

## GEOLOGY

## Paper II

Time Allowed : Three Hours

Maximum Marks : 200

## QUESTION PAPER SPECIFIC INSTRUCTIONS

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

There are **EIGHT** questions in all, out of which **FIVE** are to be attempted.

Question Nos. **1** and **5** are compulsory. Out of the remaining **SIX** questions, **THREE** are to be attempted selecting at least **ONE** question from each of the two **Sections A** and **B**.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

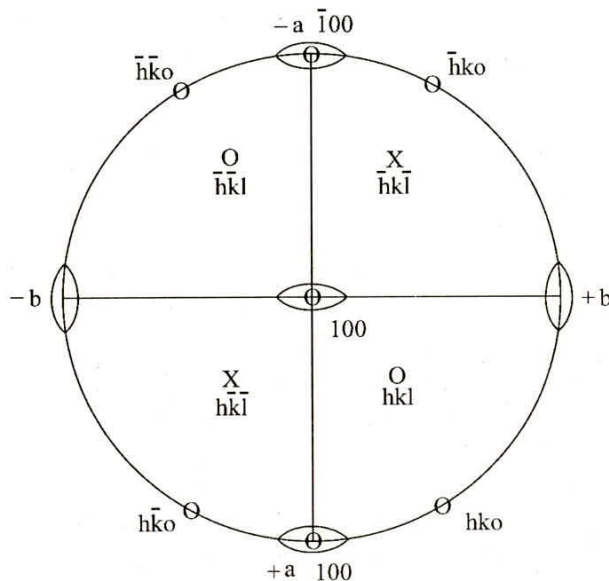
All questions carry equal marks. The number of marks carried by a question/part is indicated against it.

Answers must be written in **ENGLISH** only.

Neat sketches may be drawn, wherever required.

## SECTION 'A'

1.(a)



Symbols

- 2-fold axis of symmetry

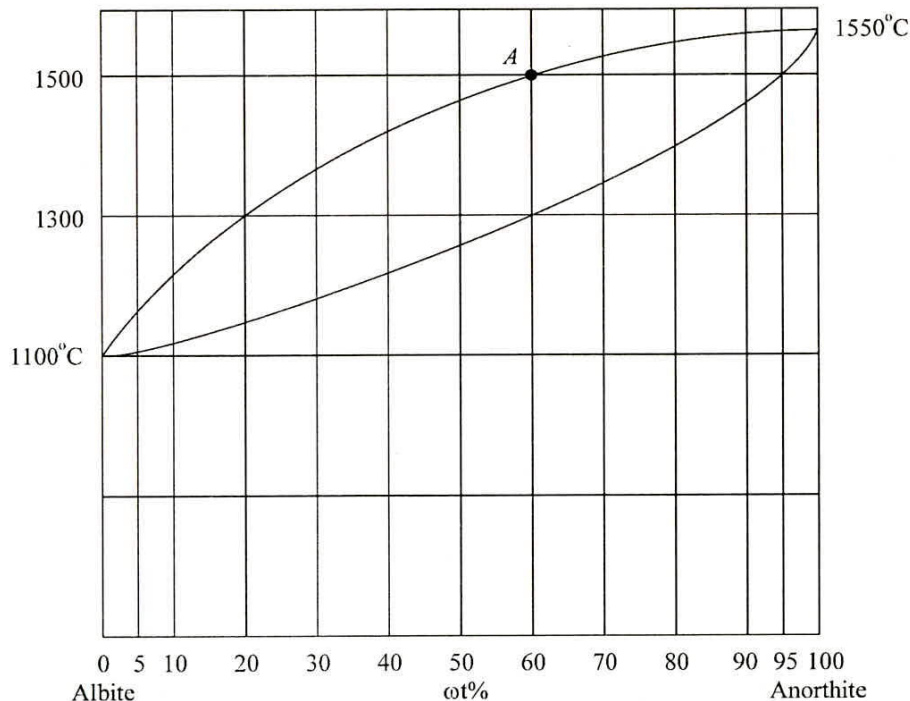
O - upper hemisphere projection of a face pole

X - lower hemisphere projection of a face pole

Which crystallographic system does the crystal represented by the stereogram above belong to? What faces constitute pinacoid form? What form do the general faces  $\{hkl\}$  belong to? Which of the projected faces are parallel to the  $c$ -axis? 8

- 1.(b) What are the two crystal-systems in which Mg-Fe and Ca-pyroxene crystallize? How do these two types of pyroxene be distinguished based on their optical properties? 8
- 1.(c) Describe magmatic differentiation and epithermal mineral characters. 8
- 1.(d) A sedimentary sequence of 2 km thickness shows shallow water deposition from top to bottom. How do you explain it? 8
- 1.(e) How a foreland basin is formed at the foot of a mountain belt? 8

2.(a)



In the given Albite-Anorthite phase-diagram liquid of *A* composition begins to crystallize at 1500°C. What would be the composition of first crystallized feldspar? What would be the composition of liquid and solid at the last stage of crystallization under equilibrium condition? If the equilibrium between liquid and solid is not maintained, what texture of plagioclase is likely to result? 10

- 2.(b) A rock of pelitic composition containing muscovite, chlorite, quartz and Na-plagioclase would belong to which metamorphic facies? How does this mineral assemblage change on progressive metamorphism to higher grade? 10
- 2.(c) Describe the formation of sand dunes with a suitable sketch. 10
- 2.(d) What is the use of heavy minerals in sedimentology? 10

- 3.(a) What metamorphic structures and textures a rock of basaltic composition would develop during progressive regional metamorphism ? 10
- 3.(b) How can mineral assemblage of a basaltic rock be shown on a triangular ACF diagram ? Explain the rationale behind the calculation of  $A$  in the ACF diagram. What is the maximum number of phases possible in a two component system according to the standard phase-rule ? 10
- 3.(c) How depositional environment is determined from sedimentary rocks. 10
- 3.(d) Describe the sedimentary structures. How they can be used to determine the order of superposition ? 10
- 4.(a) Olivine crystallizes in space group Pbnm. What crystallographic information do you derive from this space group symbol ? How does olivine in a mid-oceanic-ridge basalt alter ? Mineral formula of an olivine is given below. Express this in end-member composition :  

$$\text{Fe}_{0.16}^{2+} \text{Fe}_{0.04}^{3+} \text{Mg}_{1.80} \text{Si}_{0.96} \text{Al}_{0.4} \text{O}_4$$
 10
- 4.(b) Explain in brief the optical properties of minerals in thin sections that can be studied under transmitted light using a petrological microscope. 10
- 4.(c) Describe the classification of sedimentary rocks based on grain size. 10
- 4.(d) Describe the difference between alluvial fan, flood plain and delta. 10

### SECTION 'B'

5. Write short notes on the followings :  $5 \times 8 = 40$
- 5.(a) Red Sea Mineralisation. 8
- 5.(b) Supergene alteration of sulphide deposits. 8
- 5.(c) Placer deposits. 8
- 5.(d) Coordination number and its relation to the cation-anion radius ratio in a crystal structure. 8
- 5.(e) Uttarakhand natural disaster of June 2013. 8
- 6.(a) What are the characteristics of Volcanics-associated Massive Sulphide (VMS) deposits ? Discuss about the mineralogy and texture of VMS deposits. 10
- 6.(b) How does coal form in nature ? Why economic deposit of coal is not expected to develop in Precambrian formations ? Briefly describe the distribution of Gondwana coal in Peninsular India. 10
- 6.(c) Trace elements can be classified into compatible and incompatible elements. What is the basis of such classification ? 10
- 6.(d) Describe the important aspects of geochemical prospecting. 10



- 7.(a) What are the major minerals of manganese ? Write a note on manganese deposits of Sausar Group, India. 10
- 7.(b) Why Banded Iron Formations (BIF) are restricted to Precambrian time ? Enumerate the characters of Lake Superior type BIF. 10
- 7.(c) How does volcanic activity affect climate ? What types of volcanoes are more hazardous and how ? 10
- 7.(d) Describe the basis for open cost and underground mining. 10
- 8.(a) What are the major ore minerals of aluminium and why do their composition vary with time ? Discuss about the controls of ore localisation of bauxite through residual concentration. 10
- 8.(b) What are the characteristic features to recognize any Proterozoic-type carbonate-hosted Pb-Zn deposit ? Write a note on the sulphide deposits of Rajpura-Dhariba, Rajasthan. 10
- 8.(c) How does the urbanization affect groundwater recharge ? How can the recharge be increased ? 10
- 8.(d) What is a radioactive waste and why is it hazardous ? Discuss the waste isolation versus waste disposal strategies for the radioactive waste. 10
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