

CCE(M)/GLG-I/10/2024

GEOLOGY

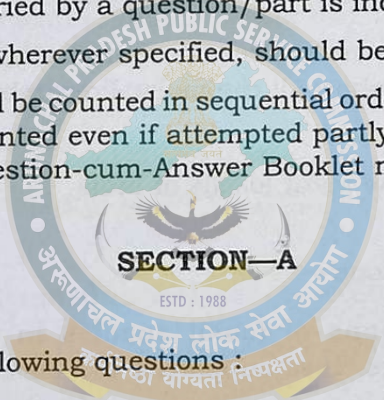
(PAPER—I)

Time : 3 hours]

[Full Marks : 250

Please read each of the following instructions carefully before attempting the questions :

- (i) There are **eight** questions divided in **two Sections**.
- (ii) Candidate has to attempt **five** questions in all.
- (iii) Question Nos. **1** and **5** are compulsory and out of the remaining, **three** are to be attempted choosing at least **one** question from each Section.
- (iv) The number of marks carried by a question/part is indicated against it.
- (v) Word limit in questions, wherever specified, should be adhered to.
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1. Answer **any five** of the following questions : 10×5=50
- (a) How does the study of earthquake help scientists understand the Earth's interior? 10
 - (b) Explain the aerial and linear properties of a drainage basin with neat sketches. 5+5=10
 - (c) Give a brief account of the satellite launched under the Indian Remote Sensing Programme of ISRO. 10
 - (d) Define the elastic, elastoviscous, viscoelastic and plastic behaviours shown by rocks. Draw suitable diagrams. $2\frac{1}{2}+2\frac{1}{2}+2\frac{1}{2}+2\frac{1}{2}=10$
 - (e) With the help of suitable diagrams, discuss briefly the different types of translational faults. 10
 - (f) What are the key differences between fluvial erosional and depositional features and how are they formed by river processes? 2+8=10
 - (g) Write briefly the applications of Geographic Information System (GIS) in geology. 10

2. Answer the following questions :

- (a) How have Quaternary climate variations influenced sea level changes and what is the relationship between glacial/interglacial cycles and eustatic sea level fluctuations? 20
- (b) What do you mean by 'stress at a point'? Define normal stress and shear stress. With the help of diagrams, deduce the equations for Mohr stress circle. From the equations, find out the two conjugate planes of maximum shear stress. $2+4+6+3=15$
- (c) Explain how different landforms serve as geomorphic markers for tectonic activity with suitable examples. 15

3. Answer the following questions :

- (a) Define Biot-Ramberg equation. On the basis of this equation, define ptygmatic fold, cuspate-lobate fold, harmonic fold, disharmonic fold and polyharmonic fold with suitable diagrams. $5+15=20$
- (b) Give a detailed account on the Precambrian stratigraphy of Peninsular India. Draw a map of India to show all the major Precambrian stratigraphic units in Peninsular India. $10+5=15$
- (c) Give a general idea of the plant fossils of India. 15

4. Answer the following questions :

- (a) Discuss the applications of fossil species in the palaeoclimatic and palaeogeographic studies. Give supportive evidences. $10+10=20$
- (b) What are the different types of stratigraphic classification? Write the hierarchy of stratigraphic units in each of the classification. Write about the nomenclature of the different stratigraphic units. $4+5+6=15$
- (c) What is weathering and what are the different types of weathering? How is it related to soil formation processes? $10+5=15$

SECTION—B

5. Answer **any five** of the following questions : $10 \times 5 = 50$

- (a) Define fossilization. Discuss the physicochemical conditions for fossilization. $4+6=10$
- (b) Give a labelled diagram of subsurface distribution of groundwater. 10
- (c) Write on the distribution of rocks belonging to Vindhyan Supergroup and the general stratigraphy (in tabular form) of Vindhyan Supergroup in Son Valley. 10

- (d) How does groundwater acquire its chemical composition? What are the major chemical constituents found in groundwater? 5+5=10
- (e) Discuss briefly the structural features found in metamorphic rocks. 10
- (f) Define aquifer with a suitable example. State the difference between aquitard and aquifuge with relevant examples. 4+6=10
- (g) Give an account of the major types of dams and their functions. Explain the geological considerations necessary for the selection of a Dam Site. 4+6=10

6. Answer the following questions :

- (a) Discuss the common methods of groundwater exploration. 20
- (b) Define megafossils and microfossils with examples. Write a note on the application of microfossils in petroleum exploration. 3+3+9=15
- (c) What is biostratigraphy? What is the basis of biostratigraphic classification? Discuss briefly the classification of different biostratigraphic zonations. 4+3+8=15

7. Answer the following questions :

- (a) Describe the different types of lithostratigraphic and biostratigraphic units. 10+10=20
- (b) Define Phreatic and Piezometric surfaces. Discuss the types of aquifers. 5+10=15
- (c) What is rainwater harvesting? Write a note on the importance of rainwater harvesting with reference to climate change. 6+9=15

8. Answer the following questions :

- (a) Name the major Gondwana basins in Peninsular and Extra-peninsular India. Show in a tabular form the general stratigraphy of Gondwana Supergroup in Damodar basin. Name the marine beds which are intercalated with Lower Gondwana rocks. What were the different paleoclimatic conditions in which the entire sequence of Gondwana rocks was deposited? 6+6+4+4=20
- (b) Discuss the water bearing characteristics of rock formations with examples. Mention the names of good aquifer materials. 10+5=15
- (c) Discuss the causes, prevention and rehabilitation measures for landslides. 15



SPACE FOR ROUGH WORK



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(PAPER—II)

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SECTION—A

ESTD : 1988

1. Answer **any five** of the following questions :

10×5=50

- (a) Mention the names of the systems at which crystals are classified and give the specification of the crystallographic axis in terms of their length and angle of each system. 5+5=10
- (b) Why do we need not study an isotropic mineral under cross polars of a petrological microscope? Define the extinction angle of an anisotropic mineral with suitable diagram. Describe with suitable diagrams the different types of extinction shown by the anisotropic minerals. 1+3+6=10
- (c) Describe the mineral reactions in prograde regional metamorphism of argillaceous sedimentary rocks (pelites) with suitable diagrams. 10
- (d) What are heavy minerals and what is their significance in sedimentary petrology? 10
- (e) Discuss why Cretaceous-Paleogene (Cretaceous-Tertiary) boundary is considered to be one of the most significant events in the Earth's evolutionary history. 10

(f) Define the basic and ultrabasic groups of igneous rocks. State the key differences with examples. 6+4=10

(g) Discuss the optical properties of rock forming minerals on the basis of which the minerals are identified under petrological microscope. 10

2. Answer the following questions :

(a) Discuss the main processes involved in the generation and crystallization of magmas. 20

(b) Classify sandstones based on their matrix content and discuss their textural and mineralogical characteristics. How does the matrix content provide insights into their depositional environments? 10+5=15

(c) Discuss the important textures exhibited by metamorphic rocks with examples. 15

3. Answer the following questions :

(a) Classify different types of sedimentary structures based on their origin, providing examples for each category. Explain the significance of sedimentary structures in interpreting past depositional conditions, paleo-flow regimes and tectonic settings. 10+10=20

(b) Give the number of axes, length and orientation of axes and also the symmetry elements of $2/m\ 2/m\ 2/m$ group of crystal. Name a mineral belonging to pyroxene family which crystallizes in $2/m\ 2/m\ 2/m$ group. 12+3=15

(c) What are ACF and AKF diagrams in metamorphic petrology? What are the purposes of these diagrams? Write the key differences between the ACF and AKF diagrams. 6+4+5=15

4. Answer the following questions :

(a) Discuss the main types of metamorphism with reference to their important characteristics. What are main factors that drive the transformation of sedimentary and/or igneous rocks into metamorphic rocks? 15+5=20

(b) What are pleochroism and twinning phenomena in optical mineralogy? Write the causes and significance of these phenomena with suitable diagrams. 6+4+5=15

(c) Discuss the important sedimentary basins of India with reference to their key characteristics and significance. 15

SECTION—B

5. Answer **any five** of the following questions : 10×5=50

(a) Discuss the important coal deposits in North-East India. 10

(b) What are the environmental impacts of mining? Write on the unit operations of surface and underground mining. 4+6=10

- (c) What are the differences between earthquake magnitude and earthquake intensity? What is measured in Richter scale? 8+2=10
- (d) What are epigenetic and syngenetic mineral deposits? Give examples. 8+2=10
- (e) Write about the important ore textures with examples. 10
- (f) Write the geographic distribution of gold deposits in India. 10
- (g) Write the common environmental impact of urbanization. 10

6. Answer the following questions :

- (a) Discuss briefly the different processes of formation of mineral deposits with relevant examples. 20
- (b) Write briefly about the geophysical methods of mineral prospecting. 15
- (c) Write the major environmental protection laws in India. What is the purpose of the Environmental Protection Acts? 10+5=15

7. Answer the following questions :

- (a) Discuss the common anthropogenic activities of both groundwater and surface water pollution. 20
- (b) Define metallogenic epoch. Discuss the major metallogenic epochs recognized in Indian geological history. 5+10=15
- (c) Write the composition of planet Earth with reference to different layers/zones of Earth. 15

8. Answer the following questions :

- (a) Discuss briefly the structural and chemical control of ore localization. 10+10=20
- (b) What is underground mine ventilation? Discuss common mine ventilation hazards and their risk control techniques. 15
- (c) Discuss the different types of chemical bonds in minerals. 15

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SPACE FOR ROUGH WORK

