A

2010 – GG

Test Paper Code : GG

Time : 3 Hours **Max. Marks : 300**

INSTRUCTIONS

1. The question-cum-answer booklet has **24** pages and has **44** questions. Please ensure that the copy of the question-cum-answer booklet you have received contains all the questions.
2. Write your **Registration Number, Name and the name of the Test Centre** in the appropriate space provided on the right side.
3. Write the answers to the objective questions against each Question No. in the **Answer Table for Objective Questions**, provided on Page No. **7**. Do not write anything else on this page.
4. Each objective question has **4 choices** for its answer : (A), (B), (C) and (D). Only **ONE** of them is the correct answer. There will be **negative marking** for wrong answers to objective questions. The following marking scheme for objective questions shall be used :
   (a) For each correct answer, you will be awarded **3 (Three)** marks.
   (b) For each wrong answer, you will be awarded **–1 (Negative one)** mark.
   (c) Multiple answers to a question will be treated as a wrong answer.
   (d) For each un-attempted question, you will be awarded **0 (Zero)** mark.
   (e) Negative marks for objective part will be carried over to total marks.
5. Answer the subjective question only in the space provided after each question.
6. Do not write more than one answer for the same question. In case you attempt a subjective question more than once, please cancel the answer(s) you consider wrong. Otherwise, the answer appearing last only will be evaluated.
7. All answers must be written in blue/black/ blue-black ink only. Sketch pen, pencil or ink of any other colour should not be used.
8. All rough work should be done in the space provided and scored out finally.
9. No supplementary sheets will be provided to the candidates.
10. **Clip board, log tables, slide rule, calculator, cellular phone or electronic gadgets in any form are NOT allowed.**
11. The question-cum-answer booklet must be returned in its entirety to the Invigilator before leaving the examination hall. Do not remove any page from this booklet.

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2010 – GG

READ INSTRUCTIONS ON THE LEFT SIDE OF THIS PAGE CAREFULLY

REGISTRATION NUMBER						

Name :

Test Centre :

Do not write your Registration Number or Name anywhere else in this question-cum-answer booklet.

I have read all the instructions and shall abide by them.

.....

Signature of the Candidate

I have verified the information filled by the Candidate above.

.....

Signature of the Invigilator

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IMPORTANT NOTE FOR CANDIDATES

- **Questions 1-30 (objective questions) carry *three* marks each and questions 31-44 (subjective questions) carry *fifteen* marks each.**
- **Write the answers to the objective questions in the *Answer Table for Objective Questions* provided on page 7 only.**

Q.1 Asteroids are minor planetary bodies located between

(A) Earth and Mars
(B) Jupiter and Saturn
(C) Mars and Jupiter
(D) Mercury and Venus

Q.2 Which one of the following options does correctly represent the elements in order of decreasing abundance in the earth's crust?

(A) Fe > Si > O > Al
(B) O > Si > Al > Fe
(C) Si > O > Al > Fe
(D) Si > Al > Fe > O

Q.3 Wind-facetted pebbles are known as

(A) Lag-gravel (B) Blowouts (C) Yardangs (D) Ventifacts

Q.4 The pitch of a fold axis on the axial plane, dipping at 45° is 88°. The fold is

(A) Vertical fold
(B) Inclined fold
(C) Reclined fold
(D) Recumbent fold

Q.5 Which one of the following successions does represent the correct stratigraphic order from bottom to top?

(A) Uttatur Group-Trichinopolly Group-Ariyalur Group-Niniyur Group
(B) Trichinopolly Group-Uttatur Group-Ariyalur Group-Niniyur Group
(C) Uttatur Group-Trichinopolly Group-Niniyur Group-Ariyalur Group
(D) Niniyur Group-Trichinopolly Group-Uttatur Group-Ariyalur Group

Q.6 Silicon has a co-ordination number six in

(A) Coesite (B) Stishovite (C) Tridymite (D) Cristobalite

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Q.7 Which one of the following is an **INCORRECT** statement?

(A) Siderite is an iron ore of carbonate composition
(B) Hematite is an iron ore with ferro-magnetic character
(C) Limonite is a hydrated iron ore
(D) Magnetite is an iron ore that crystallizes in an isometric system

Q.8 The foresets of cross beds in a horizontal sandstone bed have an attitude of N20°E/22°SE. It indicates a palaeocurrent direction towards

(A) S22°E (B) N20°W (C) S70°E (D) N70°E

Q.9 An eight-sided basal section of a mineral containing two sets of cleavages at an angle of 90° is

(A) Hornblende (B) Diopside (C) Calcite (D) Sanidine

Q.10 Which one of the following stratigraphic units does occur outside the Aravalli Craton?

(A) Berach Granite
(B) Untala Granite
(C) Gingla Granite
(D) Closepet Granite

Q.11 Match the dentition type in **Group I** with the Bivalvia genus in **Group II.**

Group I	**Group II**
P. Heterodont	1. *Trigonia*
Q. Desmodont	2. *Cerastoderma*
R. Dysodont	3. *Mya*
S. Schizodont	4. *Mytilus*

(A) P-2, Q-3, R-1, S-4
(B) P-1, Q-3, R-2, S-4
(C) P-2, Q-3, R-4, S-1
(D) P-1, Q-2, R-3, S-4

Q.12 Which one of the following constituents of limestone is characterized by concentric structure?

(A) Peloid
(B) Ooid
(C) Sparry calcite
(D) Intraclast

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Q.13 The crystal class which is **NOT** a planar point group is

(A) 3 m (B) 4 mm (C) 3 (D) 6/m

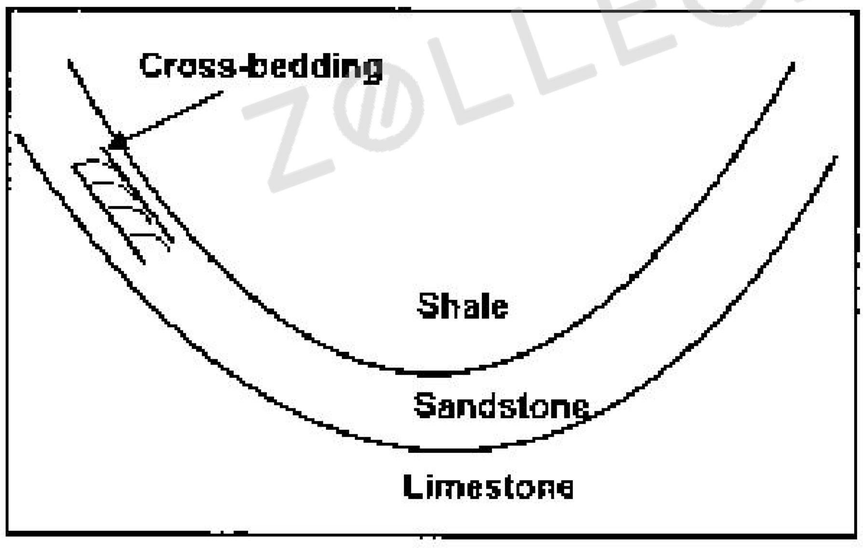
Q.14 Circular reefs enclosing shallow body of water are called

(A) Barrier reefs (B) Fringing reefs
(C) Spits (D) Atolls

Q.15 The mineral assemblage which **DOES NOT** correctly define a metamorphic facies is

(A) Albite + Epidote + Actinolite + Chlorite
(B) Hornblende + Plagioclase + Ilmenite
(C) Omphacite + Garnet + Plagioclase
(D) Orthopyroxene + Clinopyroxene + Plagioclase + Hornblende

Q.16 Shown below is a profile section of a folded sequence consisting of limestone, cross bedded sandstone and shale. The fold can be termed as



(A) Synformal syncline (B) Synformal anticline
(C) Antiformal syncline (D) Antiformal anticline

Q.17 Commercial magnesite deposit can be hosted in

(A) Serpentinite (B) Potassic Granite
(C) Gabbro (D) Nepheline syenite

Q.18 Addition of a centre of symmetry converts the crystal class 622 to

(A) 6 mm (B) 6/m 2/m 2/m
(C) $\bar{6}$ m2 (D) $\bar{6}$ 2m

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Q.19 Match textures in **Group I** with its corresponding rock types in **Group II.**

Group I	**Group II**
P. Spinifex texture	1. Dolerite
Q. Graphic texture	2. Lamprophyre
R. Ophitic texture	3. Pegmatite
S. Panidiomorphic texture	4. Komatiite

(A) P-1, Q-4, R-3, S-2 (B) P-4, Q-3, R-1, S-2
(C) P-2, Q-3, R-1, S-4 (D) P-4, Q-1, R-2, S-3

Q.20 The chemical formula of olivine containing 60 mole % forsterite and 40 mole % fayalite is

(A) $Mg_{1.2}Fe_{0.8}SiO_4$ (B) $Mg_{1.4}Fe_{0.6}SiO_4$
(C) $Mg_{1.6}Fe_{0.4}SiO_4$ (D) $Mg_{1.8}Fe_{0.2}SiO_4$

Q.21 Which one of the following sedimentary structures **DOES NOT** mark the top surface of a bed?

(A) Flute cast (B) Current ripple (C) Wave ripple (D) Rain print

Q.22 Match the economic deposits in **Group I** with their corresponding occurrences in **Group II.**

Group I	**Group II**
P. Lignite	1. Jaduguda
Q. Petroleum	2. Malanjkhand
R. Copper	3. Neyveli
S. Uranium	4. Rudrasagar

(A) P-3, Q-4, R-1, S-2 (B) P-2, Q-4, R-1, S-3
(C) P-3, Q-4, R-2, S-1 (D) P-4, Q-3, R-2, S-1

Q.23 A copper-nickel-sulphide ore deposit occurring in the basal part of a layered gabbro can originate by the following process

(A) Early magmatic segregation
(B) Late magmatic residual liquid segregation
(C) Early magmatic injection
(D) Late magmatic immiscible liquid segregation

Q.24 Which one of the following flora belongs to the Lower Gondwana?

(A) *Gangamopteris* (B) *Cladophlebis* (C) *Sphenopteris* (D) *Ptilophyllum*

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Q.25 A fault plane dips at an angle of 45° due east and shows N-S trending slickenside. The rake of net slip of this fault is

(A) 90° (B) 45° (C) 22.5° (D) 0°

Q.26 Match the hydrological terms in **Group I** with those in **Group II.**

Group I	Group II
P. Aquifer	1. Non porous, non permeable
Q. Aquiclude	2. Porous, non permeable
R. Aquitard	3. Poorly porous and poorly permeable
S. Aquifuge	4. Porous and permeable

(A) P-1, Q-2, R-3, S-4 (B) P-2, Q-3, R-4, S-1
(C) P-4, Q-2, R-3, S-1 (D) P-4, Q-3, R-1, S-2

Q.27 A limestone bed dipping at an angle of 30° due E has a width of 30 m on a horizontal plane. The vertical thickness of the bed in meters is about

(A) 17 (B) 21 (C) 34 (D) 42

Q.28 Match the modes of occurrence of igneous rocks in **Group I** with their corresponding rock types in **Group II.**

Group I	Group II
P. Batholith	1. Kimberlite
Q. Lopolith	2. Granite
R. Pahoehoe lava	3. Basalt
S. Pipe	4. Gabbro-norite

(A) P-4, Q-2, R-3, S-1 (B) P-2, Q-1, R-3, S-4
(C) P-2, Q-4, R-3, S-1 (D) P-4, Q-3, R-1, S-2

Q.29 A pillowed metabasalt containing the mineral assemblage glaucophane + lawsonite + epidote + chlorite indicates

(A) Ocean floor metamorphism
(B) Continent-continent collision metamorphism
(C) Contact metamorphism
(D) Subduction-zone metamorphism

Q.30 The rock, which **DOES NOT** have a volcanic equivalent is

(A) Anorthosite (B) Granite (C) Syenite (D) Gabbro

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Space for rough work

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Answer Table for Objective Questions

Write the Code of your chosen answer only in the 'Answer' column against each Question No. Do not write anything else on this page.

Question No.	Answer	Do not write in this column	Question No.	Answer	Do not write in this column
01			16		
02			17		
03			18		
04			19		
05			20		
06			21		
07			22		
08			23		
09			24		
10			25		
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12			27		
13			28		
14			29		
15			30		

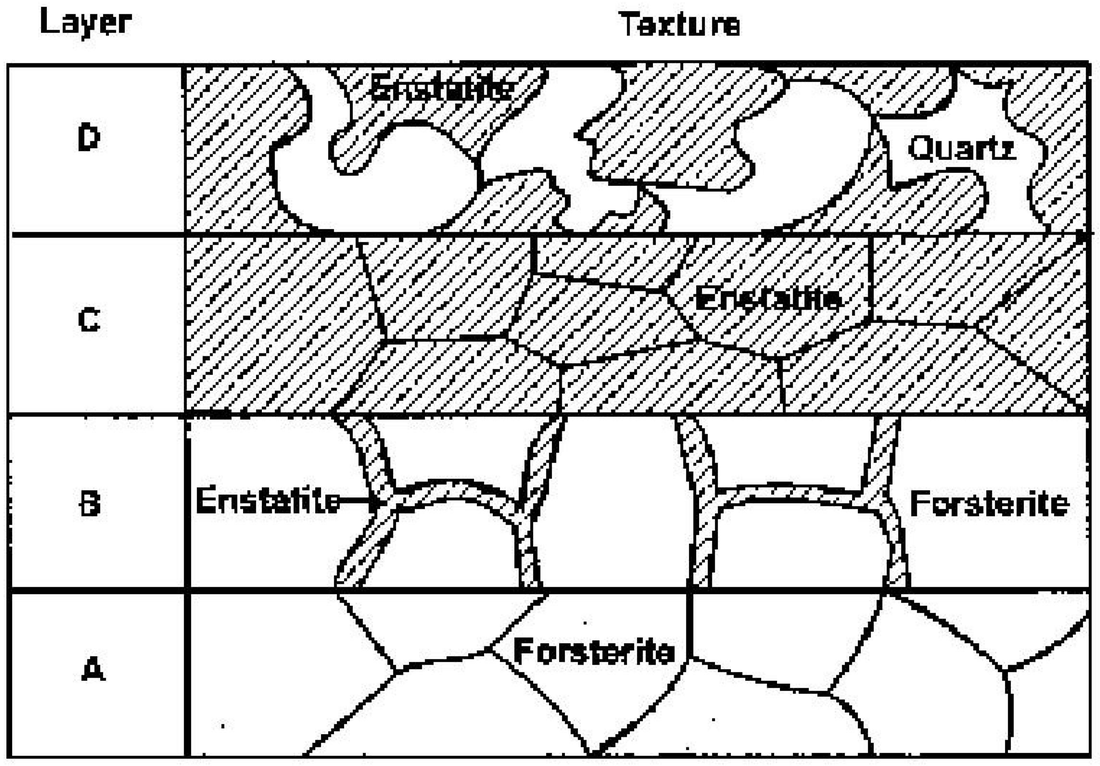
FOR EVALUATION ONLY

No. of correct answers		Marks	(+)
No. of incorrect answers		Marks	(–)
Total marks in question nos. 1-30			( )

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Q.31 The diagrammatic sketch below shows textures and mineral assemblages of rocks from a layered igneous province.



(a) (i) Name the rock in layer A. (3)

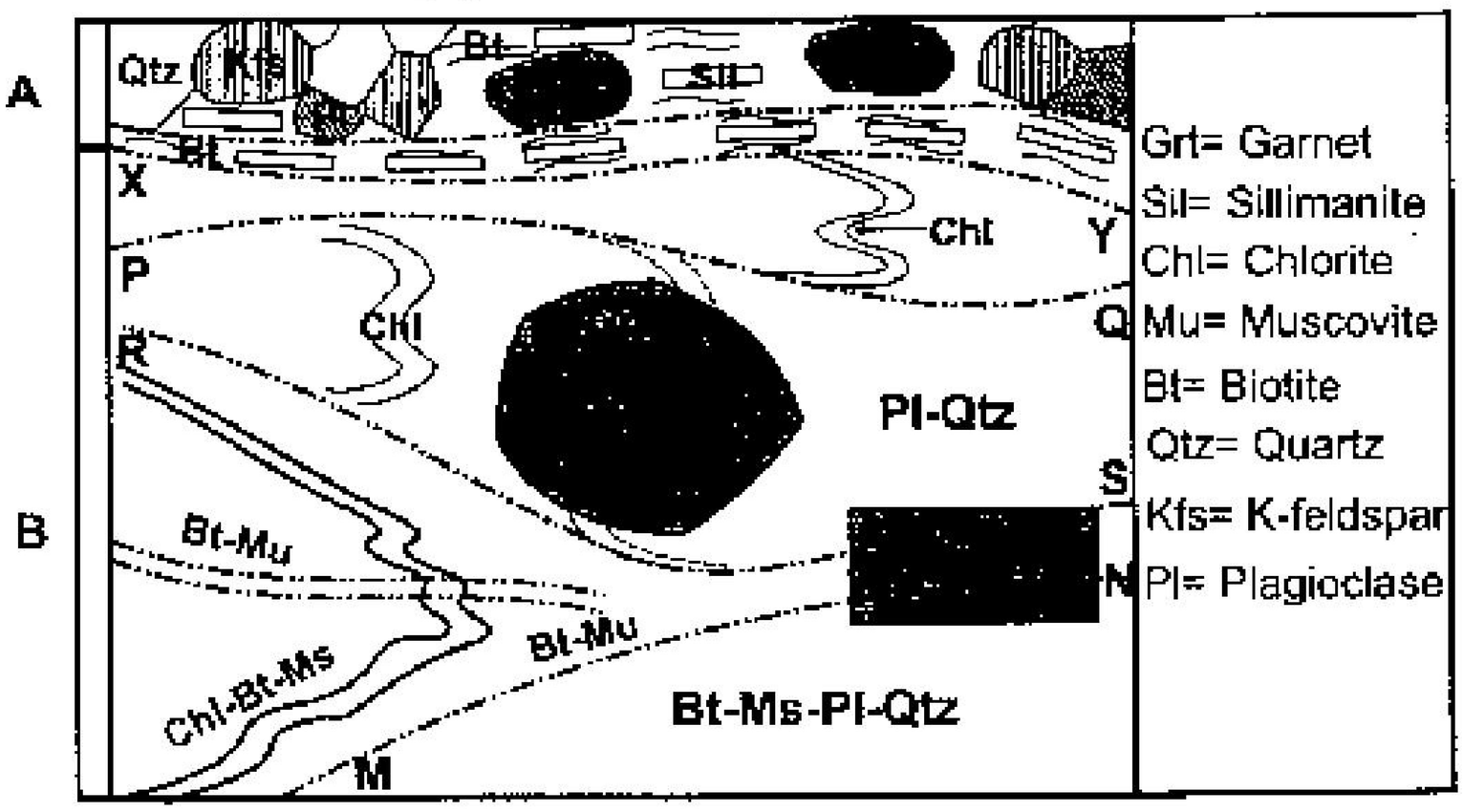
(ii) Name a simplified binary chemical system which can explain the origin of rocks A to D. (3)

(b) (i) Which broad process of magmatic crystallization can give rise to the sequence of rocks shown in the above figure? (3)

(ii) Name the layers of rocks which represent crystallization at binary eutectic and binary peritectic. (6)

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Q.32 (a) Given below is a thin section sketch (not to scale) of a banded metamorphic rock of normal pelite bulk rock composition. The rock shows development of different generations of schistosity and mineral assemblage. Band A has a mineral association of Kfs+Qtz+Grt+Sil+Bt+Pl, while band B contains Mu+Bt+Qtz+Grt+Chl+Pl. Answer the following questions.



(i) Identify the facies of metamorphism indicated by bands A and B. (6)

(ii) Giving suitable reason, identify a possible tectonic discontinuity surface in the sketch. (3)

(b) Name the high-P, low-T and low-P, low-T polymorphs of Al_2SiO_5. (6)

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Q.33 (a) Given below is an equation relating to the decay of a radioactive atom, $N(t) = N(t_0)e^{-\lambda t}$ where $N(t)$ = Number of atoms present at time t, $N(t_0)$ = Original number of radioactive atoms at time $t = 0$ and λ = Decay constant.

(i) Deduce an equation relating the half life of the radioactive atom to decay constant. (3)

(ii) Using equation in 33(a)(i), estimate the decay constant, which would be suitable for dating 4.2 Ga old rock. Assume that the rock has roughly equal proportions of parent and daughter atoms at present. Consider ln 2 = 0.693. (3)

(b) Name the radioactive isotopes, which yield ^{206}Pb, ^{207}Pb and ^{208}Pb. (9)

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Q.34 (a) Consider a biaxial mineral with a hypothetical pleochroic scheme, X = Green, Y = Yellow, Z = Pink. Answer the following questions.

(i) For an optic orientation with the maximum birefringence, what will be the range of colour of the mineral under plane polarized light? Give reason. (6)

(ii) For an optic orientation showing yellow colour under plane polarized light, what will be the nature of biaxial indicatrix section? (3)

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(b) (i) Draw a neatly labelled sketch of the indicatrix of a uniaxial positive mineral. (3)

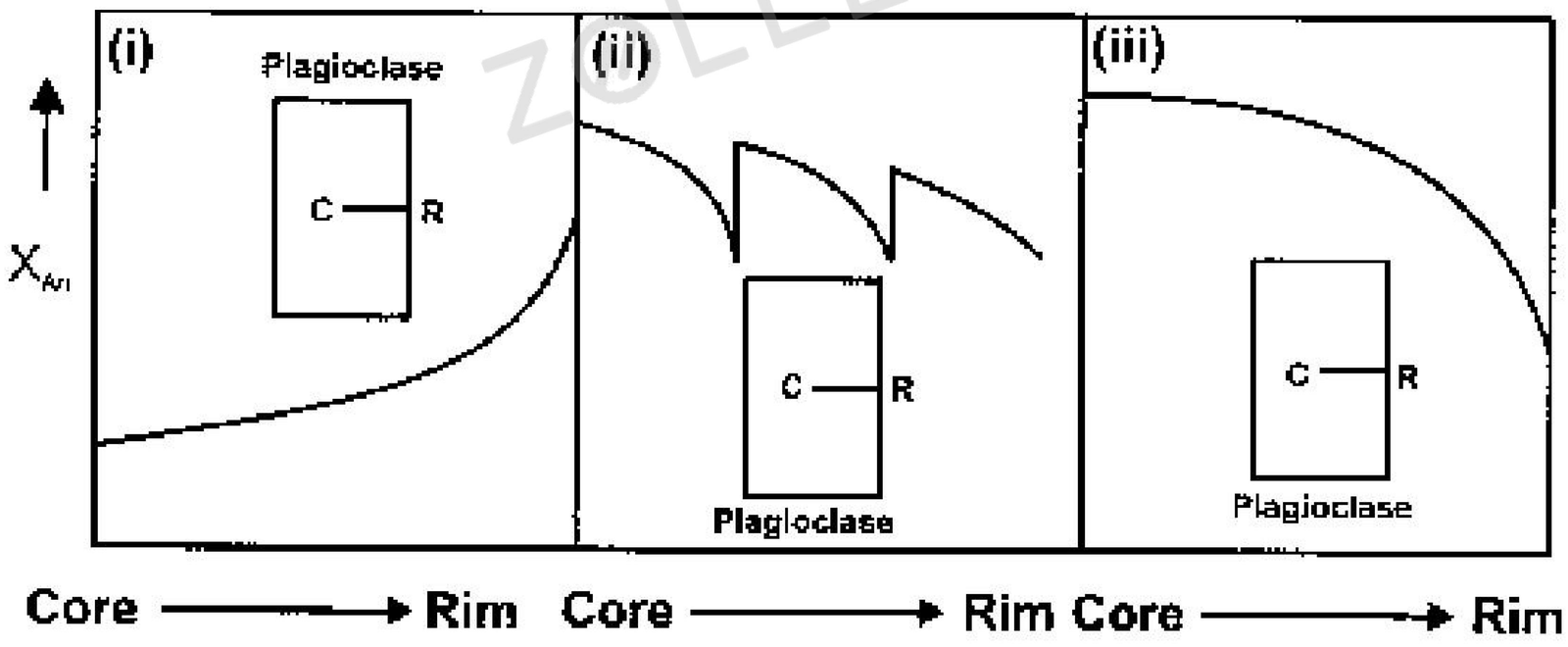
(ii) What is the optic sign of nepheline? (3)

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Q.35 (a) (i) Why is the binary eutectic absent in an isobaric T-X diagram in the chemical system, $CaAl_2Si_2O_8$-$NaAlSi_3O_8$? (3)

(ii) Name the species of plagioclase with a chemical composition of $An_{40}Ab_{60}$. (3)

(b) Name the type of plagioclase compositional zoning indicated in diagrams (i), (ii) and (iii). X_{An}= Mole fraction of anorthite in plagioclase. The arrow indicates the direction of increasing X_{An}. (9)



(i)

(ii)

(iii)

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Q.36 (a) (i) Some of the important stratigraphic units of the Aravalli Craton are as follows: Delhi Supergroup, Marwar Supergroup, Aravalli Supergroup and Banded Gneissic Complex. Arrange these into a correct stratigraphic order. (6)

(ii) Which is the oldest stratigraphic unit amongst the following: Bhander Limestone, Kajrahat Limestone, Rohtas Limestone? (3)

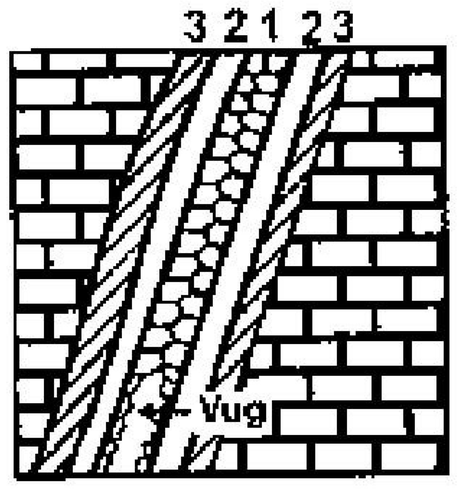
(b) (i) Name the Neoproterozoic felsic volcanic rock that is found in northwestern India. (3)

(ii) What is the name of the 200-km long, arcuate volcanic belt, lying to the north of the Singhbhum Craton? (3)

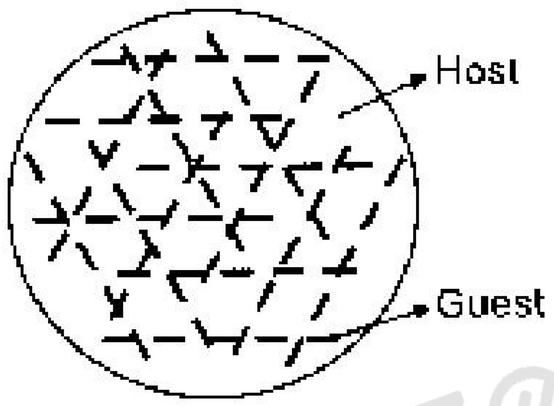
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Q.37 (a) (i) Identify the following ore structures formed by hydrothermal processes: (6)

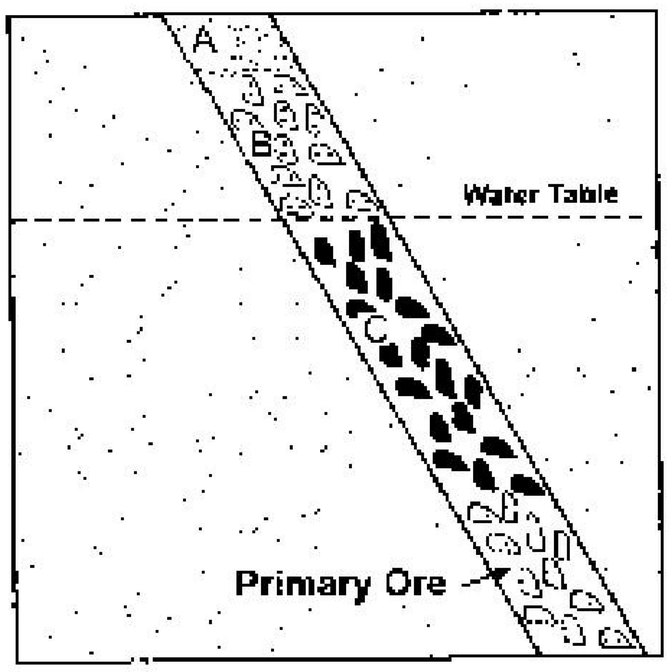




(ii) Identify the ore texture shown below: (3)



(b) (i) Given below is an idealized sketch showing the development of different alteration zones (A, B and C) above a primary copper sulphide ore body. Name the zones A, B and C. (3)



A :

B :

C :

(ii) Write the names of <u>two</u> characteristic ore minerals from each zone B and C. (3)

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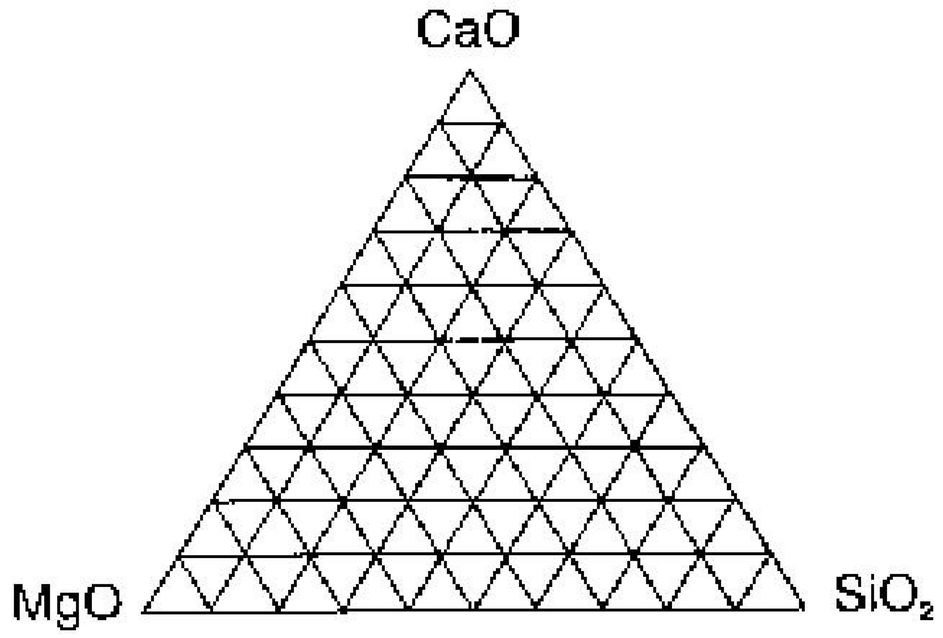
Q.38 (a) Draw the stratum contour patterns of the following structural features:
(i) Non-plunging synform, (ii) Dome, (iii) E-W trending doubly plunging antiform with the southern limb dipping steeper than the northern limb. (9)

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(b) A square is subjected to (i) Pure shearing and (ii) Simple shearing. Show the resultant geometric shapes. (6)

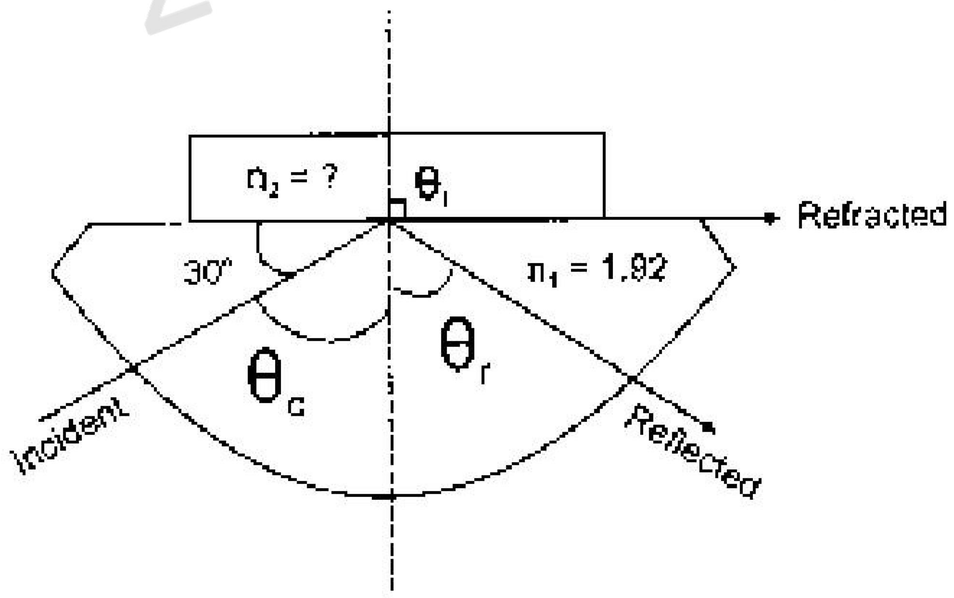
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Q.39 (a) (i) Plot the chemical composition of the mineral, $Ca_2MgSi_2O_7$ in the ternary compositional space, MgO-SiO_2-CaO. (3)



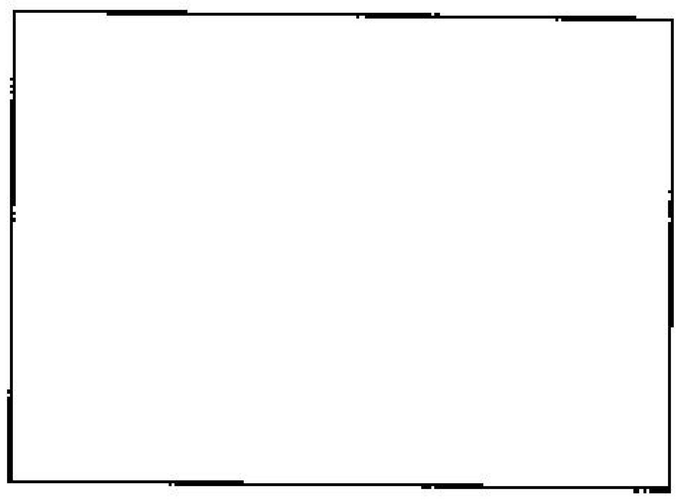
(ii) Draw the stereogram of crystal class 2/m. Name the relevant crystal system. (6)

(b) The RI of a hemicylinder is 1.92. An unknown mineral is placed on the flat surface of the hemicylinder. Determine the RI of the mineral (n_2). (6)

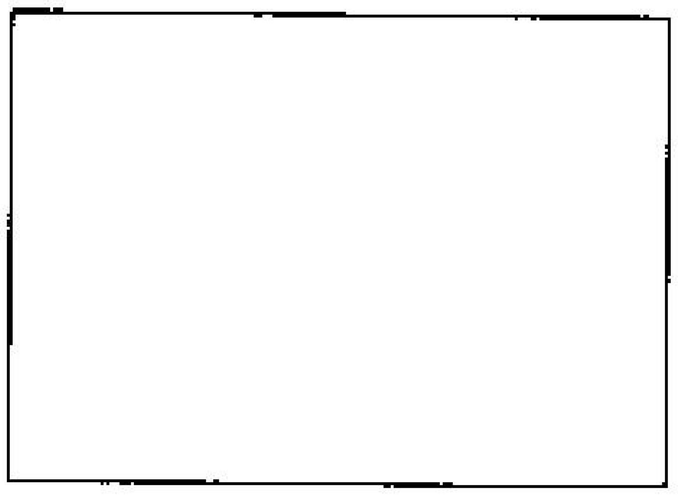


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Q.40 (a) (i) **Draw rectangular- and trellis-type drainage patterns.** (6)



Rectangular Pattern



Trellis Pattern

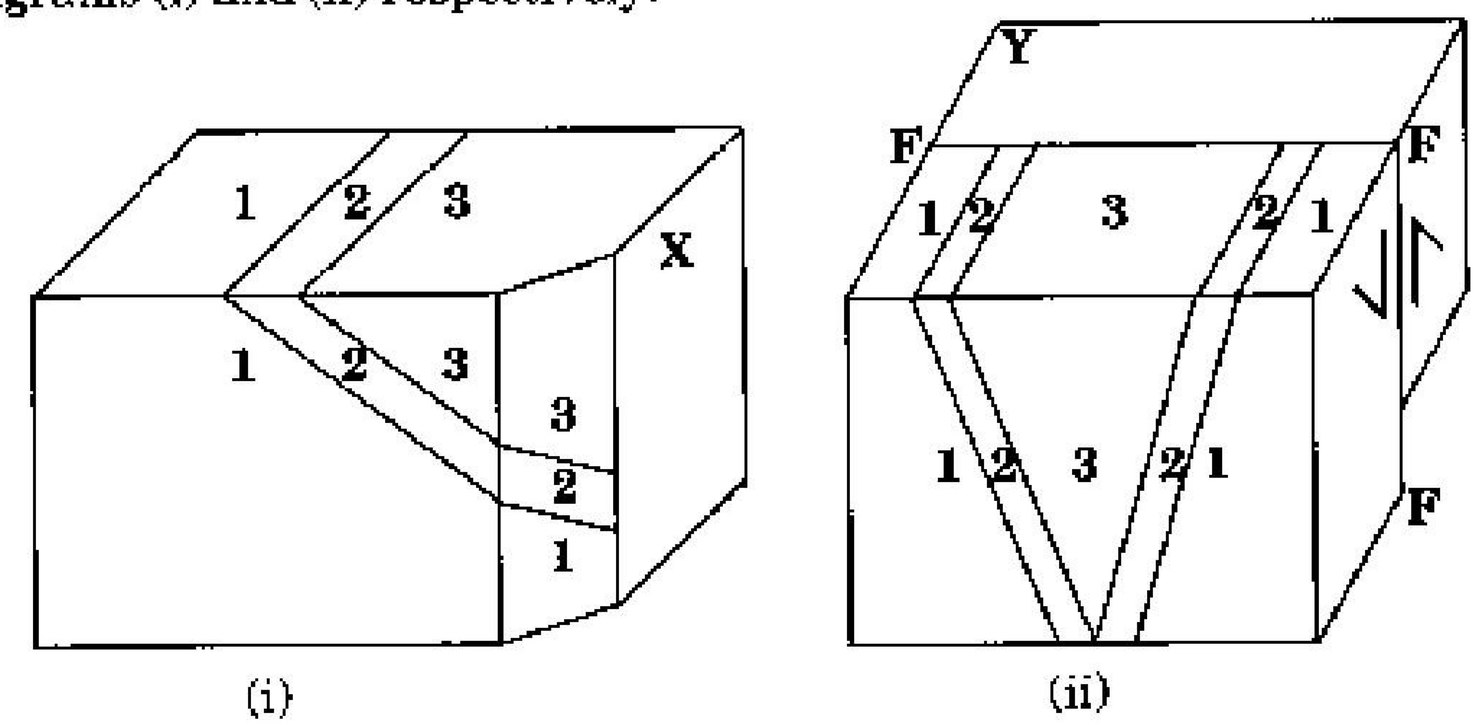
(ii) **Define an antecedent stream.** (3)

(b) (i) **Show characteristic shapes in profile sections of two valleys, formed by glacier and river in an actively rising mountainous region.** (3)

(ii) **How are terminal moraines formed?** (3)

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Q.41 (a) Draw the outcrop patterns of beds 1, 2 and 3 on X and Y surfaces of the block diagrams (i) and (ii) respectively. (6)



(b) With the help of three labelled block diagrams, show the sequence of events stated in (i) to (iii). (9)

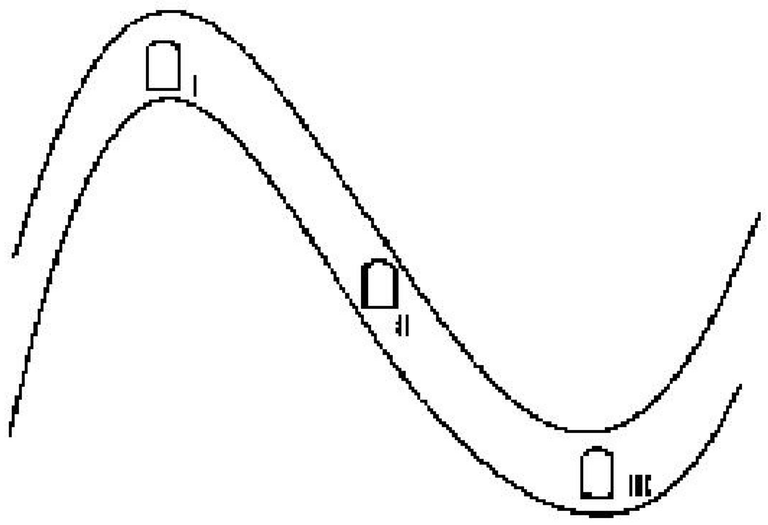
(i) On a flat ground surface, a normal sequence of westerly dipping beds 1 (oldest), 2 (intermediate) and 3 (youngest) are exposed. A N-S striking vertical fracture, cutting across the beds has developed.

(ii) Along this fracture, these beds are faulted with the upthrown block (UTB) in the west.

(iii) The upthrown block is then eroded to the level of the downthrown block, resulting in the repetition of beds.

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Q.42 (a)



(6)

Three locations (I, II and III) are indicated **in the competent layer** of a non-plunging cylindrical fold for possible tunnel construction. The tunnel axis is assumed to be parallel to the fold axis. Which location is considered to be the best for tunnelling? Give reasons for your answer.

(b) Define the following hydrological terms: (9)

Zone of Aeration, Water Table and Perched Water Table.

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Q.43 (a) Indicating the direction of aperture, show by labelled diagrams the typical geometrical patterns of suture lines found in the following ammonoids. (9)

(i) **Nautiloid**, (ii) **Goniatite** and (iii) **Ceratite**

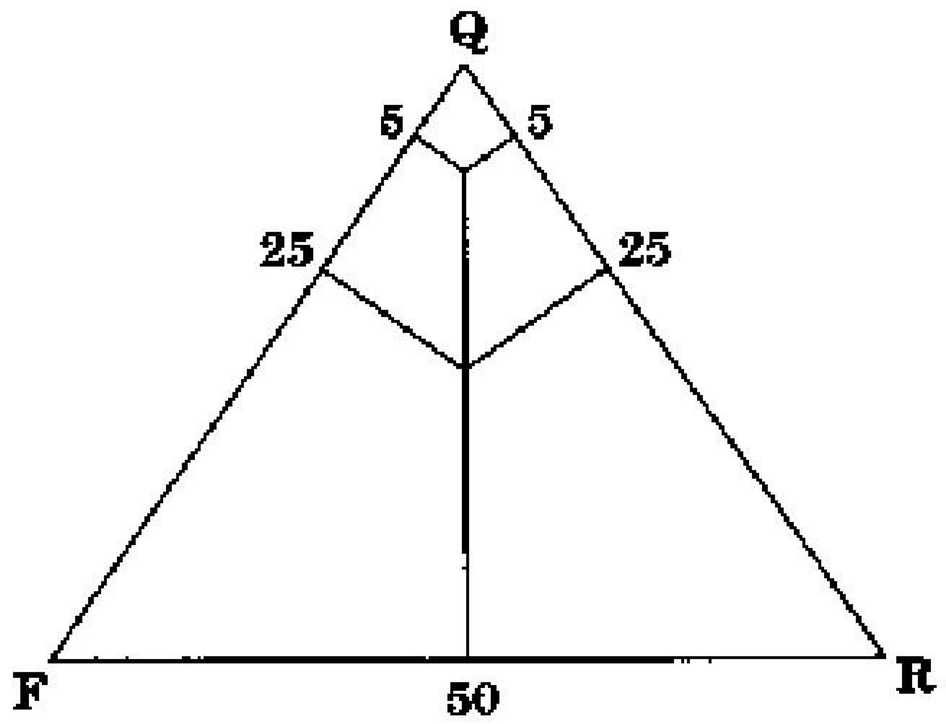
(b) (i) What is the age of Syringothyris Limestone? (6)

(ii) Amongst the fossils named below, find out the burrowing and the swimming forms (one each):

Lima, Venus, Teredo, Gryphea, Lithophaga, Pecten, Lucina

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Q.44 (a) (i) Identify the fields of subarkose and lithic arenite in the ternary Quartz (Q)-Feldspar (F)-Rock Fragment (R) diagram. (6)



(ii) Name the sandstone which is mineralogically mature but texturally immature. (3)

(b) With the help of diagrammatic sketches, distinguish between flaser lamination and lenticular lamination. (6)

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