was set up under the 3rd five year plan with Soviet collaboration. Bhilai is on the Kolkata – Mumbai railway route in the Durg District of Chhattisgarh. The iron ore for this plant is sourced from mines in the Dalli Rajhara hills, 97 kms south of Bhilai. Coal is sourced from mines in Korba (Chattisgarh) and Jharia (Jharkhand). Other minerals too are found in the nearby areas. Many small units have sprung up



Map 4.3 : Major Industrial Regions of India

in the area to supply spare parts and other items to the steel plant. Because of the plant many steel rolling mills have sprung up in the area. The rail wagon repair factory at Raipur was also set up because of easy availability of steel from Bhilai Steel Plant. The area also has many rice mills, which is an agriculture based industry. Other than mine based industries the region also has modern industries such as chemical, engineering goods, and electronic industry.

Foundation for Bharat Aluminum Company (BALCO) was laid in Korba on 27th Nov. 1965 and began production in 7th May 1975. Other than Korba, bauxite is abundantly available in Mainpat mines in Sarguja and around Amarkantak. BALCO also has captive bauxite mines Phutka Pahad in Sarguja. Korba today has 671 medium and large industrial units.

Hasdo River that flows through Korba provides water for the industry. There are 6000 employees in BALCO today. Other than bauxite, this area also has large coal deposits. A thermal power plant has been established to tap this potential. The plant supplies power to BALCO and the state and helped it emerge as an electricity producing centre. Along with this the area has cement, paper and pulp, electrical and electronics and chemical units. Household units that producer tassar yarn and cloth dot the area. The main industrial centers of this area are Bhilai, Durg, Raipur, Kumahari, Jamul, Mandar, Mahasamand, Korba, Chapa, Urla, Dharsiva, Raigadh, Gopalpur and Sirgitti.

With a view to push industrial development, the government in 2007 has decided to develop **industrial corridors.** Under the Delhi-Mumbai Industrial Corridor (DMIC) Project 8 large investment regions have been declared. The details are as follows:

- 1. Ahmedabad- Dholera investment region, Gujarat
- 2. Shendra-Bidkin Industrial Park City, near Aurangabad, Maharashtra
- 3. Manesar- Bawal investment regions, Haryana
- 4. Khushkhera- Bhiwadi- Neemrana investment region, Rajasthan
- 5. Pithampur- Dhar- Mhow investment region, Madhya Pradesh
- 6. Dadri- Noida- Ghaziabad, Uttar Pradesh
- 7. Jodhpur- Pali- Marwar, Rajasthan

Other than this we have Chennai Bangalore Industrial Corridor, Mumbai-Bangalore economic corridor, Amritsar Delhi Kolkata Industrial Corridor and East Coast Economic Corridor.

Impact of Industralization

There are a number of advantages of industrialization:

- * Development of industries leads to large scale production at very low costs. This makes goods available to consumers at very reasonable prices.
- * Industrialization improves quality of life
- * Diverse consumer goods produced, which gives many choices to the consumer.
- * Industrialization creates new opportunities for employment



Map 4.4 : Delhi-Mumbai Industrial Corridor

- * Industrialization creates many modes of transport and facilitates import and export.
- * Resources are utilized as a result of industrialization
- * Industrialization leads to foreign exchange inflow

Industrialization has not just advantages but also many disadvantages. Numerous environmental problems arise out of industrialization. Industries use raw material and power. Raw material leads to exploitation of natural resources which result in land degradation and expansion of resources. Industrial effluents pollute air, water and soil creating lots of environmental problems.

After a point land, transportation, labor, power, water etc. become expensive. Sometimes labor organizes and negotiates, and this leads to breakdown of work. All these factors prompt industrialist to shift the indutry to another location. At times even government forbids setting up of a particular industry in a town, city or area, which deters industrialization of that area.

EXERCISE

Fill in the blanks:

- 1. In India's east coast states we have..... and industrial regions, whereas in west coast states we have and industrial regions.
- 2. Chhattisgarh's slurry pipeline has been constructed to carry iron ore mined inmines to
- 3. Automobile industry is located in India'sand industrial regions.

Answer the following questions in brief:

- 1. Which minerals are important sources of energy?
- 2. Which metallic mineral is most abundantly found in India?
- 3. What was the objective of the first mineral-related law enacted after independence?
- 4. When did foreign companies get permission to mine in India?
- 5. What type of industries is established close to sources of raw material; and what type of mines are established close to the market?
- 6. What is the role of banks in the establishment of industries?
- 7. Why is it that only the government invests in industries in backward regions?
- 8. What is the difference between hydel power and thermal power?
- 9. What are the negative environmental impacts of mining? What are the possible means to curb this negative impact?
- 10. What should be done to minimize the impact of mining on local communities and what measures can be undertaken to ensure that they benefit from mining operations?
- 11. What should be done to ensure that the whole country and not just a few investors gain from mining activities?
- 12. What can be done to make capital and technology available for mining? How could national interests be threatened in the process?
- 13. What are the advantages and disadvantages of permitting foreign companies to enter the mining industry?

- 14. The districts in India with the most abundant mineral resources are also the regions that are least developed and where the poorest people live. Why is this so in your opinion?
- 15. Why have industries migrated from developed to developing nations in the last 50 years? Explain with examples.
- 16. Why are industrial regions unstable? Why do industries shift out of locations that they were well established in?
- 17. What is the relation between labor and market development?

PROJECT WORK

Make a list of major industrial areas in Chhattisgarh. What are the predominant industries of that region and why are they located there? Make a detailed report and develop posters highlighting features of each of these regions.

Develop a play on the condition of skilled and unskilled and organized and unorganized labor of Chhattisgarh.