



2013 – GG

Test Paper Code : GG

Time : 3 Hours Maximum Marks : 100

**INSTRUCTIONS**

1. This question-cum-answer booklet has 20 pages and has 30 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. 3. 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 **2 (Two)** marks.
  - (b) For each wrong answer, you will be awarded **-0.5 (Negative 0.5)** 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 fill in the blank type and descriptive type questions only in the space provided after each question. No negative marks for fill in the blank type questions.
6. Do not write more than one answer for the same question. In case you attempt a fill in the blank or a descriptive 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, cellular phone and electronic gadgets in any form are NOT allowed. Non-Programmable calculator is 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.



2013 – 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



**IMPORTANT NOTE FOR CANDIDATES**

- Questions 1-10 (objective questions) carry *two* marks each, questions 11-20 (fill in the blank questions) carry *three* marks each and questions 21-30 (descriptive questions) carry *five* marks each.
- The marking scheme for the objective type question, is as follows:
  - (a) For each correct answer, you will be awarded **2 (Two)** marks.
  - (b) For each wrong answer, you will be awarded **-0.5 (Negative 0.5)** 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.
- **There is no negative marking for fill in the blank questions.**
- **Write the answers to the objective questions in the Answer Table for Objective Questions provided on page 3 only.**

**Objective Questions**

- Q.1 The oldest rocks in the present ocean floor have age in the range:  
(A) 4.0-4.6 billion years (B) 2.0-2.5 billion years  
(C) 185-200 million years (D) 60-65 million years
- Q.2 Which one of the following morphological features is **ABSENT** in the Class Pelecypoda?  
(A) Umbo (B) Deltidium (C) Pallial sinus (D) Resilifier
- Q.3 Match the lithostratigraphic units in Group I with their corresponding geological period in Group II.
- | Group I                | Group II               |
|------------------------|------------------------|
| P. Mamal Formation     | 1. Triassic            |
| Q. Fenestella Shale    | 2. Permian             |
| R. Maleri Formation    | 3. Cretaceous          |
| S. Lameta Formation    | 4. Carboniferous       |
| (A) P-2, Q-4, R-1, S-3 | (B) P-4, Q-2, R-1, S-3 |
| (C) P-2, Q-3, R-4, S-1 | (D) P-4, Q-1, R-2, S-3 |
- Q.4 Which one of the following represents a closed form?  
(A) Tetragonal prism (B) Dihexagonal pyramid  
(C) Orthodome (D) Trigonal dipyramid
- Q.5 The tightness of a fold should be estimated in sections  
(A) parallel to both the fold axis and the axial plane  
(B) parallel to the fold axis and perpendicular to the axial plane  
(C) perpendicular to the profile plane of the fold  
(D) perpendicular to the fold axis

Q.6 Match the geological features listed in **Group I** with their corresponding processes in **Group II**.

**Group I**

- P. Cumulate  
 Q. Migmatite  
 R. Fenitized rock  
 S. Pillow basalt  
 (A) P-2, Q-1, R-4, S-3  
 (C) P-2, Q-3, R-4, S-1

**Group II**

1. Sub-aqueous eruption  
 2. Magmatic segregation  
 3. Anatexis  
 4. Volatile transport  
 (B) P-4, Q-3, R-1, S-2  
 (D) P-4, Q-2, R-2, S-1

Q.7 Match the minerals listed in **Group I** with their corresponding twin types in **Group II**.

**Group I**

- P. Staurolite  
 Q. Quartz  
 R. Gypsum  
 S. Orthoclase  
 (A) P-2, Q-4, R-1, S-3  
 (C) P-2, Q-3, R-4, S-1

**Group II**

1. Japan twin  
 2. Swallow-tail twin  
 3. Carlsbad twin  
 4. Cruciform twin  
 (B) P-4, Q-2, R-1, S-3  
 (D) P-4, Q-1, R-2, S-3

Q.8 Which one of the following is a glacio-fluvial deposit?

- (A) Esker (B) Till (C) Moraine (D) Drumlin

Q.9 Malachite and Azurite are characteristic ore minerals of

- (A) Gossan zone (B) Zone of oxidation  
 (C) Zone of supergene enrichment (D) Protore

Q.10 Which of the following is **NOT** a depositional sedimentary structure?

- (A) Trough cross-bedding (B) Massive bedding  
 (C) Convolute bedding (D) Graded bedding



**Answer Table for Objective Questions**

Write the Code of your chosen answer only in the 'Answer' column against each Question Number. Do not write anything else on this page.

Question Number	Answer	Do not write in this column
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		

**FOR EVALUATION ONLY**

Number of Correct Answers		Marks	(+)
Number of Incorrect Answers		Marks	(-)
Total Marks in Question Nos. 1-10			( )

**Fill in the blank questions**

Q.11 The faces present in a zone of a crystal are (011), (010), (011); what is the zone axis?

Ans:

Q.12 The hardest silicate mineral in Mohs scale of hardness is:

Ans:

Q.13 A commonly found monomineralic sedimentary rock when metamorphosed also forms a monomineralic metamorphic rock. The same mineral also forms a rare monomineralic igneous rock. The component mineral belongs to the hexagonal system and is uniaxial in character. The mineral is:

Ans:

Q.14 A dark coloured rock with high specific gravity is composed of orthopyroxene, clinopyroxene, plagioclase and a minor proportion of quartz. The constituent minerals have similar grain size and are equidimensional with straight boundary contacts that meet in triple junctions with approximately  $120^\circ$  between them. The rock is called

Ans:



Q.15 An amphibolite terrane has a penetrative foliation striking  $N30^{\circ}E$  and dipping  $45^{\circ}$  easterly. This is unconformably overlain by a sandstone unit whose bedding strikes  $N45^{\circ}W$  and dips  $10^{\circ}$  northeasterly. What is the type of unconformity?

Ans:

Q.16 A sulfide mineral is magnetic in nature and has black streak. The sulfur atomic proportion in the mineral is between 50-55%. Identify the mineral.

Ans:

Q.17 A group of multi-cellular, bivalved, bilaterally symmetrical, marine, benthic and inequivalved organisms proliferated during the Ordovician for the first time. Name the group.

Ans:

Q.18 The sedimentary structure characterized by bulbous, downward-directed protuberances of a sandstone bed into the underlying mudrock horizon is called

Ans:

Q.19 A river flows from north to south along a V-shaped valley with steep slopes ranging from 60-70°. The country rocks in the area are metamorphic, with a prominent foliation striking N10°E and dipping at an angle of 40° towards west. There is a proposal of road alignment. Considering the geological conditions described above, suggest which bank of the river is more suitable for road construction.

Ans:

[Empty dashed box for answer to Q.19]

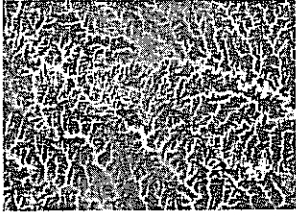
Q.20 The type of plate boundary associated with deep focus earthquakes is

Ans:

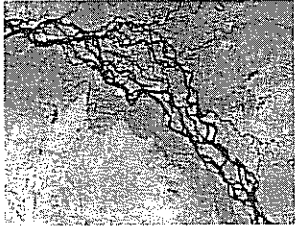
[Empty dashed box for answer to Q.20]

**Descriptive questions**

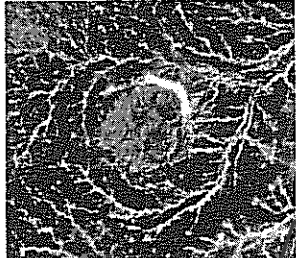
Q.21 Identify the following five drainage patterns.



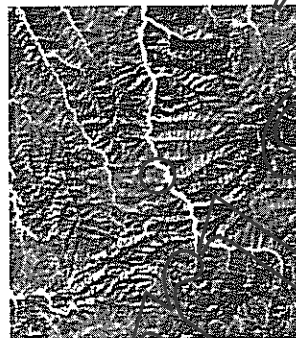
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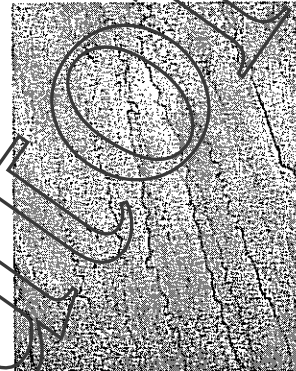
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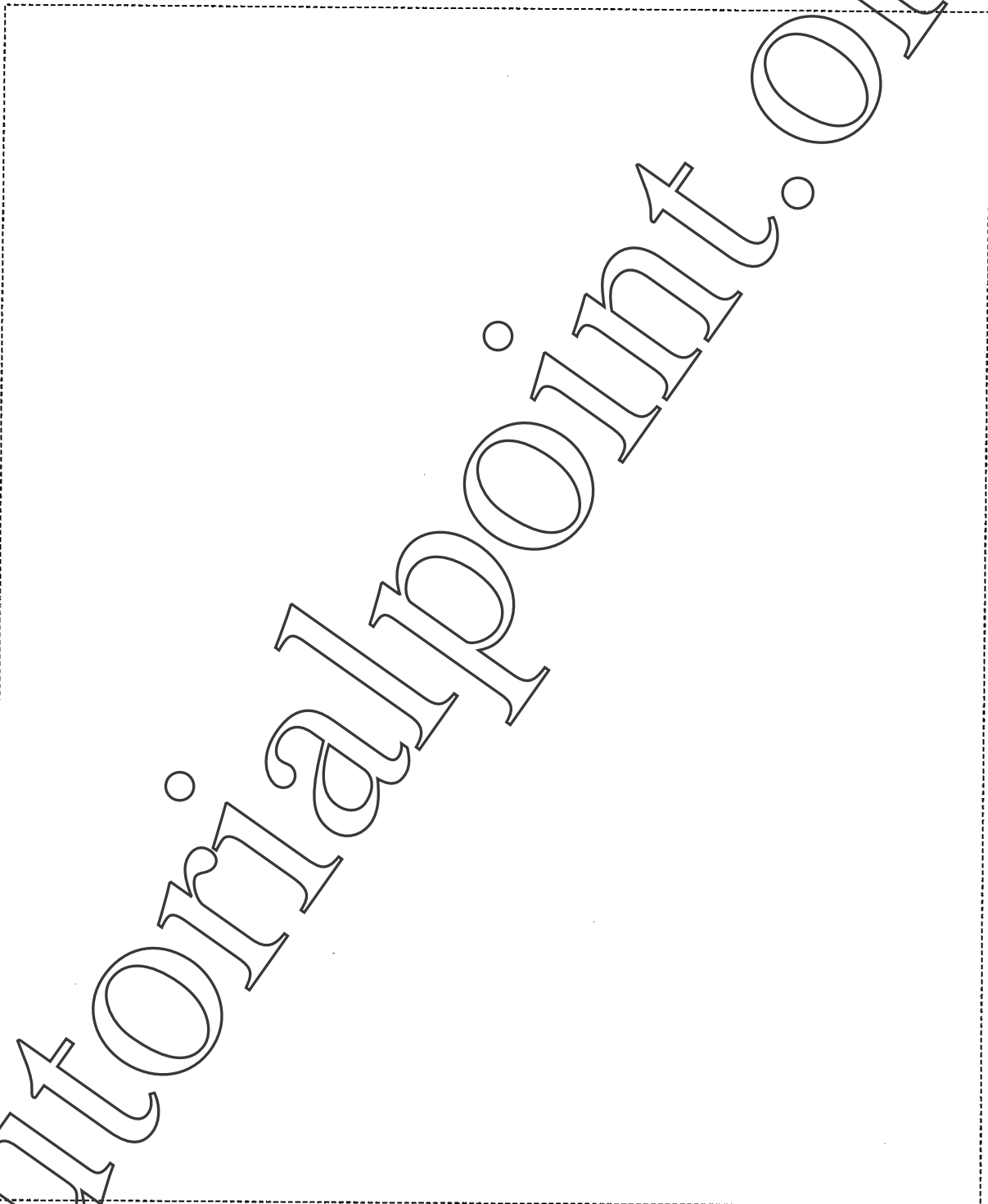
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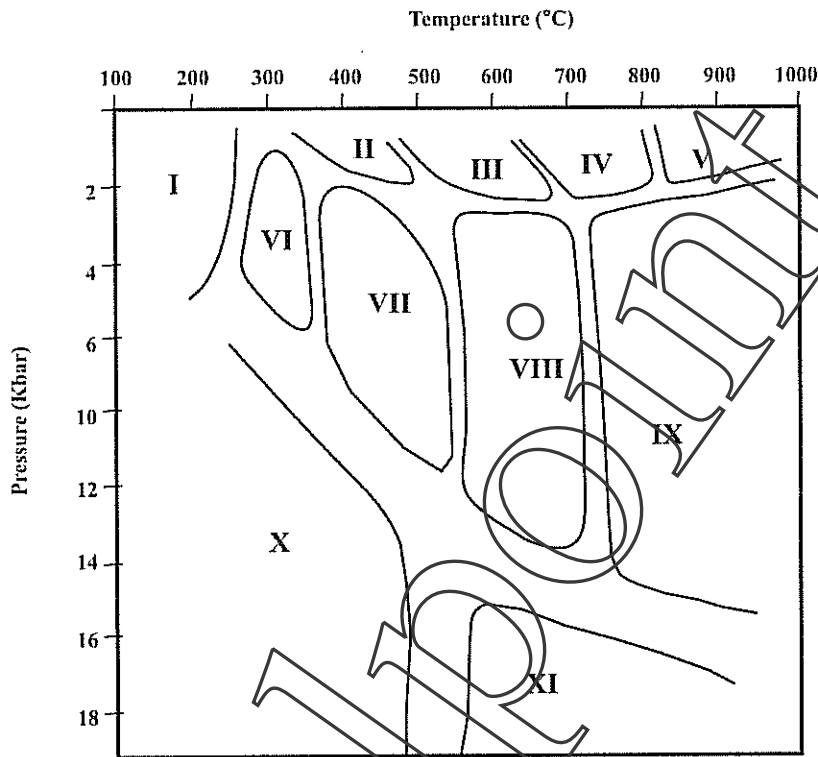
Q.22 Name the crescent-shaped easterly concave Proterozoic sedimentary basin of India. Give the stratigraphic succession (starting with the oldest at the bottom) of the basin at Group rank. Name the major diamond-bearing lithostratigraphic unit in this basin.

Space for the answer



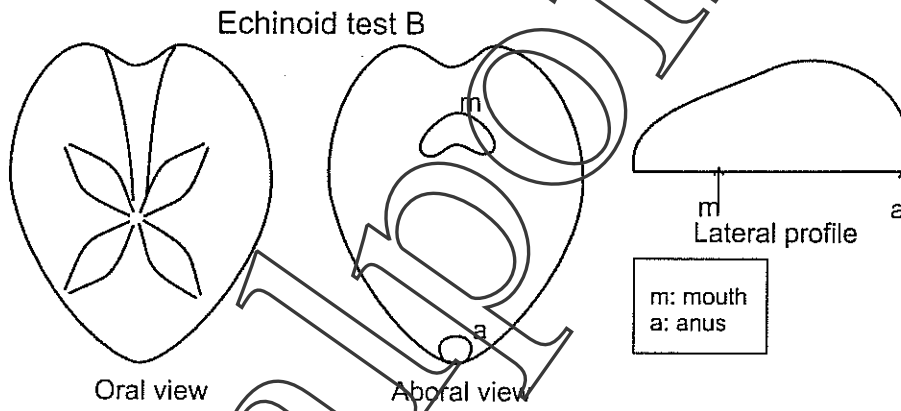
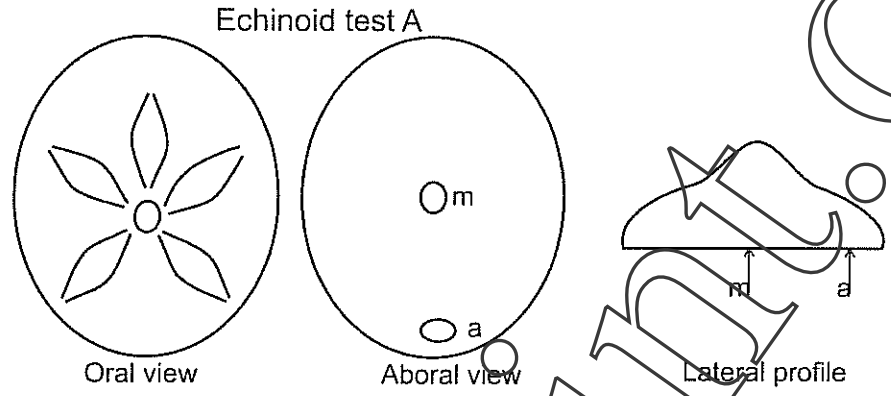
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- Q.23 The following figure shows various metamorphic facies in P-T space (numbered as domains I to XI). In this figure, name the domains and the corresponding facies in which the following two mineral assemblages would stabilize by metamorphism of basic rocks: (lawsonite + jadeite) & (prehnite + pumpellyite). Which domain and corresponding facies will **NOT** contain plagioclase feldspar in metamorphosed basic rocks? Explain why.



Space for the answer

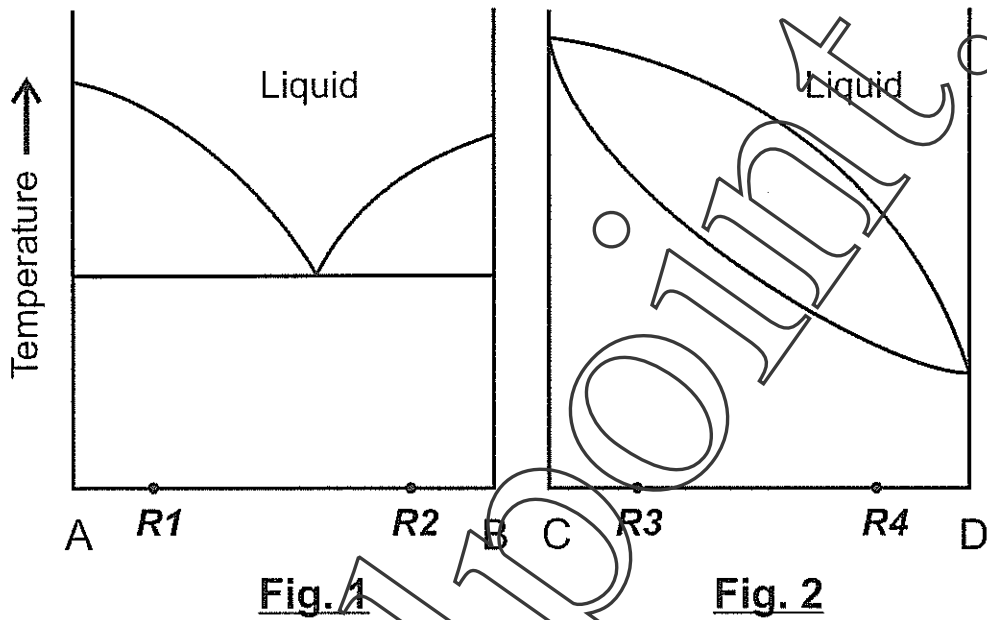
Q.24 The figures below show different views of two hypothetical echinoid tests 'A' and 'B'. Differentiate between the two echinoid tests based on each of the following five features: symmetry, shape, lateral profile, ambs and periproct. The answers for each parameter should be given in one or two words in the table given below.



m: mouth  
a: anus

	Echinoid test A	Echinoid test B
Symmetry		
Shape		
Lateral profile		
Ambs		
Periproct		

Q.25 Fig. 1 and Fig. 2 given below represent schematic phase relations in two binary systems at identical and constant pressure. A and B have eutectic relationship while C and D form a solid solution. The temperature scale (Y-axis) is same in both figures. R1, R2, R3 and R4 represent four rock compositions in these two systems. Write the sequence in which melts will start forming in these rocks (R1, R2, R3 and R4) with increasing temperature (without changing pressure). Explain with justification, the order in which the solid component will completely melt (under equilibrium condition) in R1, R2, R3 and R4 as heating proceeds.



Space for the answer

A large dashed rectangular box is provided for the student to write their answer to the question.

Q.26 Tables 1 and 2 provide jumbled up data on depth and descriptions of zones in the interior of the earth. Select appropriate entries from these tables and complete Table 3.

**Table 1**

Average depth in km
0 – 35
0 – 100
35 – 100
35 – 2890
100 – 200/250
2890 – 5150
5150 – 6360

**Table 2**

Zone characters
Brittle solid zone; moves laterally as on a conveyor belt; overlies the seismic Low Velocity Zone (LVZ)
Solid high density zone; Ni-Fe composition
Interpreted to be <i>partially</i> molten; marked by the presence of convection cells
<i>Completely</i> molten zone; high density, Ni-Fe composition
Brittle solid zone; bounded by Moho at the base
Contains several transition zones, Gutenberg discontinuity at the base

**Table 3**

Zones in the interior of the Earth	Depth (Choose one match from Table 1)	Zone character (Choose one match from Table 2)
Crust		
Lithosphere		
Asthenosphere		
Mantle		
Outer core		



Q.27 Two sedimentary structures occur commonly in tidal regions and are caused by the mixing of sand- and mud-sized fractions. Name the structure when mud-deposition is intermittent with ripple migration causing mud to be deposited in ripple troughs. Name the isolated ripples that occur as cross-laminated lenses within mud or mudstone in a vertical section. Differentiate between desiccation cracks and syneresis cracks on the basis of morphology, process of formation, and depositional environment.

Space for the answer

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Q.28 Which genetic type of mineral deposit is likely to form at the contact of impure limestone and intrusive granite? Out of the following metals (Cr, Ni, W, Pt, Sn, Mo, Au) select only those which are found in this type of geological association and give reasons. If the same limestone is intruded by dolerite, can a similar type of ore deposit form? Justify your answer.

Space for the answer

A large rectangular area enclosed by a dashed line, intended for writing the answer to the question.

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Q.29 In an alluvial terrain, the general ground water table is at a depth of 12.5 m below the ground surface. What is the name of the aerated zone above the ground water table? In this terrain, during exploration for ground water supply for a village, a clay lens was encountered at a depth of 8.5 m below the ground surface. The clay lens has a spatial extent of 1 km x 1 km and a vertical thickness of 0.5 m. What is the type of aquifer formed above the clay lens? Comment on the suitability of this aquifer as a source for long-term supply of water. What will happen to this aquifer if the clay lens is punctured through?

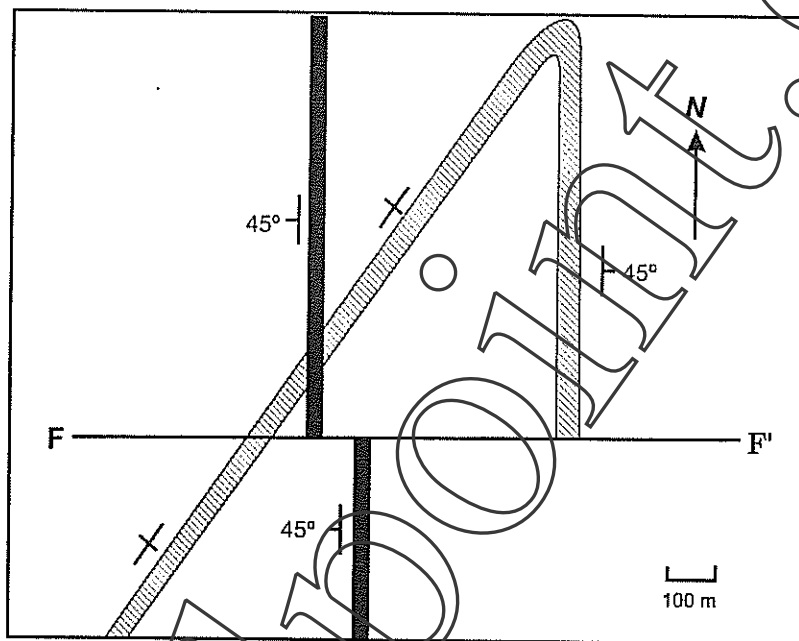
Space for the answer

Tutu Oriental Point.

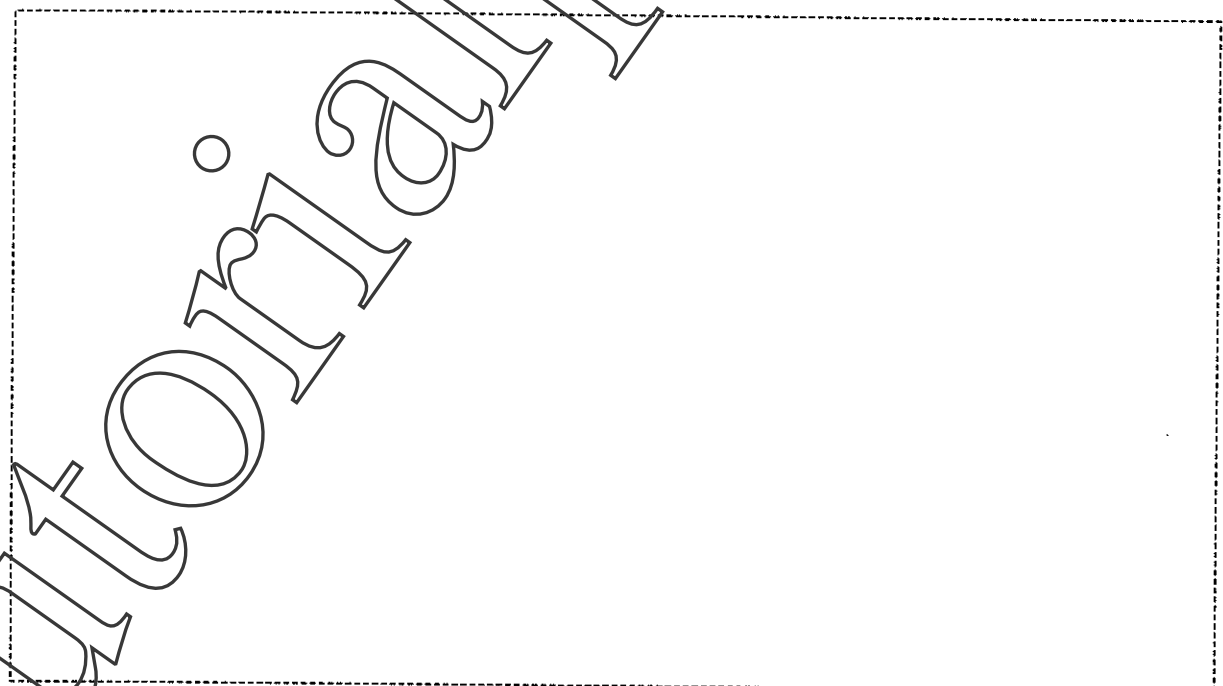


A


Q.30 The geological map below shows a folded quartzite bed (hatched) in which the western limb is vertical, and the eastern limb strikes due north and dips  $45^\circ$  to the east. A north-south trending dolerite dyke (solid black) that dips  $45^\circ$  westerly cuts across the folded bed. An east-west trending vertical fault (F-F') cuts across all the rock types. Explain why the western limb of the fold is apparently not displaced by the fault. Compute the net slip on the fault F-F'. Trace the eastern limb of the fold south of the fault F-F' in the map below.



Space for the answer



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2013 - GG Objective Part (Question Number 1 – 10)	
Total Marks	Signature

Fill in the blanks Part and Descriptive Part					
Question Number	Marks		Question Number	Marks	
11			21		
12			22		
13			23		
14			24		
15			25		
16			26		
17			27		
18			28		
19			29		
20			30		
Total Marks in Fill in the blanks Part and Descriptive Part					

Total (Objective Part)	:	
Total (Fill in the blanks Part and Descriptive Part)	:	
Grand Total	:	
Total Marks (in words)	:	
Signature of Examiner(s)	:	
Signature of Head Examiner(s)	:	
Signature of Scrutinizer	:	
Signature of Chief Scrutinizer	:	
Signature of Coordinating Head Examiner	:	