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LEARNING OTCOMES!

Candidates should be able to:

- identify the main locations of limestone, gypsum and rock salt extraction from a map, and understand their uses
- identify the main metallic and non-metallic mineral resources of Pakistan, and in what quantities they: – are extracted – exist as reserves
- understand the extent to which these can be exploited
- describe the environmental problems caused by mineral extraction
- evaluate the benefits of developing mineral resources and understand the sustainability of extraction
- identify the main imported minerals, where they come from, and in what quantities.

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MINERALS

- ✓ A mineral is defined as being a naturally occurring element or compound that is formed by inorganic processes and contains a crystalline structure.
- ✓ Mineral is defined
- ✓ Minerals have following features;
- They are solids.
- They are formed naturally in the earth.
- They are not alive or made of living things.
- They have definite shape.

HOW MINERALS ARE FORMED?

- ✓ Either by solidification of molten rocks i.e. from magma and lava. When magma solidifies in the surface it forms Plutonic or Intrusive rocks. (They are both types of rigorous rocks). They can be changed into different forms by heating and compression, and are converted into metamorphic rocks. When lava solidifies it forms Volcanic rock and Exclusive rocks.
- ✓ Some are formed by evaporation of water. When water evaporates it leaves behind crystals of salts which forms rock salt. Rock salt is a sedimentary rock.
- ✓ Some are formed by heating and compression of rocks. When limestone compresses it forms marble. Limestone is also known as calcium carbonate.
- ✓ When there is slow heating of rocks in the subsurface they form large crystals and form gemstones.

MINERAL EXPLORATION

- ✓ To discover the metallic or non metallic minerals from the earth.

MINERAL EXTRACTION

- ✓ Taking out the minerals from the earth by different methods.

MINERAL EXPLOITATION

- ✓ Means to utilize the available mineral resources for development purposes.

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LIMESTONE

Uses

- ✓ The manufacture of quicklime (calcium oxide) and slaked lime (calcium hydroxide)
- ✓ Cement and mortar
- ✓ Pulverized limestone is used as a soil conditioner to neutralize acidic soil conditions
- ✓ Crushed for use as aggregate—the solid base for many roads
- ✓ As a reagent in flue gas desulfurization (sulphur dioxide air pollution control)
- ✓ Glass making, in some circumstances
- ✓ Added to paper, plastics, paint, tiles
- ✓ Toothpaste
- ✓ Re-mineralizing and increasing the alkalinity of purified water to prevent pipe corrosion and to return essential nutrients
- ✓ Used in blast furnaces to extract iron from its ore
- ✓ Medicines
- ✓ Cosmetics

Areas

- ✓ It is found widespread in Pakistan e.g. Daud khel, Zinda pir, Kot Digi, Harnai, Ganjotaker, Mangopir and Murlihills.

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GYPSUM

Uses

- ✓ Gypsum Board primarily used as a finish for walls and ceilings
- ✓ Plaster ingredient
- ✓ Fertilizer and soil conditioner
- ✓ Plaster of Paris (surgical splints; casting moulds; modelling)
- ✓ Adding hardness to water used for home brewing (making beer)
- ✓ A component of Portland cement used to prevent flash setting of concrete.
- ✓ Soil/water potential monitoring (soil moisture tension)
- ✓ In foot creams, shampoos and many other hair products.

Areas

- ✓ It is mined from Khewra, Dandot and Daudkhel.

ROCKSALT

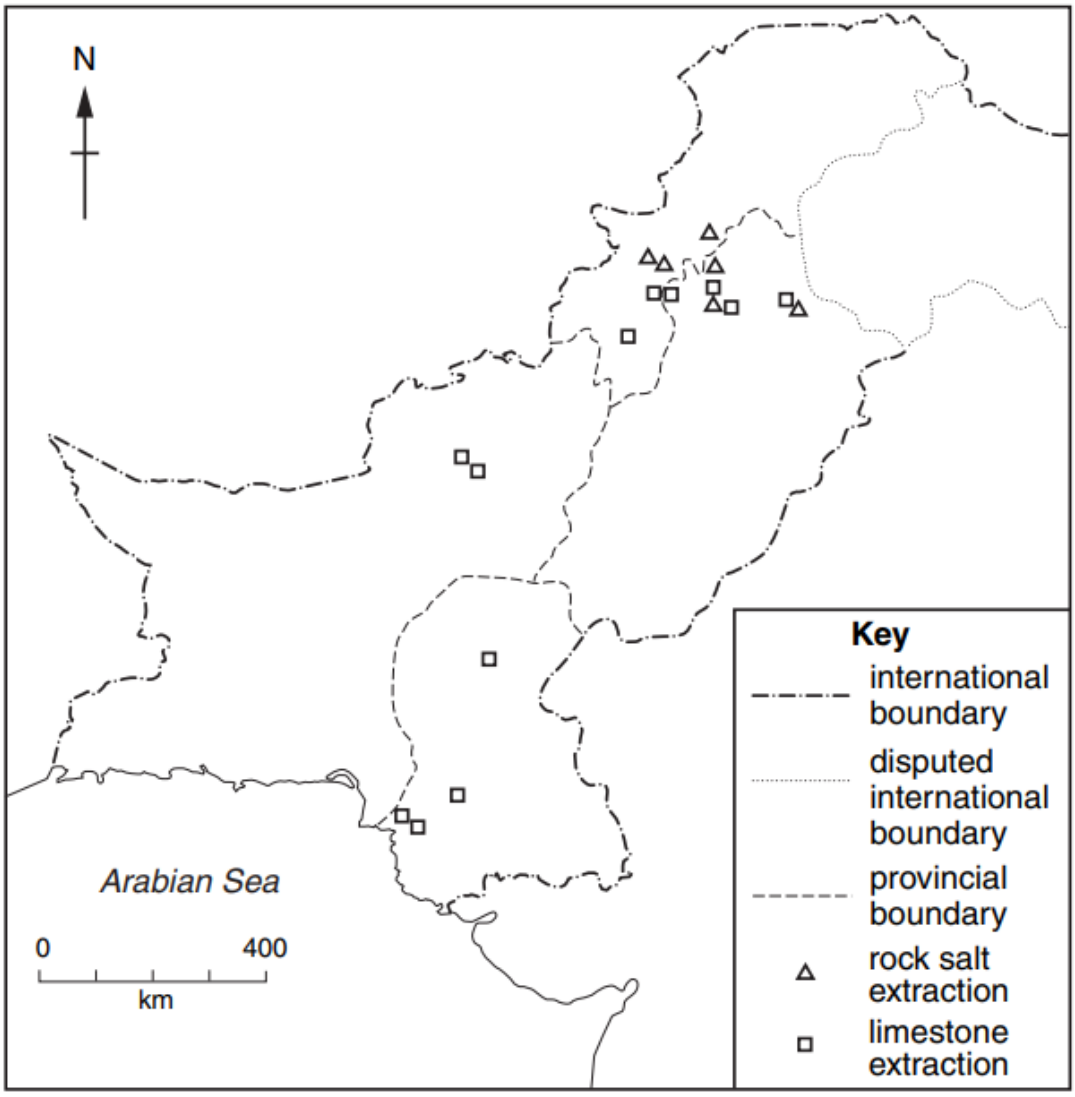
Uses

- ✓ Cooking
- ✓ Spreading on icy roads to improve traction
- ✓ Manufacturing pulp and paper
- ✓ Setting dyes in textiles and fabric
- ✓ Producing soaps, detergents, and other bath products
- ✓ Major source of industrial chlorine and sodium hydroxide
- ✓ To preserve fish after it has been caught

Areas

- ✓ Important mines are Khewra, Warcha and Kalabagh

LOCATION OF LIMESTONE, GYPSUM, ROCKSALT



PRACTICE QUESTIONS 1.1

Question 1 N2016/P2/Q2/A

(a) Study Fig. 3 which is a map showing the locations where three different non-metallic minerals are extracted in Pakistan.

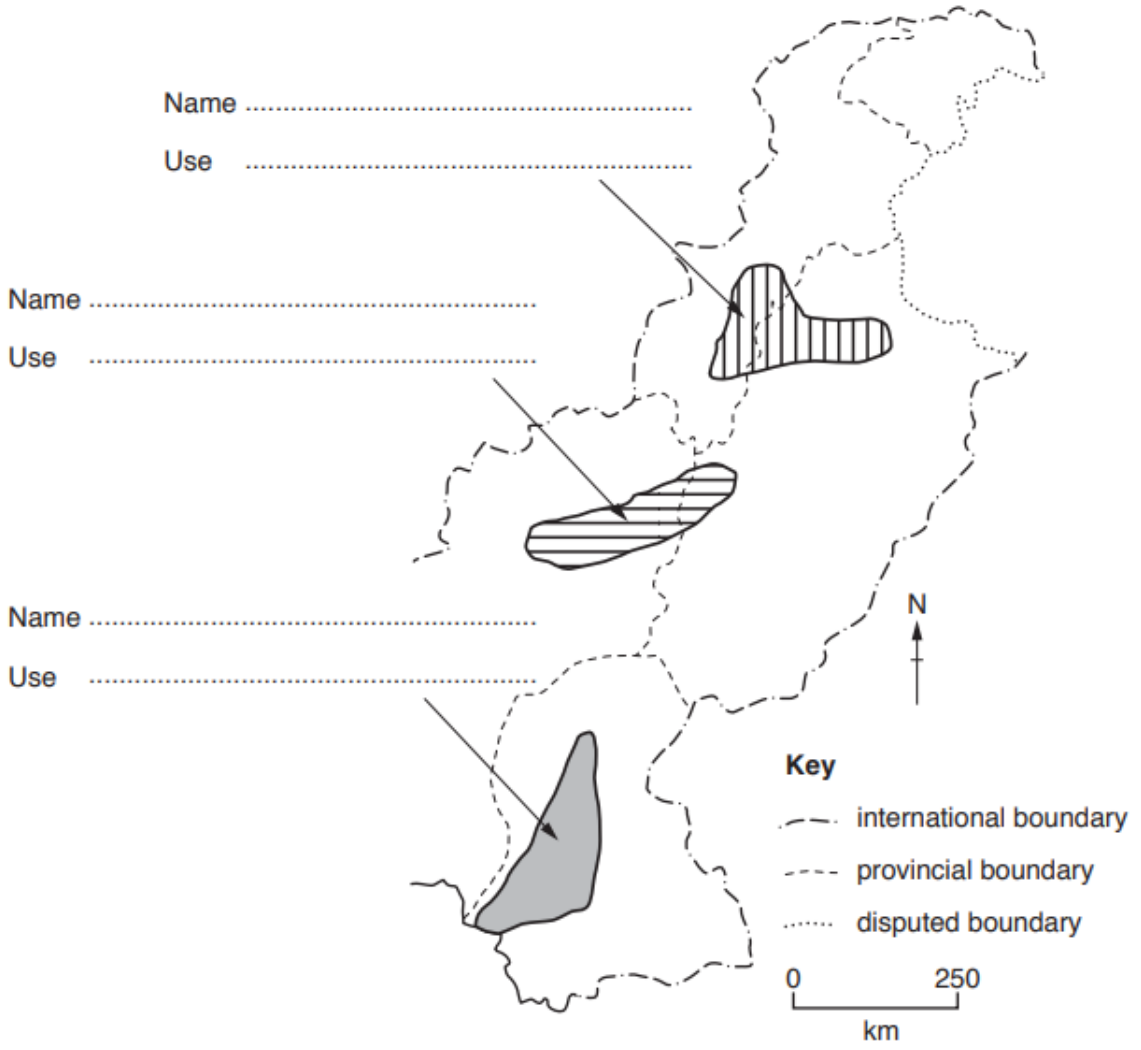


Fig. 3

(i) For any **two** locations, state the name of the mineral extracted and a use for this mineral. Write your answers in the spaces provided on Fig. 3. [4]

You should choose from the following list:

gypsum limestone rocksalt

(ii) Using Fig. 3 and your own knowledge, suggest difficulties there may be in getting minerals to export markets.

.....

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.....

.....

.....[3]

Question 2 N2012/P2/Q1/A

(a) Study Fig. 1 which shows mineral extraction in 2008 in Pakistan.

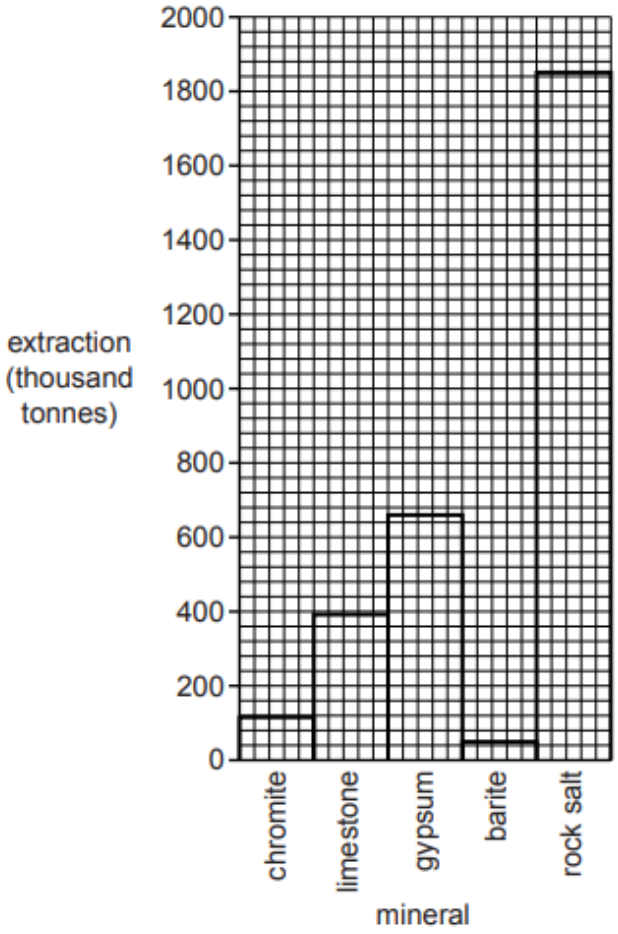

Fig. 1

(i) Name **two** minerals shown on Fig. 1 that are used to make cement.

1 .....

2 .....[2]

(ii) State **two** uses of rock salt.

1 .....

2 .....[2]

(iii) State the amount of gypsum extracted.

.....[1]

Question 3 N2007/P2/Q3/A-B

(a) Study Fig. 3, which shows limestone and rock salt extraction.

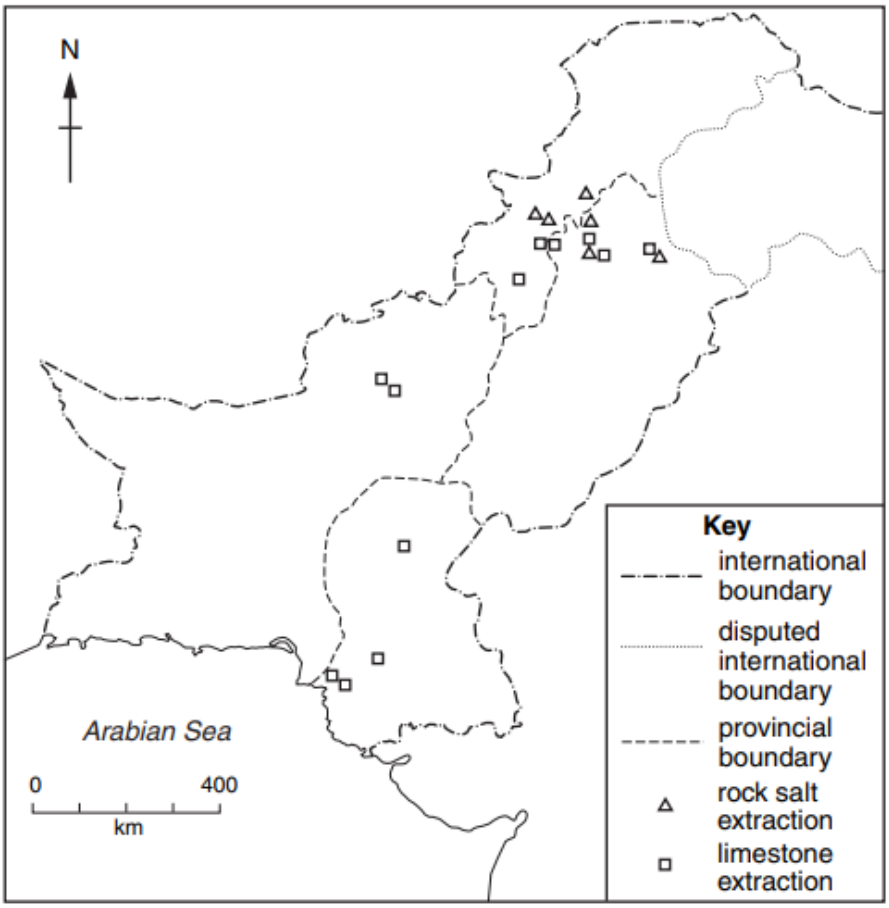

Fig. 3

(i) Describe the distribution of limestone extraction in Pakistan. [3]

(ii) Limestone and rock salt are both called 'bulky goods'. What is the cheapest form of transport for these goods? [1]

(iii) Why is the supply of limestone to most areas likely to be cheaper than rock salt? [1]

(b) Nearly one million tonnes of rock salt were extracted in Pakistan during 2002.

(i) What is a mixture of rock salt and water called? [1]

(ii) What is rock salt used for in Pakistan? [2]

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METALLIC MINERALS

- ✓ Metallic minerals are those which are made up of a metallic compound e.g. Iron, copper.
- ✓ Economically more valuable e.g. Gold.
- ✓ Generally hard, tough and shiny e.g. Iron.
- ✓ Can change shape without breaking e.g. copper
- ✓ Can be stretched and compressed e.g. Iron.
- ✓ Many are good thermal and electrical conductors e.g. copper.
- ✓ More reactive with water and acid e.g. copper.

NAME	DEPOSITS	QUALITY	EXTRACTION
Aluminium	74 million tonnes	Low to medium	2,000 tonnes
Iron Ore	900 million tonnes	Low to high	24,000 tonnes
Copper	1900 million tonnes	Low to high	15,000 tonnes
Chromite	2.53 million tonnes	Low to medium	27,000 tonnes
Gold	11.2 million ounces	Low Grade	-

CHROMITE

- ✓ It gives hardness and electrical resistance to steel.
- ✓ It is used for bridges and railway carriages.
- ✓ It is used as lining in metallurgical furnaces and for making engineering tools and stainless steel.

IRON ORE

- ✓ It is used in steel making, construction and in transport industry.

COPPER

- ✓ It is used to make copper wire and other electrical appliances specially switches, that carry current.
- ✓ It is also used in making Alloys, water pipes and tanks.

MANGANESE

- ✓ It is used in making dry cell and paints.

BAUXITE

- ✓ Alluminium is mainly obtained from bauxite and is a valuable metal.
- ✓ It is used in utensils, tins, cans and many other products.

CELESTITE

- ✓ It is used in tracer bullets, fireworks, ceramics, paints and plastics.

NON-METALLIC MINERALS

- ✓ Non-Metallic minerals are those which are made up of a non metallic compound e.g. Limestone, Gypsum.
- ✓ Economically less valuable except power resources e.g. oil, gas and coal
- ✓ Softer, rough and may not shine e.g. clay.
- ✓ Breaks away when shape is changed except oil and gas.
- ✓ Cannot be stretched or compressed except natural gas
- ✓ Poor thermal and electrical conductors e.g. rock salt.
- ✓ Less reactive with water and acid except limestone and salt

NAME	DEPOSITS	QUALITY	EXTRACTION
Limestone	Large	High	8,697,573 tonnes
Gypsum	4850 million tonnes	Medium to high	384,513 tonnes
Rocksalt	600 million tonnes	High	1 million tonnes
Coal	185000 million tonnes	Low to medium	3 million tonnes
Oil	300 million barrels	Good	23 million barrels
Gas	27 trillion cubic feet	Good	900000 million cubic feet

MARBLE

- ✓ It is found in bands of white, grey, yellow and brown.
- ✓ It is used in buildings and for making chips for flooring and decorative pieces.

SULPHUR

- ✓ It is used to manufacture sulphuric acid, explosive materials, paints, dyes, pulp, fertilizers and is used in the refining of petroleum.

CLAYS

- ✓ It can be differentiated into China Clay, Fire Clay and Fuller's Earth.
- ✓ China Clay is used in ceramic industry.
- ✓ Fire clay is used for insulation and preparation of bricks and also used in making pottery.
- ✓ Fuller's Earth is used in steel mills, oil drilling and oil refining.

SOAPSTONE

- ✓ It is found in the form of stone and then crushed to make powder.
- ✓ It is used as a filler in soap, ceramics and face powder

BARITES

- ✓ It is used in oil industry and for manufacturing the paints, glass and insecticides.

PRACTICE QUESTIONS 1.2

Question 1 J2015/P2/Q2/A-B(i)

(a) Study Figs 3 and 4 which give information about the extraction of three metallic minerals in Pakistan in 2010–11.

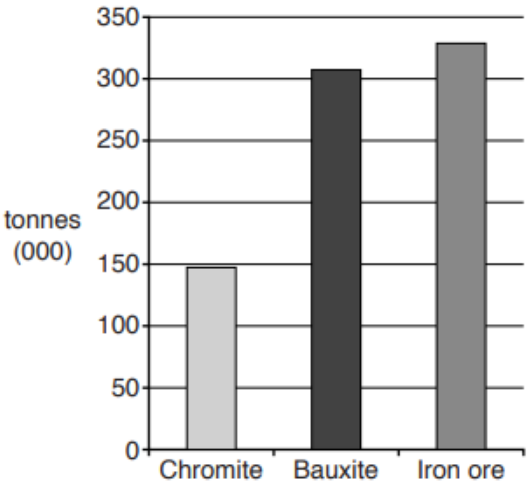

Fig. 3

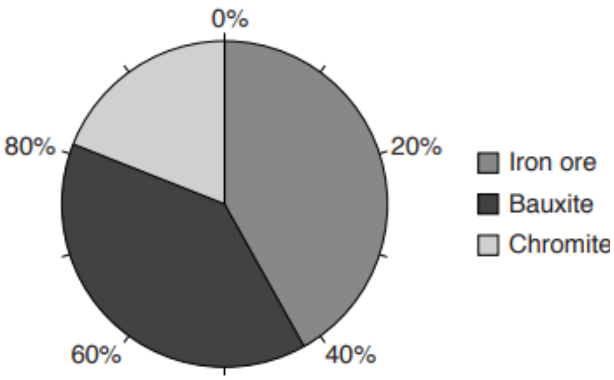

Fig. 4

(i) How much iron ore was extracted in 2010–11?

.....[1]

(ii) State the difference between the type of information being provided in Fig. 3 compared to that in Fig. 4.

.....

.....[1]

(b) **(i)** Give **one** use for the mineral chromite and name **one** area where it is extracted in Pakistan.

Use .....

Area .....[2]

Question 2 N2012/P2/Q1/B

(b) Study Fig. 2 which shows chromite extraction in Pakistan.

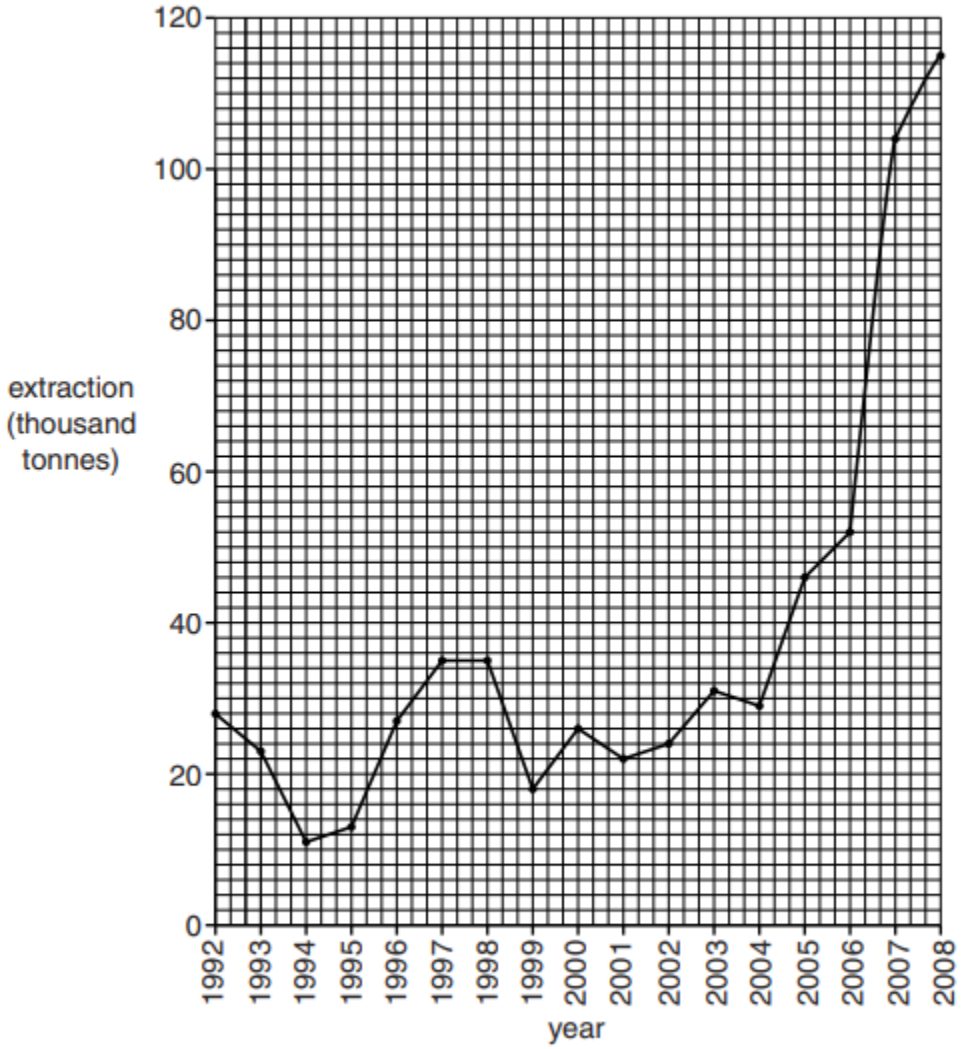

Fig. 2

(i) Describe the changes in extraction from 1992 to 2008.

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.....[3]

(ii) Suggest why the extraction of minerals, such as chromite, varies from year to year.

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.....[3]

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EFFECTS OF MINING ON ENVIRONMENT

- ✓ Deforestation.
- ✓ Vegetation cut down resulting in soil exposure
- ✓ Natural landscape deformed due to construction of roads and miners' houses
- ✓ Rock blasting or digging of earth.
- ✓ Depressions caused by subsidence of land may become flooded.
- ✓ Noise pollution and ground vibration from blasting.
- ✓ Traditional mining methods are hazardous to the health of miners.
- ✓ Land pollution due to mining waste.
- ✓ Water supply polluted from mineral waste.
- ✓ Air pollution from dust and smoke.

SOLUTION OF THESE PROBLEMS

- ✓ Mining should be done on scientific lines to maximize the benefits and minimize the negative effects.
- ✓ When mining is done in an area, special precautions must be taken to prevent environmental losses.
- ✓ The land should be leveled and the depressions should be filled in after the mining activity to avoid deformation.
- ✓ All the mining waste including gases, fumes and semi-solid waste should be properly treated before their final disposal.
- ✓ The people involved should be provided with proper protective clothing to prevent the effects of gases and dust.
- ✓ The area around the mine should be properly planted with trees so that the atmosphere may remain healthy and when minors come out of the mines, they may have fresh air to breathe
- ✓ Water treatment plants should be set up to supply clean water to the workers living near mines.

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PRACTICE QUESTIONS 1.3

Question 1 J2015/P2/Q2/B(iii)

(iii) Explain the effects of mineral extraction on the natural environment.

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.....[4]

Question 2 N2012/P2/Q1/C(i-ii)

(c) Study Photograph A (Insert) which shows a quarry in Pakistan.

(i) Use the photograph and your own knowledge to describe the environmental problems that can be caused by mineral extraction.

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.....[4]

(ii) How can these problems be reduced?

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.....[4]

BENEFITS OF MINERALS

- ✓ Increase GNP (Gross National Product)
- ✓ It encourages foreign investment.
- ✓ Provides raw materials for industries.
- ✓ Decrease imports.
- ✓ It saves and earns foreign exchange.
- ✓ Provides power for industries.
- ✓ Provides fuel for transport and homes.
- ✓ Provides employment opportunity.
- ✓ It reduces rural urban migration.
- ✓ It encourages the development of areas where they are formed.
- ✓ Reduces National debts.
- ✓ Revenue/Taxes earned by Government.

WHY PAKISTAN IS BACKWARD IN MINERAL?

HUMAN FACTORS

- ✓ Infrastructure is very poor in Pakistan. Many areas do not have roads and railways, especially those in Northern areas and Baluchistan.
- ✓ There is also lack of electricity and water supply.
- ✓ Lack of skilled labor in Pakistan.
- ✓ Finance shortages
- ✓ Poor planning
- ✓ Heavy reliance on Multi-national companies which takes most of the profit.
- ✓ Inadequate planning and geology mapping.
- ✓ Institutional Mismanagement and corruption.
- ✓ Frequent change of government in previous years which do not have consistent policies related to mineral sector.
- ✓ Low priority given to mineral sector.
- ✓ Lack of security and terrorism which discourages investors.
- ✓ Many areas of Baluchistan and FATA are not under central Administration and the tribal chiefs do not want any development in their area. Hence, in the long run people can stand against them.

NATURAL FACTORS

- ✓ Many areas have rugged topography. They are cut off by mountains, deserts and glaciers such as Baluchistan and Northern Areas.
- ✓ Many areas have extreme climatic conditions. They are either very hot or very cold. Hence, exploration can't be carried out. Labor are not ready to work in extreme conditions.
- ✓ Geology is very complex. There is much folding and faulting.

SUSTAINABLE MINING

- ✓ The available mineral resources meet the needs of the present and the future generation but not harm the environment.
- ✓ Mining should be done on modern lines to maximize the benefits and minimize the negative effects.
- ✓ The discharge of toxic substances and the release of heat, which is harmful to environment should be strictly checked.
- ✓ Proper training should be given to workers.
- ✓ The land should be leveled and the depressions should be filled in after the mining activity to avoid deformation.
- ✓ Hi-tech knowledge and experts should be available.
- ✓ Provision of infrastructure (transport, power, telephone lines, water supply etc).
- ✓ Explore more mineral resources.
- ✓ Reprocess the mineral waste.

UNSUSTAINABLE MINING

- ✓ The available mineral resources could not meet the needs of the present and the future generation but harm the environment.
- ✓ Deforestation
- ✓ Pollution i.e air, water and noise
- ✓ Soil erosion
- ✓ Lack of infrastructure.
- ✓ Corruption

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PRACTICE QUESTIONS 1.4

Question 1 — J2015/P2/Q2/B(ii)

(ii) What are the benefits of extracting mineral resources for local people and the national economy?

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.....[4]

Question 2 — N2012/P2/Q1/D

(d) To what extent can more extraction of mineral resources help to increase development in Pakistan?

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.....[6]

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MAIN IMPORTED MINERALS

IRON AND STEEL

- Pakistan imports around $400 million worth of iron and steel related products annually from countries like Japan, Russia, and Ukraine etc

COAL

- Pakistan imports around $300 million of coal and related products from countries like South Africa and Indonesia

CRUDE OIL AND PETROLEUM PRODUCTS

- Pakistan imports around $5 billion worth of these products, from countries like Saudi Arabia, UAE and Qatar etc

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RECENT PAST PAPER QUESTIONS

- No question asked from mineral resources in Recent Past Papers (2018 & 2019)

ANSWER KEY

Practice Questions 1.1

Question 1 — N2016/P2/Q2/A

(a) Study Fig. 3 which is a map showing the locations where three different non-metallic minerals are extracted in Pakistan.

(i) For any <u>two</u> locations, state the name of the mineral extracted and a use for this mineral. Write your answers in the spaces provided on Fig. 3. [4]

You should choose from the following list: gypsum limestone rocksalt

<u>Location</u>
NW – rocksalt / limestone / gypsum
Central – limestone / gypsum
S – limestone

Mark <u>any</u> <u>two</u> correct

<u>Uses</u>
Rocksalt: cooking / preservation / soda (used in laundries / textiles / tanning) flavouring food
Gypsum: paints / fertilisers / boards / cement / to treat saline soil / plaster of paris
Limestone: for building / cement / bleach / glass / soap / paints / to treat saline soil / bleaching powder / paper

(ii) Using Fig. 3 and your own knowledge, suggest difficulties there may be in getting minerals to export markets. [3]

Heavy / bulky commodities
Expensive to transport
Roads and railways from mining areas poorly developed / or not connected
Mostly extracted far inland / away from ports / Karachi / distance from markets / takes a long time / remoteness
Mountainous / rugged terrain
Theft
Inappropriate / inadequate vehicles to transport minerals

Question 2 — N2012/P2/Q1/A

(a) Study Fig. 1 which shows mineral extraction in 2008 in Pakistan.

(i) Name two minerals shown on Fig. 1 that are used to make cement. [2]

limestone
gypsum

(ii) State two uses of rock salt. [2]

Do not credit vague answers such as 'food' 'chemicals' 'textiles' 'pharmaceuticals' etc.

Two of the following (there may be others)
Food - Flavour, preserving, curing, table salt
Textiles - dyeing, bleaching, water softening,
Chemicals - Soda ash, sodium bicarbonate, artificial rubber,
Misc.- Tanning, household cleaner, fire extinguisher, artificial rubber, roads etc.

(iii) State the amount of gypsum extracted. **[1]**

640 - 680 thousand tonnes

Question 3 N2007/P2/Q3/A-B

(a) Study Fig. 3 which shows limestone and rock salt extraction.

(i) Describe the distribution of limestone extraction in Pakistan. **[3]**
Widespread
NWFP-Punjab border/Potwar Plateau
N(E) Baluchistan
S Sindh/near Karachi
Central Sindh

(ii) Rock Salt and Limestone are both 'bulky goods'. What is the cheapest form of transport for these goods? **[1]**
Railway

(iii) Why is the supply of limestone to most areas of Pakistan likely to be cheaper than that of rock salt? **[1]**
does not have to travel so far
quarried in many areas/more widely available

(b) Nearly one million tonnes of rock salt were extracted in Pakistan in 2002.

(i) What is a mixture of rock salt and water called? **[1]**
brine

(ii) What is rock salt used for in Pakistan? **[2]**
Cooking, preservation, soda ash, bicarbonate, caustic soda for tanning, textiles and laundries
Table salt

(Credit 2 uses, or one with development)

Practice Questions 1.2

Question 1 J2015/P2/Q2/A-B(i)

(a) Study Figs 3 and 4 which give information about the extraction of three metallic minerals in Pakistan in 2010–11.

(i) How much iron ore was extracted in 2010–11? **[1]**

329 000 tonnes (accept 327 000 tonnes to 331 000 tonnes)

(ii) State the difference between the type of information being provided in Fig. 3 compared to that in Fig. 4. **[1]**

Fig. 3 shows quantities/amounts/tonnes whereas Fig. 4 shows proportions/share/percentages of the total amount (Bar v Pie alone = 0)

(b) (i) Give one use for the mineral chromite and name one area where it is extracted in Pakistan. **[2]**

Used in steel/bridges/railway carriages/furnace linings/tools

Muslimbagh/Zhob (Valley)/Wad

Question 2 **N2012/P2/Q1/B**

(b) Study Fig. 2 showing chromite production.

(i) Describe the changes in production from 1992 to 2008. **[3]**

Increases overall
Variable overall / 1992-2008
comment on fall and rise from 1992-97/98
variable 1998 – 2004/5
Rises from 2004-2008 / sharp rise in 2007
Secondary peak 1996-1998 / rises then falls 1996-1999
Lowest 1994
Figures to illustrate one of the above (max 1) eg. 28,000-115,000 tonnes 1992-2008

(ii) Suggest why the production of minerals, such as chromite, varies from year to year. **[3]**

Investment / funding
Demand / orders
Bankruptcy / companies leave
Problems with machinery
Reserves reducing /new reserves exploited /geological problems
Terrorism

Practice Questions 1.3

Question 1 **J2015/P2/Q2/B(iii)**

(iii) Explain the effects of mineral extraction on the natural environment. **[4]**

Deforestation to clear land
Destroys habitat/wildlife/plants
Land deformation/destruction/destroys land
E.g. holes/pits/depressions/tips/spoil heaps/flooding
Ash waste/ash ponds/toxic waste
Subsidence even after mining activity finished
Noise pollution from machinery/blasting/scares/disturbs wildlife
Air pollution from dust and smoke
Water pollution – seepage into ground water/rivers/seas

Question 2 **N2012/P2/Q1/C(i-ii)**

(c) Study Photograph A (Insert)

(i) With reference to the photograph and using your own knowledge, describe the environmental problems that can be caused by mineral extraction. **[4]**

From photograph - loss of vegetation / deforestation
Land deformation / piles of rocks /pits
Loss of soil
Dust

Own knowledge-smoke / gasses
Soil erosion
Loss of farmland / grazing / no cultivation

Holes / pits etc.
Noise / vibration
(reserve one mark for reference to photograph)

(ii) How can these problems be reduced? [4]

Laws / legislation+ details
Tree planting / screens + details
Land restoration + details
Personal health and safety – eg wearing masks against the dust, ear defenders, regular medical check ups, etc
(allow up to two marks for each line)

Practice Questions 1.4

Question 1 J2015/P2/Q2/B(ii)

(ii) What are the benefits of extracting mineral resources for local people and the national economy? [4]

Local people

Employment opportunities
Higher/more stable incomes
Higher living standards/settled lifestyle
Business opportunities for local/ancillary industries/services
Improvement to local infrastructure such as roads/electricity (infrastructure alone = 0)
Local use of raw materials with example (do not double mark raw material in national economy)

National economy

Raw material for named sectors of economy, e.g. energy, construction, agriculture, industry
Named raw material
Industrialisation / industry developed
Revenue/taxes for government
Export earnings/contributes to balance of payments/source of foreign exchange/ exports increase
Reduces national debt/deficit
Reducing imports

Question 2 N2012/P2/Q1/D

(d) To what extent can more extraction of mineral resources help to increase development in Pakistan? [6]

In favour (res. 2)
Increase trade / exports / reduce imports
Raise GDP/GNP/ increase the economy
Increase employment
Raise taxes/ government earnings
Foreign investment
Rural development
Industrialisation / more industry
Better infrastructure + example
Provides more fuel or raw material + example.
Education / skills

Against (res. 2)
Lack of funds
Lack of machinery / technology
Unattractive to investors
In remote areas
Lack of infrastructure (but do not double mark)
Competition from other countries / other countries safer
Environmental damage
Lack of skills / expertise