

**EDUMATE**

**XII**

*Geology*



Government of Kerala  
**DEPARTMENT OF EDUCATION**

State Council of Educational Research and Training (SCERT), Kerala  
2017

*Prepared by:*

State Council of Educational  
Research & Training (SCERT)  
Poojappura, Thiruvananthapuram -12,  
Kerala. E-mail:scertkerala@gmail.com

*Type setting by:*

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Education Department  
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## *Foreword*

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As part of the comprehensive revision of curriculum from pre-primary to the Higher Secondary sector, new textbooks have been developed for Std. XI and Std XII during the years 2014 -15 and 2015-16 respectively. Evaluation activities should go hand in hand with the new curriculum. Real learning takes place by constructing knowledge through various learning processes.

In a constructive classroom, learners have opportunities to engage in a number of activities in which a range of attributes can be developed. The same activities provide the learner with scope for assessing development of these attributes. Hence there has been a shift from assessing only the products of learning to the process of learning. Anyhow it is to be noted that term end assessment is a part of continuous and comprehensive evaluation.

The main objective of this book is to help the learners to face the public examination with confidence. In this context, questions from all chapters of each subject of Std. XII have been developed along with the scoring indicators. Hope that this question bank titled “Edumate” will be helpful to learners as well as teachers.

Your comments and suggestions are welcome and will assist us in improving the content of this book.

Wish you all the best.

**Dr. J. Prasad**  
**Director**

# Contents

## Units

- 1 ROCKS
- 2 ECONOMIC MINERAL DEPOSITS
- 3 FOSSIL FUELS
- 4 GEOLOGICAL STRUCTURES
- 5 HISTORY OF THE EARTH
- 6 GEOLOGY AND ENVIRONMENT
- 7 EARTHQUAKES
- 8 GEOLOGICAL HAZARDS AND DISASTER MANAGEMENT

### Learning Outcomes

Explains the textural and compositional differences exhibited by igneous rocks

Q.1 a) Which one of the following is NOT true about Basalt?

- (i) It is composed mostly of mafic minerals
- (ii) It is the volcanic equivalent of gabbro
- (iii) It is a fine-grained extrusive rock
- (iv) It is a coarse grained plutonic rock

*Score 1, Time 1 Minute*

b) What do you mean by texture of an igneous rock?

*Score 2, Time 2 Minutes*

c) Mention any three textures exhibited by the igneous rock pegmatite.

*Score 3, Time 3 Minutes*



### Scoring Indicators

- a) (iv). It is a coarse grained plutonic rock
- b) The texture of a rock describes the degree of crystallisation, size, shape, and arrangement of the mineral grains or crystals that make up the rock.
- c) Very coarse grained, holocrystalline, phaneritic

### Learning Outcomes

- Distinguishes between the three basic types of rock found on the Earth's crust.
- Identifies the common sedimentary rocks megascopically.

Q.2. a) Which one of the following is a sedimentary rock?

*Score 1, Time 1 Minute*

(Shale, Slate, Granite, Charnockite)

b) Differentiate between igneous and metamorphic rocks.

*Score 2, Time 4 Minutes*



### Scoring Indicators

- a. Shale
- b. Igneous-formed by the consolidation of magma or lava  
Metamorphic-formed by the transformation of pre existing rocks under heat, pressure and fluids

**Learning Outcomes**

- Explains the textural and compositional differences exhibited by igneous rocks.

Q.3 State whether the following statements are true or false

- Plutonic rocks cool relatively faster than volcanic rocks
- Volcanic rocks are fine grained in texture
- Hypabyssal rocks are formed from magma crystallized at great depth
- Extrusive rocks are formed at the surface

*Score 4, Time 5 Minutes*



**Scoring Indicators**

- False
- True
- False
- True

**Learning Outcomes**

- Identifies the common types of metamorphic rocks.

Q.4 Classify the given metamorphic rocks into foliated and non-foliated rocks.

(Schist, Quartzite, Gneiss, Marble, Slate, Hornfels)

*Score 3, Time 3 Minutes*



**Scoring Indicators**

- foliated – Schist, Gneiss, Slate
- non-foliated – Quartzite, Marble, Hornfels

**Learning Outcomes**

- Explains the textural and compositional differences exhibited by igneous rocks.

Q.5 a) Igneous rocks containing a large proportion of feldspar and silica are termed as – – –

(Mafic, Felsic, Intermediate, Ultramafic)

*Score 1, Time 1 Minute*

b) What is the difference between mafic and ultramafic igneous rocks?

*Score 2, Time 5 Minutes*



**Scoring Indicators**

- Felsic
- Mafic-rich in minerals containing magnesium and iron, silica percentage ranges between 45-52, dark in colour  
Ultra mafic-much more rich in magnesium and iron, silica percentage less than 45.

### Learning Outcomes

- States the formation of igneous rocks.
- Identifies common igneous rocks in hand specimens.

Q. 6 a) If a mafic magma erupts on the surface of the Earth in the form of lava, what will be the extrusive/volcanic rock formed?  
(Basalt, granite, pegmatite, rhyolite)

*Score 1, Time 1 Minute*

b) What will be the texture of the extrusive rock so formed?

*Score 1, Time 1 Minute*

c) Why do coarse grained mineral crystals develop in plutonic rocks?

*Score 2, Time 2 Minutes*



### Scoring Indicators

- Basalt
- Fine grained and aphanitic
- Slow cooling, crystals grow in size, crystallises at depth.

### Learning Outcomes

- States the formation of igneous rocks.

Q. 7 a) Dykes are tabular plutons that cut across country rocks, while sills are plutons that are --- to layering of pre-existing rocks.

*Score 1, Time 1 Minute*

b) What do you mean by the term 'plutons'?

*Score 2, Time 2 Minutes*

c) Give a diagrammatic representation of dyke, sill and batholith.

*Score 3, Time 5 Minutes*



### Scoring Indicators

- Parallel
- Forms of igneous bodies formed at deep or shallow depth
- Labelled diagram

### Learning Outcomes

- Illustrates diagrammatically the concept of rock cycle.

Q. 8 Rocks can be broadly classified into igneous, sedimentary and metamorphic. But the earth's rocks do not remain the same forever. Describe the geologic process by which a rock is transformed from one type to another over millions of years. Illustrate with the help of a neat diagram.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Diagram of rock cycle
- Processes of re cycling of rocks over millions of years-melting, crystallisation-igneous rocks-sedimentation, diagenesis and lithification- sedimentary rocks-changing conditions of heat and pressure-metamorphism-metamorphic rocks -melting.

**Learning Outcomes**

- Explains the textural and compositional differences exhibited by igneous rocks.
- Identifies the common sedimentary rocks megascopically.

Q. 9 Differentiate between the following

- Magma and lava
- Clastic and non clastic rocks
- Conglomerate and breccia

3 x 2 = 6

*Score 6, Time 12 Minutes*

 **Scoring Indicators**

- Magma -molten rock materials beneath the earth:  
Lava-magma erupted at the surface
- Clastic-sedimentary rocks formed by lithification of broken fragments of rocks:  
Non clastic rocks-sedimentary rocks formed by chemical ,biochemical or organic processes.
- Conglomerate -sedimentary rocks composed of well rounded clasts and pebbles:  
Breccia- sedimentary rocks composed of angular pieces of various sizes.

**Learning Outcomes**

- Explains the textural and compositional differences exhibited by igneous rocks.
- Identifies the common sedimentary rocks megascopically.
- Identifies the common types of metamorphic rocks.

Q. 10 Give examples to the following

- Igneous rock having aphanitic textures
- Volcanic rock with glassy textures
- Sedimentary rock composed entirely of coarse grained quartz
- Metamorphic rock having schistose foliation

4 x 1 = 4

*Score 4, Time 5 Minutes*

 **Scoring Indicators**

- Basalt/Rhyolite
- Obsidian
- Sandstone
- Schist



### Learning Outcomes

- Describes the agents and types of metamorphism.

Q. 11. a) There are several factors/agents involved in the transformation of a protolith into a metamorphic rock. Mention any three agents that contribute to the process of metamorphism.

*Score 3, Time 3 Minutes*

b) How do the pressure factor helps in metamorphic process?

*Score 2, Time 5 Minutes*



### Scoring Indicators

- Heat, pressure and chemically active fluids.
- Affects on the texture of rocks, rounded grains become flattened, re orient along preferred direction, foliation form.

### Learning Outcomes

- Explains the formation and classification of sedimentary rocks.

Q. 12 a) What geologic processes transform loose sediments into a sedimentary rock?

- Weathering and erosion
- Erosion and transportation
- Diagenesis and lithification
- Transportation and deposition

*Score 1, Time 2 Minutes*

b) What is the role of minerals like calcite and hematite in the process of lithification?

*Score 2, Time 5 Minutes*



### Scoring Indicators

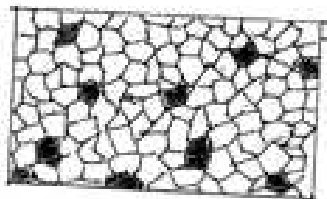
- iii) Diagenesis and lithification
- Binds the mineral grains together, acts as a cementing material.

### Learning Outcomes

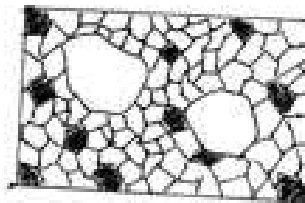
- Explains the textural and compositional differences exhibited by igneous rocks

Q. 13 Examine the following figures and identify the textures present in each.

(a)



(b)



*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- (a) Holocrystalline ,phaneritic,coarse grained,
- (b) Holocrystalline,porphyritic,inequigranular

**Learning Outcomes**

- Explains the textural and compositional differences exhibited by igneous rocks.

Q. 14 What do you mean by the textures of of igneous rocks. Which are the important textures of igneous rock?

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- The texture of an igneous rock describes the degree of crystallisation, size, shape, and arrangement of the mineral grains or crystals that make up the rock.
- Size of the mineral grains -Coarse-medium-fine
- Crystallinity- holocrystalline- merocrystalline- holohyaline
- Granularity- phaneritic-aphanitic- porphyritic

**Learning Outcomes**

- Explains the formation and classification of sedimentary rocks

Q. 15 Perhaps the most easily observable clues left by the depositional process of sedimentary rocks are the structures. Analyse the statement and report the major structures found in sedimentary rocks.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- The term sedimentary structures signifies the layering of sedimentary rocks and surface features on the layers formed during the sedimentation process. Sedimentary structures leave clues to processes that were operating in the past. The major structures found in sedimentary rocks are-Stratification-and Bedding- lamination-Cross Bedding-Graded Bedding-Ripple Marks- Mudcracks-Raindrop Marks.

**Learning Outcomes**

- Delineates the conditions to treat mineral deposits as ores.

Q.1 a) A mineral deposit that contain economically extractable quantity of one or more metals is called an ore, and in an ore deposit the assemblage of useless minerals is called as — — — — .

*Score 1, Time 1 Minute*

b) Why do we say that all mineral deposits are not ore deposits?

*Score 2, Time 4 Minutes*

**Scoring Indicators**

- a) Gangue
- b) Economic extraction of metals is not feasible from all minerals

**Learning Outcomes**

- Delineates the conditions to treat mineral deposits as ores.
- Identifies major metallic and non-metallic mineral specimens based on their salient physical properties.

Q.2 Identify the metals present in the given ore minerals.

- i) Ilmenite
- ii) Chalcopyrite
- iii) Bauxite
- iv) Chromite

$4 \times 1 = 4$

*Score 4, Time 5 Minutes*

**Scoring Indicators**

- i) Titanium
- ii) Copper
- iii) Aluminium
- iv) Chromium

**Learning Outcomes**

- Distinguishes between residual and placer mineral deposits.

Q.3 Fill in the blanks

| Types ore deposits | Examples               |
|--------------------|------------------------|
| Placer deposits    |                        |
|                    | Bauxite                |
| Evaporite deposits |                        |
|                    | Banded Iron Formations |

4 x 1 = 4

*Score 4, Time 5 Minutes*

 **Scoring Indicators**

- Placer deposits- Ilmenite/Monazite/Rutile
- Residual deposit- Bauxite
- Evaporite- Gypsum/Rock salt
- Chemical sedimentary deposits- BIF

**Learning Outcomes**

- Identifies major metallic and non-metallic mineral specimens based on their salient physical properties.

Q.4 Classify the following into metallic and non-metallic mineral deposits  
(Clay, Galena, Rutile, Baryte, Gypsum, Monazite)

*Score 3, Time 4 Minutes*

 **Scoring Indicators**

- Metallic:- Monazite, Rutile, Galena
- Non-metallic:- Clay, Baryte, Gypsum

**Learning Outcomes**

- Identifies major metallic and non-metallic mineral specimens based on their salient physical properties.
- Mentions the uses of some major industrial minerals.

Q.5 Match the column A with B and C

| A           | B               | C                |
|-------------|-----------------|------------------|
| Silica sand | Chavara, Kollam | Nuclear energy   |
| Clay        | Alappuzha       | Ceramic industry |
| Monazite    | Kundara         | Glass industry   |

3 x 1 = 3

*Score 3, Time 5 Minutes*



### Scoring Indicators

Silica sand - Alappuzha - Glass industry  
 Clay - Kundara - Ceramic industry  
 Monazite - Chavara - Nuclear energy

### Learning Outcomes

- Delineates the conditions to treat mineral deposits as ores.
- Describes the formation of mineral deposits associated with magmatic concentrations.

Q.6 Define the following terms with examples.

- Grade of an ore
- Syngenetic mineral deposits

1 x 2 = 2

*Score 2, Time 4 Minutes*



### Scoring Indicators

- Grade of an ore-concentration of metal content in an ore deposit; Eg:Hematite-grade 70%
- Syngenetic mineral deposits-mineral deposits formed simultaneous with enclosing rock.  
Eg: Placer deposits

### Learning Outcomes

- Mentions the uses of some major industrial minerals.
- Describes the formation of mineral deposits associated with magmatic concentrations.

Q.7 Choose the correct answer from those given in alternatives.

- Raw material used in ceramic industry  
(Gypsum, Clay, Baryte, Magnesite)

*Score 1, Time 2 Minutes*

- Example of mineral deposit formed by magmatic dissemination processes  
(Chromite, pegmatite, diamond, gypsum)

*Score 1, Time 2 Minutes*

- iii) Mineral deposit that shows pisolitic structure  
(Graphite, Ilmenite, Bauxite, Monazite)

*Score 1, Time 2 Minutes*

 **Scoring Indicators**

- i) Clay
- ii) Chromite
- iii) Bauxite

**Learning Outcomes**

- Distinguishes between residual and placer mineral deposits.

- Q. 8 a) What processes of mineral formation were responsible to the formation of Ilmenite, Rutile and Monazite deposits of Kerala?  
(Magmatism, Metasomatism, Sedimentary process, Metamorphism)

*Score 1, Time 2 Minutes*

- b) What qualities of these minerals do favour their concentration in the form of placer deposits?

*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- a) Sedimentary process
- b) Chemical resistance, durability, high specific gravity.

**Learning Outcomes**

- Explains the ways of formation of hydrothermal mineral deposits.

- Q. 9. a) What are vein deposits?

*Score 2, Time 4 Minutes*

- b) Describe briefly the formation of vein deposits from hydrothermal solutions.

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- a) Tabular bodies that form by filling of pre existing fissures
- b) Hydrothermal solutions when flowing through fractures of rocks, their dissolved minerals are precipitated.

### Learning Outcomes

- Identifies major metallic and non-metallic mineral specimens based on their salient physical properties.
10. Both Galena and Graphite are lead grey in colour. Then how can you distinguish Galena from Graphite? Discuss with the help of their salient diagnostic properties.

*Score 4, Time 5 Minutes*

### Scoring Indicators

- Galena-high specific gravity(7.5),hardness 2.5, cubic form
- Graphite-low specific gravity (2.2),hardness 1, massive form

### Learning Outcomes

- Describes the formation of mineral deposits associated with magmatic concentrations.
- Q.11 a) Valuable minerals may be concentrated during crystallization of magma. Mention any two types of magmatic deposits.

*Score 2, Time 3 Minutes*

- b) Briefly explain the concentration of diamond crystals occurring in ultramafic rocks in South Africa.

*Score 2, Time 5 Minutes*

### Scoring Indicators

- a) Magmatic segregation deposits/liquid immiscibility deposits/magmatic dissemination deposits/ pegmatite deposits
- b) Crystals of diamond will be distributed throughout the rock during crystallization- minerals occur as small particles scattered throughout the country rock- magmatic disseminated deposits

### Learning Outcomes

- Identifies metamorphism as a mode of mineral formation.
  - Discusses the formation of mineral deposits associated with contact metasomatism.
- Q.12. Explain the formation of mineral deposits by metamorphic and contact metasomatic processes.

*Score 4, Time 10 Minutes*

### Scoring Indicators

- Metamorphic process- Changes caused by the heat and pressure of metamorphism produce economic mineral deposits- changes that occur in this environment affect the chemical and physical stability of minerals-new minerals are produced. Eg. clay may be converted to mica schist or garnet, talc is formed by the alteration of the magnesian minerals, etc. Deposits of magnetite, kyanite, corundum, talc, graphite, garnet and asbestos, building stones including marble and slate are products of metamorphism.
- Contact metasomatism- fluids from magma may produce wide-spread changes near the contacts of intrusive with the surrounding rocks- the invaded constituents replace many of the minerals of the invaded rocks along the contact and form contact metasomatic mineral deposits. Eg. iron and copper ore deposits; garnet and graphite deposits formed by contact metasomatic process.

(any four relevant points)



**Learning Outcomes**

- Recognises the significance of fossil fuels as a non-renewable source of energy
- Describes the origin and types of coal

Q.1 Name the following

- Fuels derived from the remains of ancient organisms
- Sedimentary formations of highly carbonaceous character that are derived from vegetable matter.
- Carbon content in the coal left after the volatile materials are driven off

3 x 1 = 3

*Score 3, Time 3 Minutes*

**Scoring Indicators**

- Fossil fuels
- Coal
- Fixed carbon

**Learning Outcomes**

Describes the origin and types of coal

Makes an appraisal of the distribution of fossil fuels in India

Q.2 Fill in the blanks using the hints given below

- Coal :Solid; Petroleum: - - - - -
- Neyveli: Lignite Mumbai high: - - - -

2 x 1 = 2

*Score 2, Time 2 Minutes*

**Scoring Indicators**

- Petroleum: Liquid
- Mumbai high: Petroleum

**Learning Outcomes**

- Describes the origin and types of coal

Q. 3 Peat, lignite, bituminous coal and anthracite are different varieties of coal. What is the basis of classifying coal into different varieties? Prepare a chart showing the different varieties of coal and their characteristics.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

Based on fixed carbon content, degree of coalification processes  
Table shown below illustrates types of coal and their certain characteristics

| Type of coal    | Characteristics                                       |
|-----------------|---|
| Peat            | First stage, relatively less altered vegetable matter |
| Lignite         | Carbon below 70%, higher grade to peat                |
| Bituminous coal | Black, waxy soft coal, carbon upto 80%                |
| Anthracite      | Highest ranked, hardest, carbon more than 90%         |

**Learning Outcomes**

- Explains the processes involved in the formation of petroleum and natural gas

Q. 4 a) The naturally occurring petroleum is also termed as — — —  
(Kerogene, Petrol, Crude oil, Fuel oil)

*Score 1, Time 1 Minute*

b) Oil and natural gas are believed to be formed from the microorganisms lived in the geological past. Give your ideas on the transformation of organic matter into petroleum and natural gas.

*Score 3, Time 5 Minutes*

c) What are the specific conditions required for the accumulation of oil in the form of oil pools?

*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- Crude oil
- Accumulation of dead microorganisms in the marine mud, burial under sediments, increase in pressure and temperature with depth, gradual decay, cooking under heat within the earth -transformation of organic matter first into kerogen then into liquid and gaseous hydrocarbons.
- Migration, reservoir rock, oil trap, accumulation

### Learning Outcomes

- Recognises the significance of fossil fuels as a non-renewable source of energy
- Evaluates the environmental issues associated with the consumption of fossil fuels

Q.5 Why do we say that fossil fuels are non-renewable resources? Discuss also the significance and impacts of consumption of fossil fuels.

*Score 3, Time 8 Minutes*

### Scoring Indicators

- Can not be renewed within a short period of time,once consumed is lost for ever.
- Significance-source of energy for domestic,industrial and commercial sectors.Required for all forms of transportation. Source for a number of industrial products.
- Impact:Depletion of finit natural resources,release of large quantities of CO<sub>2</sub>,atmospheric pollution,climatic change,green house effect,global warming

### Learning Outcomes

- Describes the origin and types of coal

Q.6 a) Which of the following is NOT true about bituminous coal?

- Bituminous coals are harder than lignite.
- Bituminous coal is used for making coke.
- Bituminous coals burn without smoke.
- Bituminous coals soften during combustion.

*Score 1, Time 3 Minutes*

b) Mention any two qualities of anthracite.

*Score 2, Time 3 Minutes*

### Scoring Indicators

- iii.)Bituminous coals burn without smoke.
- highest fuel ratio,burns without smoke with little flame

### Learning Outcomes

- Describes the origin and types of coal

Q.7 Coal is formed from plant remains. Can you agree with this statement? Give evidences to substantiate your answer.

*Score 3, Time 5 Minutes*

### Scoring Indicators

- Yes,remains of altered vegetable matter ,found as sedimentary deposit,carbonaceous character reveals organic origin.

**Learning Outcomes**

- Explains the processes involved in the formation of petroleum and natural gas

Q. 8 a) Pick out the hardest variety of coal from the following  
(Lignite, Anthracite, Peat, Bituminous coal)

*Score 1, Time 1 Minute*

b) Which of these grades produce the most and least amount of energy when burned?

*Score 1, Time 2 Minutes*

c) What is meant by calorific value?

*Score 2, Time 2 Minutes*

**Scoring Indicators**

- a) Anthracite
- b) Peat-least, Anthracite-most
- c) Amount of heat produced by burning a standard unit of coal

**Learning Outcomes**

- Explains the processes involved in the formation of petroleum and natural gas

Q. 9 Generally oil is migrated from the source rock to the reservoir rock. What do you mean by the terms source rock and reservoir rock?

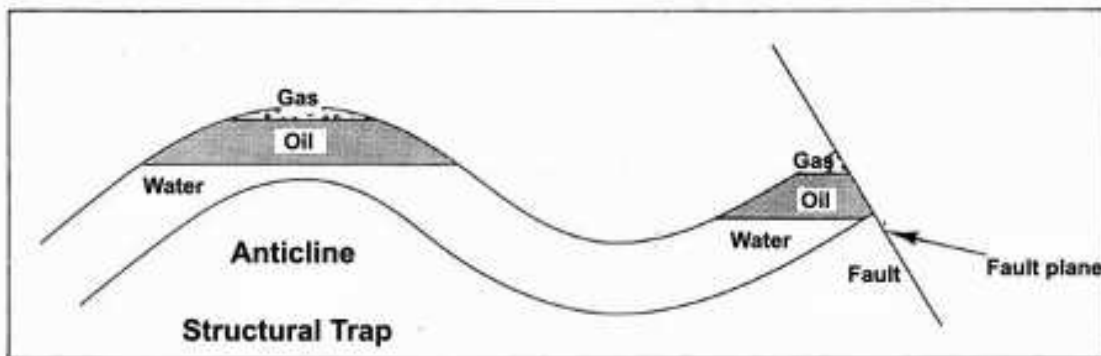
*Score 2, Time 4 Minutes*

**Scoring Indicators**

- Source rock-rock where organic matter is converted to oil
- Reservoir rock-rock in which oil occurs at present.

**Learning Outcomes**

Q. 10 Analyse the given diagram answer the following questions



(FIG:3.10)

a) What is an oil trap?

*Score 1, Time 2 Minutes*

- b) How does fold and fault traps hold oil and gas in reservoir rocks?

*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- Oil trap-non porous rock formation that holds the oil in place.
- Fold trap-oil moves into the upper most porous layer of the fold until it meets an impermeable layer (cap rock)  
Fault trap-the reservoir rock is blocked along a fault by an impermeable rock layering

**Learning Outcomes**

- Describes the origin and types of coal
- Explains the processes involved in the formation of petroleum and natural gas

Q. 11 Match the column A with B and C

| A           | B                    | C                      |
|-------------|----------------------|------------------------|
| Coal        | Carbon               | Mumbai off-shore       |
| Petroleum   | Gaseous hydrocarbons | Gondwana formations    |
| Natural gas | Liquid hydrocarbons  | Krishna-Godavari basin |

*Score 3, Time 6 Minutes*

 **Scoring Indicators**

- Coal - carbon - Gondwana formations
- Petroleum - liquid hydrocarbons - Mumbai off-shore
- Natural gas - Gaseous hydrocarbons - Krishna-Godavari basin

**Learning Outcomes**

- Describes the origin and types of coal
- Makes an appraisal of the distribution of fossil fuels in India

Q. 12 Fossil fuels are fuels formed from once-living organisms. Prepare a note on the formation of coal and petroleum.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Coal: Accumulation of plant materials in suitable environment- breakdown of buried vegetation-burial of sediments over the thick layers of dead trees required for the formation of coal-bio-chemical transformation of organic material into coal-dynamo-thermal transformation- process of conversion of peat to coal – *coalification*- sequence of coalification from peat to lignite, lignite to sub-bituminous to bituminous to anthracite-two hypotheses regarding the accumulation of source material- Growth in place or the in-situ theory and drift theory. Factors affecting coalification such as climatic conditions,time, effect of depth of burial, and transformation-Type of coal-ranks of coal (any four relevant points)

Petroleum: forms by the breaking down of large molecules of fats, oils and waxes present in the animal bodies. Marine organism died and sank to the ocean floor-sand, clay and minerals settled over this organic rich mud and solidified into rocks- gradual decay by the effect of heat and pressure resulted in the formation of organic compounds. Specific conditions are required for the formation of an oil pools-Source Rock -Reservoir Rock-Oil Trap- Burial-Migration and formation of oil pool.

(any four relevant points)

### Learning Outcomes

- Makes an appraisal of the distribution of fossil fuels in India

Q. 13 India has got numerous coal fields and productive oil basins.

(a) Which are the important Gondwana coal fields of India?

*Score 2, Time 5 Minutes*

(b) List out the presently productive oil basins of India?

*Score 2, Time 5 Minutes*

### Scoring Indicators

- (a) Jharia Bokaro, Giridih, Talcher, Singareni
- (b) Mumbai High, Digboi, Mangala, Aishwarya, Krishna-Godavari

**Learning Outcomes**

- Explains the meaning of linear and planar features exhibited by rocks.

Q.1 Classify the following into Linear and Planar structures

(Lava flow lines, Faults and folds, Gneissose structure in metamorphic rocks, Growth of Kyanite crystal along one direction, Parallel orientation of micas in foliated rocks, Rock strata)

*Score 3, Time 6 Minutes*

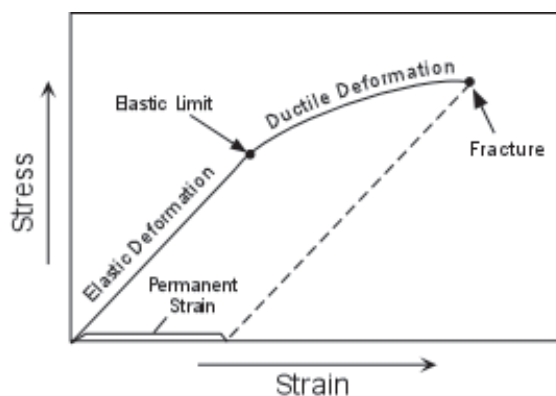
**Scoring Indicators**

- Linear structures: Lava flow lines; Growth of Kyanite crystal along one direction
- Planar structures: Faults and folds; Gneissose structure in metamorphic rocks;
- Parallel orientation of micas in foliated rocks; Rock strata

**Learning Outcomes**

- Demonstrates the basic concepts of rock deformation which results in secondary structures in rock masses.

Q.2 Analyse the given diagram and answer the following questions.



(a) Differentiate between stress and strain

*Score 2, Time 4 Minutes*

(b) What is the difference between elastic and ductile strain?

*Score 2, Time 4 Minutes*

(c) When a rock has undergone non-recoverable strain, what types of deformations take place?

*Score 1, Time 3 Minutes*

 **Scoring Indicators**

- a) Stress: force exerted on rocks  
Strain: change in shape due to stress
- b) Elastic strain: temporary changes in shape/size of the rock  
ductile strain: permanent change in shape
- c) Plastic/Ductile

**Learning Outcomes**

- Recognizes important large scale structures such as fold, fault, joints and unconformities.

Q.3 Identify the folds mentioned below.

- (a) Folds in which both the limbs dips toward the centre of the fold.
- (b) Folds in which the both the limbs dip away from the crest of the fold.

*Score 2, Time 3 Minutes*

 **Scoring Indicators**

- a) Syncline
- b) Anticline

**Learning Outcomes**

- Illustrates basic types of fold, fault, joints and unconformities.

Q.4 (a) A graben, or rift valley, will only form in response to slip along:

- i) Normal faults
- ii) Reverse faults
- iii) Thrust faults
- iv) Strike-slip faults

*Score 1, Time 2 Minutes*

- (b) How do faulting results in the formation of Horst and Graben? Illustrate with the help of a digram

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- a) i) Normal fault
- b) Blocks of the either side of the fault plane moves up or down; labeled diagram-up thrown and down thrown blocks

**Learning Outcomes**

- Demonstrates the basic concepts of rock deformation which results in secondary structures in rock masses.

Q.5 a) A clinometer compass is used to measure \_\_\_\_\_ .

- i) Strike and dip direction only



- ii) Strike direction only
- iii) Dip direction and amount of dip only
- iv) Strike direction, dip direction and dip amount

*Score 1, Time 2 Minutes*

- b) What is meant by attitude of rock beds?

*Score 2, Time 3 Minutes*

- c) How is the true dip direction and strike direction related with each other?

*Score 2, Time 3 Minutes*

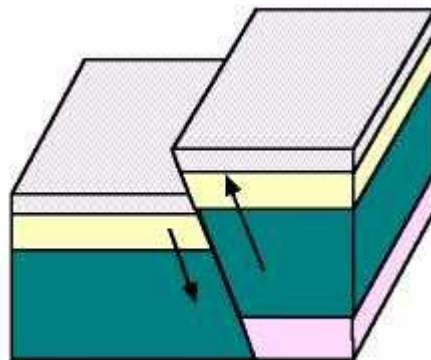
### Scoring Indicators

- a) iv) Strike direction, dip direction and dip amount
- b) Orientation of a feature in space/position of a surface relative to the horizontal
- c) True dip is measured in direction perpendicular to the strike

### Learning Outcomes

- Illustrates basic types of fold, fault, joints and unconformities.

- Q.6 a) The type of fault given in the diagram shown is — — — —



(FIG:4.6)

*Score 1, Time 2 Minutes*

- b) Mention the terms used for referring the rock blocks seen on either side of the fault plane.

*Score 2, Time 4 Minutes*

### Scoring Indicators

- a) Reverse fault
- b) Foot wall and Hanging wall

**Learning Outcomes**

- Illustrates basic types of fold, fault, joints and unconformities.

Q.7 Differentiate between the following

- Columnar joints and Sheet joints
- Angular unconformity and Non-conformity

2 x 2 = 4

*Score 4, Time 8 Minutes*



**Scoring Indicators**

- Columnar joints: polygonal joints bounded by three to eight sides; found in basalts  
Sheet joints: parallel or horizontal set of joints; found in granites
- Angular unconformity: younger gently dipping horizontal rock strata separated by older and tilted rock layers  
Non-conformity: younger sedimentary rock units separated by older intrusive rock

**Learning Outcomes**

- Illustrates basic types of fold, fault, joints and unconformities.

Q.8 Fill in the blanks

- In \_\_\_\_\_ fault, the hanging wall appears to have move down relative to the foot wall.
- A folds consist of two sides. Each side of the fold is called a \_\_\_\_\_ .
- Fractures without displacement of blocks are called — — — —

1 x 3 = 3

*Score 3, Time 6 Minutes*



**Scoring Indicators**

- Normal fault
- Limb
- Joints

**Learning Outcomes**

- Measures the attitude of beds in terms of dip and strike.
- Demonstrates the basic concepts of rock deformation which results in secondary structures in rock masses.

Q.9 Correct the mistakes in the underlined part of the given sentences

- The term outcrop is used to denote the direction that the bedding plane of a structural feature intersects an imaginary horizontal plane
- Tensional stress pushes rock together
- Arrangement of sedimentary rocks in beds or layers of varying thickness is termed as sedimentation

1 x 3 = 3

*Score 3, Time 6 Minutes*

 **Scoring Indicators**

- (i) Strike
- (ii) Compressional
- (iii) Stratification

**Learning Outcomes**

- Recognizes important large scale structures such as fold, fault, joints and unconformities.
10. Describe the significance of faults and joints in civil engineering field.

*Score 3, Time 6 Minutes*
 **Scoring Indicators**

- Faults-potential surfaces along which rocks can slide, hazards due to rock slide and earthquakes
- Joints-significant in quarry operations, orientation and concentration of joints are critical in civil engineering projects

**Learning Outcomes**

- Recognizes important large scale structures such as fold, fault, joints and unconformities.
- Illustrates basic types of fold, fault, joints and unconformities.

Q. 11 Match the column A with B and C

| Structural feature (A) | Type (B)       | Description (C)                        |
|------------------------|----------------|--|
| Fold                   | Horst          | Up-thrown blocks                       |
| Fault                  | Non-conformity | Horizontal axial plane                 |
| Unconformity           | Recumbent      | Period of long term uplift and erosion |

*Score 3, Time 6 Minutes*
 **Scoring Indicators**

- Fold - Recumbent - Horizontal axial plane
- Fault - Horst- Up-thrown blocks
- Unconformity - Non-conformity- Period of long term uplift and erosion

**Learning Outcomes**

- Recognizes important large scale structures such as fold, fault, joints and unconformities.
- Illustrates basic types of fold, fault, joints and unconformities.

Q. 12 Curves or bends of rock strata can be termed as folds. Give a brief explanation on the formation of folds. Mention also any two types of folds with illustrative diagrams.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Formation of folds: product of plastic or ductile deformation-formed due to compressive forces acting on rock mass -diagram showing compressive stress.
- Types- anticline/syncline/symmetrical/asymmetrical/overturned/recumbent/isoclinal folds  
Diagrams illustrating the respective folds

**Learning Outcomes**

- Illustrates basic types of fold, fault, joints and unconformities.

Q. 13 Faults are fractures in rocks along which movement has occurred. Illustrate common types of faults with suitable diagrams.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Diagrams illustrating Normal faults, Reverse faults, Strike-slip faults, Horst and Graben (any two diagrams)
- Types - Normal faults - Reverse faults - Strike - slip faults - Horst and Graben (any two types)

**Learning Outcomes**

- Recognizes important large scale structures such as fold, fault, joints and unconformities.
- Illustrates basic types of fold, fault, joints and unconformities.

Q. 14 What are unconformities? Describe various types of unconformities with figures.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Unconformity is a surface of erosion or non-deposition occurring within a sequence of rocks and that separates younger strata from older rocks.
- Types-Angular Unconformity-Parallel Unconformity-Non conformity. Illustrations of Angular Unconformity-Parallel Unconformity-Non conformity.

**Learning Outcomes**

- Explains the necessary conditions for preservation of fossils in rock strata.

Q.1 Fossils are remains or evidence of ancient plants and animals. How are once living organisms preserved in sedimentary rocks?

*Score 3, Time 6 Minutes*

**Scoring Indicators**

- Sediments accumulate, often bury organic parts along with, compacted with the passage of time, buried organisms are preserved as fossils- different modes of fossilization

**Learning Outcomes**

- Summarizes the different modes of fossilization.

Q.2 Choose the right word from those given in brackets to denote the following (Mould, Trace Fossils, Replacement, Carbonisation)

- Signs of the organisms' activity.
- Forms of fossil when the organism decays leaving a cavity in the rock
- Preservation of soft tissues of plants or animals as thin carbon films
- Cells of plants replaced by silica

*Score 4, Time 8 Minutes*

**Scoring Indicators**

- Trace fossils
- Moulds
- Carbonisation
- Replacement

**Learning Outcomes**

- Understands the concept of geologic time and its usefulness in understanding the history of the Earth.

Q.3 a) The correct arrangement of the different divisions of geologic time , from longest to shortest, is:

- Epochs, Periods, Eons, Epochs

- ii) Epochs, Eras, Eons, Periods
- iii) Eons, Eras, Periods, Epochs
- iv) Eras, Eons, Epochs, Periods

*Score 1, Time 3 Minutes*

- b) How can you substantiate that the Geologic Time Scale signifies the appearance and disappearance of certain fossil species in rock records?

*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- a) iii) Eons, Eras, Periods, Epochs
- b) Periods end with mass extinction of species, followed by appearance of new species

| <b>Ages of organisms</b>    | <b>Periods</b>          |
|-----------------------------|-------------------------|
| Age of Man                  | Quaternary              |
| Age of Mammals              | Cenozoic                |
| Age of Reptiles             | Mesozoic                |
| Age of Coal                 | Carboniferous           |
| Age of Fishes               | Silurian and Devonian   |
| Age of marine invertebrates | Cambrian and Ordovician |

**Learning Outcomes**

- Describes the significance of fossils in stratigraphy.

- Q. 4 a) The term strata is used to denote — — — — — in historical geology
- i) Geologic time
  - ii) Fossil record
  - iii) Rock layers
  - iv) Geologic events

*Score 1, Time 2 Minutes*

- b) Mention any two role of fossils in establishing geological history of an area

*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- a) iii) Rock layers
- b) Establishing geologic time, correlation of rock strata, dating of rock strata, reconstructing palaeo environment, etc.

**Learning Outcomes**

- Establishes the difference between the determination of relative age and absolute age of geological events.

Q.5 Fill in the blanks

- i) — — — — is the process/science of determining the age of rocks, fossils or geological events.
- ii) Relative dating determines the chronological order of a sequence of events, whereas — — — dating tells how many years ago a geologic event took place.
- iii) The process of forming a fossil is described as — — — — —

*Score 3, Time 6 Minutes*



#### Scoring Indicators

- i) Dating
- ii) Absolute dating
- iii) Fossilisation

#### Learning Outcomes

States the principles of stratigraphy that are employed to determine relative age of rocks.

Q.6 Describe how will you determine younger and older rock units in a sequence of strata based on each of the principles given below.

- i) Principle of superposition
- ii) Principle of faunal succession

*Score 4, Time 10 Minutes*



#### Scoring Indicators

- i) Superposition: oldest rocks on the bottom and younger layers on the top
- ii) Faunal succession: fossils occur in a definite chronological order in rock sequences all over the world- period of time can be recognized by its respective fossils

#### Learning Outcomes

- States the principles of stratigraphy that are employed to determine relative age of rocks.

Q.7 a) The underlying theme of historical geology that “the present is the key to the past” is known as: — — —

- i) The principle of uniformitarianism
- ii) The principle of horizontality
- iii) The principle of faunal succession
- iv) The principle of super position

*Score 1, Time 2 Minutes*

b) What do you mean by the above mentioned theme?

*Score 2, Time 4 Minutes*

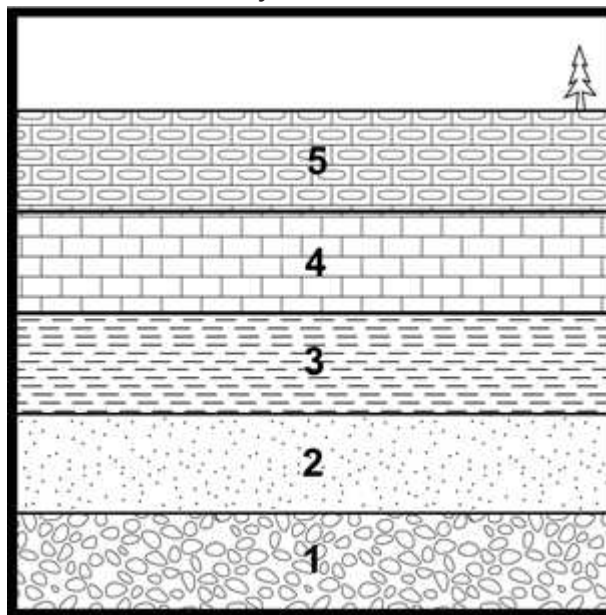
**Scoring Indicators**

- a) i) The principle of uniformitarianism
- b) Geological processes that are operating during the present on the earth are the same processes that have operated in the past

**Learning Outcomes**

- Establishes the difference between the determination of relative age and absolute age of geological events.
- States the principles of stratigraphy that are employed to determine relative age of rocks.

Q. 8 Explain the ideas shown in the given diagram using the law of superposition and principle of horizontality.



(FIG:5.8)

*Score 2, Time 5 Minutes*

**Scoring Indicators**

- Superposition: rock bed 1; is the oldest one and 5 is the youngest one; age increases from 1 to 5 progressively
- Original Horizontality: Strata have not been deformed; horizontal layers witness the absence of significant crustal movements

**Learning Outcomes**

- States the principles of stratigraphy that are employed to determine relative age of rocks.

Q. 9 a) If a bed has a fault cutting through it, which one is older? the bed or the fault?

*Score 1, Time 2 Minutes*

b) How does the principle of crosscutting relationship helps in determining the relative age of strata?

*Score 2, Time 4 Minutes*



 **Scoring Indicators**

- Rock beds are older
- According to the principle, the cross cutting feature will be always younger than the strata they cut; cross cutting relationship is an indicator of relative ages; can be applied to igneous intrusions, faults, veins, erosional surfaces

**Learning Outcomes**

- Describes the significance of fossils in stratigraphy.
- Understands the concept of geologic time and its usefulness in understanding the history of the Earth.

Q. 10 What is meant by correlation of rock strata? How are fossils useful in correlation?

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Correlation: process of determining the age relationship between strata located at different places
- Fossils are useful in determining the relative age of rock units, fossils of same age and same type in different localities- law of faunal succession- rocks of the same age contain the same fossil species in widely separated geographical area

**Learning Outcomes**

- Summarizes the different modes of fossilization.

Q. 11 Complete the given table on modes of fossilization

| Modes of fossilization | Process/description                     | Examples                       |
|------------------------|---|--------------------------------|
| Replacement            | Cells of plants replaced by silica      | ----- (a)                      |
| ----- (b)              | Imprints of an organism in the sediment | Fossilized shells of organisms |
| Trace fossils          | ----- (c)                               | Foot prints, borings           |

*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- Petrified wood
- Impressions/moulds/casts
- Traces of an organism's activity

**Learning Outcomes**

- Explains the necessary conditions for preservation of fossils in rock strata.

Q. 12 The process of forming a fossil is described as fossilization. Describe any three conditions that favour fossilization

*Score 3, Time 5 Minutes*

**Scoring Indicators**

- Rapid burial, possession of hard parts, suitable environment, escape from physical and chemical destruction, etc.

**Learning Outcomes**

- Understands the concept of geologic time and its usefulness in understanding the history of the Earth.

Q. 13 For relative dating of rock units scientists are guided by certain principles which are known as 'fundamental principles of historical geology'. Briefly describe these principles.

*Score 4, Time 10 Minutes*

**Scoring Indicators**

- Principle of uniformitarianism - Principle of superposition - Principle of original horizontality - Principle of crosscutting relationship - Principle of faunal succession

**Learning Outcomes**

- Establishes the significance of geology in environmental management.

Q.1 How are the interactions among geosphere, atmosphere and hydrosphere significant in sustaining life on this planet?

*Score 4, Time 10 Minutes*

**Scoring Indicators**

- Rocky part of the earth is in contact with water, air and life-spheres interact among each other-energy and matter circulates through them- sustains the earth system as a whole-changes made in one system affect all others-forms a complex global system- biosphere depends on water, air and soil for their sustenance

**Learning Outcomes**

- Realizes the interaction among various sub systems of the Earth.
- Establishes the significance of geology in environmental management.

Q.2 a) Do you agree that anthropogenic activities have made harmful impacts on our environment? Why?

*Score 3, Time 5 Minutes*

b) How does the study of geology help us to manage our environment?

*Score 3, Time 5 Minutes*

**Scoring Indicators**

- Yes, environmental effects associated with over exploitation of resource, problems associated with sand mining, quarrying, pollution, waste disposal, industrialization, urbanization, and related activities.
- Helps to understand environmental problems, optimize the use of natural resource, solve issues related with anthropogenic activities, mitigate natural hazards, study earth systems, and so on.

**Learning Outcomes**

- Delineates the effects of mining on different spheres of the Earth.

Q.3 a) Mention any three effects of mining on hydrosphere.

*Score 3, Time 5 Minutes*

b) How does mining and quarrying activities affect aquatic and wild life?

*Score 2, Time 4 Minutes*

**Scoring Indicators**

- Water pollution, acid mine drainage, lowering of water table

- b) Release of toxic chemicals and contamination of water during mining and processing stages are harmful to fauna and flora of the water bodies

**Learning Outcomes**

- Examines the consequences of green house effect and global warming.
- Q. 4 a) Identify the cause of enhanced green house effect and global warming from the following.
- Burning of fossil fuels
  - Variation in solar radiation
  - Climatic change
  - Sea level rise

*Score 1, Time 2 Minutes*

- b) What effect do greenhouse gases have on solar radiation?

*Score 2, Time 4 Minutes*

- c) Mention any two gases that enhance greenhouse effect.

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- i) Burning of fossil fuels
- Green house gases absorb longer solar radiation, keep the atmosphere warm
- Carbon dioxide(CO<sub>2</sub>), Methane (CH<sub>4</sub>)

**Learning Outcomes**

- Locates the major sources of contamination of ground water.
- Q. 5 What are the sources of common contaminants in groundwater?

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- Chemicals, fertilizers, septic systems, waste disposal sites, pesticides, industrial effluents, etc.

**Learning Outcomes**

- Describes the impacts of sand mining on our environment.
- Q. 6 Describes the impacts of sand mining on our environment.

*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- Lowering of stream bottom, depletion of sand in the stream bed, deepening of rivers and estuaries, enlargements of river mouths, dropping of water table, saltwater intrusion

**Learning Outcomes**

- Recognizes the need of conservation of natural resources for sustainable development.
- Q. 7 a) Which among the following is an example for renewable resource? (Coal, Petroleum, Groundwater, Hematite)

*Score 1, Time 2 Minutes*

- b) What makes a resource renewable and non-renewable?

*Score 2, Time 2 Minutes*

- c) What is the difference between natural and artificial resources?

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- Groundwater
- Replacement rate within a short span of time
- Natural resources- naturally occurring substances in their relatively unmodified format  
Artificial resources- resources developed by man, derived from natural resources, eg:-  
thermal electricity, bio gas

**Learning Outcomes**

- Recognizes the need of conservation of natural resources for sustainable development.
- Q. 8 Proper use of minerals is a method of conservation. How do recycling and substitution works in conservation of mineral resources.

*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- Recycling- helps to augment resources-metallic minerals can be reused- collected, melted and reused-Substitution supplements the use of scarce minerals, shortage of rare minerals can be supplemented

**Learning Outcomes**

- Appraises the problems associated with saline water intrusion.
- Q. 9 What is meant by saline water intrusion? What might be done to control the saltwater intrusion?

*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- Movement of saline water into fresh water system
- Controlling measures-creating a trough parallel to the coast, reduce pumping time, recharging of freshwater into wells, minimizing sand mining

**Learning Outcomes**

- Recognizes the need of conservation of natural resources for sustainable development.
- Q. 10 An integrated planning of soil, water and energy management have to be considered in achieving sustainable development. Why do we sustain these environmental resources?

*Score 3, Time 5 Minutes*

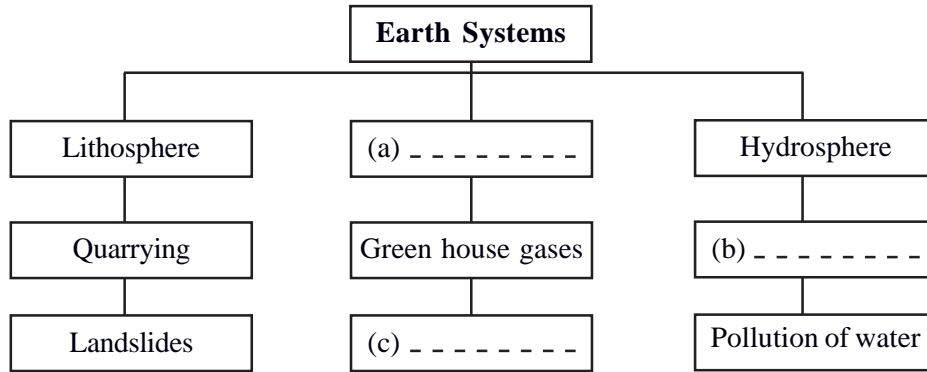
 **Scoring Indicators**

- To meet the needs of the present generation and conserve it for the future generation
- To leave the water, air, soil and other resources as pure and unpolluted
- To sustain the life on the earth

**Learning Outcomes**

- Realizes the interaction among various sub systems of the Earth.
- Delineates the effects of mining on different spheres of the Earth.
- Locates the major sources of contamination of ground water.

Q. 11 Complete the given flow chart



*Score 3, Time 5 Minutes*

 **Scoring Indicators**

- (a) Atmosphere
- (b) Pesticides/chemicals/biological pollutants
- (c) Global warming

**Learning Outcomes**

- Realizes the interaction among various sub systems of the Earth.
- Delineates the effects of mining on different spheres of the Earth.

Q. 12 The earth system consists of various sub systems of interacting realms such as the lithosphere,atmosphere,hydrosphere and biosphere. Briefly describe the effects of mining on various subsystems of the earth.

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Lithosphere: deforestation,land degradation,land subsidence,landslide, accumulation of quarry waste
- Hydrosphere:Acid mine drainage, loss of aquatic life, water pollution
- Atmosphere:Noise pollution,air pollution
- Biosphere: loss of habitat, destruction of bio-diversity

**Learning Outcomes**

- Locates the major sources of contamination of ground water.

Q. 13 List out the dangers of contaminated groundwater

*Score 2, Time 5 Minutes*

 **Scoring Indicators**

- Drinking contaminated groundwater can have serious health effects. A wide range of diseases such as hepatitis and dysentery may be caused by contamination from septic tank waste. Poisoning may be caused by toxins that have leached into well water supplies.

**Learning Outcomes**

- Discriminates among different types of seismic waves.

Q.1 a) The first seismic wave to arrive from an earthquake is:

- the S-wave
- the Love wave
- the Rayleigh wave
- the P-wave

*Score 1, Time 2 Minutes*

b) How are primary and secondary waves alike? How are they different?

*Score 3, Time 6 Minutes*

**Scoring Indicators**

- iv-the P wave
- Both are body waves; the P-waves are compressional waves, but the S waves are shear/transverse waves; compressional waves pass through all media- Shear waves travel only through solids

**Learning Outcomes**

- Compares the magnitude and intensity scales of measuring the size of an earthquake.

Q.2 a) The scale for measuring the magnitude of an earthquake is known as

-----

*Score 1, Time 2 Minutes*

b) What is meant by the magnitude of an earthquake? How is it determined?

*Score 2, Time 5 Minutes*

**Scoring Indicators**

- Richter scale
- Magnitude-amount of energy released during an earthquake; determined from the amplitude of the seismic waves recorded by seismographs

**Learning Outcomes**

- Illustrates seismographs and seismograms.
- Compares the magnitude and intensity scales of measuring the size of an earthquake.

Q.3 Mention the terms used to describe the following:

- (a) The actual position of the earthquake's origin.
- (b) Location on the earth's surface lying directly above the focus.
- (c) Records obtained from seismograph.

*Score 3, Time 5 Minutes*

**Scoring Indicators**

- a) Focus
- b) Epicentre
- c) Seismogram

**Learning Outcomes**

- Discriminates among different types of seismic waves.
- Illustrates seismographs and seismograms.

Q.4 Choose the correct answer from those given in brackets.

(Seismology, Seismograph, Seismicity, Tsunami)

- (a) Seismic sea waves of very long wave length.
- (b) Instruments that detect arrival of seismic waves.
- (c) Scientific study of earthquakes.
- (d) The distribution and frequency of earthquakes.

$4 \times 1 = 4$

*Score 4, Time 8 Minutes*

**Scoring Indicators**

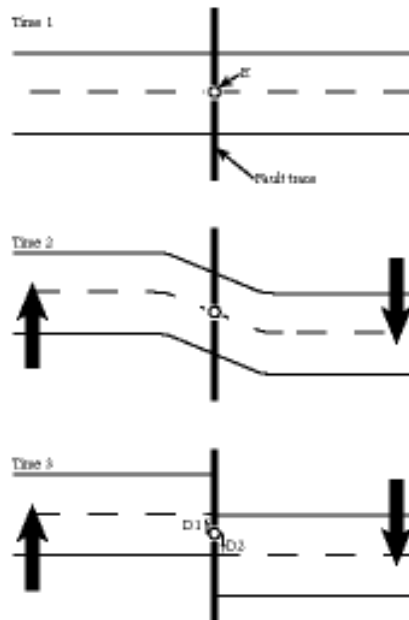
- a) Tsunami
- b) Seismograph
- c) Seismology
- d) Seismicity



## Learning Outcomes

- Describes the mode and causes of earthquakes.

Q.5 Analyse the given diagram. Describe briefly the widely acclaimed theory on the cause of earthquakes illustrated here.



(FIG 7.5)

*Score 3, Time 5 Minutes*

### Scoring Indicators

- Rock masses behave as elastic materials under stress; initially respond by elastic deformation, then rock masses bent as plastic deformation; further increase in stress results in breaking and rupture takes place; stored energy is released-

## Learning Outcomes

- Explains the occurrence of earthquakes along the plate boundaries.

Q.6 (a) How does the distribution of earthquakes correlate with plate boundaries?

*Score 2, Time 4 Minutes*

(b) Why subduction zones are associated with deep focus earthquakes?

*Score 2, Time 4 Minutes*

### Scoring Indicators

- Plate boundaries are zones along which plates move relative to one another-areas where different types of stress operates-three types of boundaries and plate movement-plates rub against, move apart or pull along-rock masses break and can cause earthquakes
- Subduction zones- where oceanic plate is pushed beneath either oceanic or continental plate convergence-fracture under compressional stress-generate deep focus earthquakes.

### Learning Outcomes

- Identifies the effects of earthquakes as a natural calamity.

Q.7 Describe any three major effects of earthquakes. Why are fires common during earthquakes?

*Score 4, Time 8 Minutes*

#### Scoring Indicators

- Structural damage, ground rupture, fire, tsunami, landslides, etc.
- Fires are caused because of broken power, gas and water lines

### Learning Outcomes

- Draws the major seismic belts of the world.

Q.8 a) Most of the destructive earthquakes originate within two well defined belts of the world. What are those two zones?

*Score 2, Time 3 Minutes*

b) Which one of these two follows the belts of Tertiary and recent mountain building areas?

*Score 1, Time 2 Minutes*

#### Scoring Indicators

- The Circum-Pacific belt and Mediterranean- Trans Asiatic Himalayan belt
- Mediterranean- Himalayan belt

### Learning Outcomes

- Identifies the effects of earthquakes as a natural calamity.

Q.9 Which of the following is the correct description of **liquefaction** due to an earthquake?

- Water-saturated sediments tend to flow when ground shaking take place
- Giant seismic sea waves
- Large scale slides of rock blocks on waterlogged mountain slopes
- Rhythmic motion of water in landlocked bays or water bodies

*Score 1, Time 2 Minutes*

#### Scoring Indicators

- Water-saturated sediments tend to flow when ground shaking take place

### Learning Outcomes

- Discriminates among different types of seismic waves.

Q.10 Compare and contrast Rayleigh(R) waves and Love(L) waves

*Score 3, Time 6 Minutes*

#### Scoring Indicators

- R-waves and L-waves:- Both are surface shear waves
- R-waves make the ground up and down in the vertical plane, where as L-waves cause the ground move side to side in a horizontal plane

## GEOLOGICAL HAZARDS AND DISASTER MANAGEMENT

### Learning Outcomes

- Defines the terms associated with disaster management such as hazard, disaster, vulnerability, risk and capacity

Q.1 (a) Define the terms hazard and disaster

*Score 2, Time 4 Minutes*

(b) What is meant by hazard mitigation

*Score 2, Time 4 Minutes*



### Scoring Indicators

- (a) Hazard- a potential situation that poses threat to life, property or environment  
Disaster- a serious disruption in the functioning community causing widespread losses
- (b) Hazard mitigation- actions intended to minimize risk

### Learning Outcomes

- Describes the various phases of the disaster management cycle

Q.2 a) What is the aim of disaster management?

*Score 2, Time 4 Minutes*

b) What steps can be taken before a disaster (pre-disaster phase) to minimize the vulnerability? Discuss with examples.

*Score 3, Time 5 Minutes*



### Scoring Indicators

- a) To avoid, lessen or transfer the adverse effects of hazards through activities and measures including prevention, mitigation and preparedness
- b) Activities that reduce the effects of disasters and measures to reduce the intensity of a forthcoming disasters  
Example: Public education, vulnerability analysis, building codes, water management in drought prone areas, strengthening structures to reduce damage and relocation of people away from the hazard prone areas

### Learning Outcomes

- Defines the terms associated with disaster management such as hazard, disaster, vulnerability, risk and capacity

- Identifies the steps to be taken to minimize the risks associated with earthquakes.

Q.3 a) Mention some of the risks associated with a disaster.

*Score 2, Time 5 Minutes*

b) Identify any three major mitigation measures to reduce earthquake risk.

*Score 3, Time 5 Minutes*



### Scoring Indicators

- a) Potential losses in lives, health status, assets, livelihoods and services ;
- b) Seismic resistant construction, enforcement of building codes, community preparedness in the form of planning and public education etc.

### Learning Outcomes

- Draws a conclusion about the mitigation of tsunami hazards.

Q.4 Tsunami differ from ordinary ocean waves and are extremely dangerous to coastal communities.

(a) What is a tsunami?

*Score 1, Time 2 Minutes*

(b) Why are tsunamis so hazardous than ordinary ocean waves?

*Score 2, Time 4 Minutes*

(c) What steps can be taken to mitigate tsunami hazards?

*Score 3, Time 5 Minutes*



### Scoring Indicators

- a) Seismic sea waves
- b) Travel much faster, much longer wave lengths, occur suddenly, dangerous to coastal communities
- c) Tsunami warning system, public education, building tsunami walls, etc.

### Learning Outcomes

- Explains the effects, and mitigation of volcanic disasters.

Q.5 a) Most active volcanoes are located in:

(Mediterranean belt, Circum-Pacific belt, Hawaiian Islands, Along the oceanic ridges)

*Score 1, Time 2 Minutes*

b) What are pyroclastics? Why are these so hazardous?

*Score 2, Time 4 Minutes*

c) What are the toxic gases released during volcanic eruptions?

*Score 2, Time 5 Minutes*

### Scoring Indicators

- Circum-Pacific belt
- Solid rock fragments ejected from volcanoes  
Hazardous because they move swiftly and are hot rock fragments
- Hydrogen chloride, Carbon dioxide, Hydrogen fluoride; Chlorine, Sulphur and Fluorine gases

### Learning Outcomes

- States the causes, adverse effects and mitigation of flood hazards

Q. 6 a) Ridges on the edges of a stream channel are called \_\_\_\_\_.  
(Levees, Deltas, Floodplains, Dams)

*Score 1, Time 1 Minute*

b) Discuss the ways by which we can control the flood hazards.

*Score 3, Time 5 Minutes*

c) List out some of the adverse effects of floods.

*Score 2, Time 5 Minutes*

### Scoring Indicators

- Levees
- Channel modification, dams, retention ponds, artificial levees, flood walls etc.
- Collapse of building, bridges, farmlands; loss of life to humans and livestock; health impacts, groundwater contamination, epidemics, disruption of services, etc.

### Learning Outcomes

- Demonstrates the controlling factors and mitigation strategies of landslides.

Q. 7 Mass movements including landslides constitute a major natural hazard in Kerala. What are the measures recommended for making mass movement less likely or less vulnerable?

*Score 3, Time 6 Minutes*

### Scoring Indicators

- Proper land use practices, forestation, avoiding blockage of water, retaining walls, slope modification and stabilization, etc.

### Learning Outcomes

- Defines the terms associated with disaster management such as hazard, disaster, vulnerability, risk and capacity
- Describes the various phases of the disaster management cycle

Q. 8 Fill in the blanks in the given table

| Hazards         | Mitigation measures            |
|-----------------|--------------------------------|
| Flood           | Reduce surface run off         |
| Coastal erosion |                                |
| Landslides      |                                |
| Earthquakes     | Earthquake resistant buildings |

2 x 1 = 2

*Score 2, Time 3 Minutes*

 **Scoring Indicators**

- Coastal erosion:-Sea wall/Groin/Re-vegetation/Beach nourishment
- Landslides:-Slope modification/ Forestation/ Proper drainage/Appropriate engineering practices

**Learning Outcomes**

- Illustrates the causative factors of coastal erosion and evaluates the strategies of coastal zone management.

Q. 9 a) What is the aim of beach nourishment?

*Score 2, Time 4 Minutes*

b) What happens to longshore drift of sediments when a groin is built to protect coastal zones?

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- To create a wider beach by artificially increasing the quantity of sediment a beach
- Longshore drift is trapped and movement of sand is checked.

**Learning Outcomes**

- Defines the terms associated with disaster management such as hazard, disaster, vulnerability, risk and capacity
- Describes the various phases of the disaster management cycle

Q. 10 Select the one which is not suitably matched from the following

Tsunami: Wind driven waves

Earthquake: Release of stored elastic energy

Flood: Excess surface run off

Landslide: Unstable hill slopes

*Score 1, Time 2 Minutes*

 **Scoring Indicators**

- Tsunami: Wind driven waves

**Learning Outcomes**

- Demonstrates the controlling factors and mitigation strategies of landslides.

Q. 11 Which of the following will not help prevent landslide?

- Proper drainage of water
- Construction of retaining wall
- Removal of vegetation from hill slopes
- Grading of slopes to reduce steepness

*Score 1, Time 2 Minutes*

 **Scoring Indicators**

- Removal of vegetation from hill slopes

**Learning Outcomes**

- Illustrates the causative factors of coastal erosion and evaluates the strategies of coastal zone management.

Q. 12 Read the following hazard mitigation measures. Select the correct combination that can be adopted for mitigating coastal erosion.

- Dune building
- Re-vegetation
- Break waters
- Retention ponds
- Groins
- Resonance

*Score 1, Time 4 Minutes*

- b, c, d, f
- a, c, e, f
- a, c, d, e
- a, b, c, e

 **Scoring Indicators**

- a, b, c, e

**Learning Outcomes**

- Demonstrates the controlling factors and mitigation strategies of landslides.

Q. 13 'Majority of landslides occur during the monsoon season in Kerala'. Justify the above statement giving the reasons.

*Score 2, Time 4 Minutes*

 **Scoring Indicators**

- Heavy and continuous rainfall, oversaturated ground, less infiltration.

**Learning Outcomes**

- States the causes, adverse effects and mitigation of flood hazards

Q. 14 Man plays an important role in increasing flood hazards. On the other hand, he also capable of implementing various strategies to reduce the risk of flood hazards. Do you agree with these statements? Justify

*Score 4, Time 8 Minutes*

 **Scoring Indicators**

- Yes, urbanization, deforestation, improper land use patterns, filling of wetlands, sand mining, etc. trigger flood hazards.
- Strategies To reduce risk: Channel modifications, Construction of dams, Making of retention ponds for trapping water, Construction of artificial levees, dikes, and floodwalls, floodways, etc.

**Learning Outcomes**

- Illustrates the causative factors of coastal erosion and evaluates the strategies of coastal zone management.

Q. 15 Explain the hard and soft engineering schemes used for coastal protection?

*Score 4, Time 10 Minutes*

 **Scoring Indicators**

- Hard structures are constructed along the beach to prevent coastal erosion. Includes seawalls, groins, breakwaters/artificial headlands .
- Soft structural/engineering options aim measure to dissipate wave energy by mirroring natural forces and maintaining the natural topography of the coast. They include beach nourishment/feeding, dune building, re vegetation and other non-structural management options.