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2011-GG

Test Paper Code: GG

Time: 3 Hours **Maximum Marks: 300**

INSTRUCTIONS

1. The question-cum-answer booklet has **X** 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. **Y**. 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 and 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.
12. Refer to special instructions/useful data on the reverse.

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2011-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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Special Instructions/ Useful Data

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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 Glaciers are downward moving bodies of

(A) only snow
(B) mostly ice and some snow at the top
(C) mostly snow and some ice at the top
(D) snow and ice in alternate layers

Q.2 The basal section of amphibole is six-sided while the same of pyroxene is eight-sided. This is because of the absence of the crystal face

(A) {100} (B) {011} (C) {111} (D) {010}

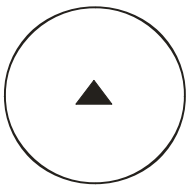
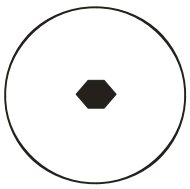
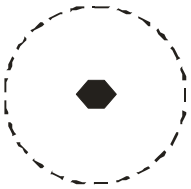
Q.3 The mean density of Earth is about

(A) 2650 kg m^{-3} (B) 2750 kg m^{-3} (C) 4400 kg m^{-3} (D) 5500 kg m^{-3}

Q.4 The surface slope of shield volcano is gentle, but strato-volcano is steep-sided. This is due to variation in

(A) environment of eruption
(B) duration of eruption
(C) viscosity of magma
(D) position with respect to latitude

Q.5 Identify the correct stereogram depicting the $\bar{6}$ symmetry in crystals.

(A)  (B)  (C)  (D) 

Q.6 Match the mineral in **Group I** with corresponding property in **Group II**.

Group I	**Group II**
P. Fayalite	1. Purple colour
Q. Calcite	2. Specific gravity ~ 4.4
R. Autunite	3. Radioactive
S. Amethyst	4. Scalenohedron

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

Q.7 Match the item in **Group-I** with appropriate item in **Group-II**.

Group I	**Group II**
P. Beach placers	1. Submarine hydrothermal system
Q. Sulfide chimney	2. Mechanical concentration
R. Bauxite	3. Biogenic
S. Phosphorite	4. Residual Concentration

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

Q.8 Which of the following landforms is **NOT** the result of strike-slip faulting?

(A) stream deflection (B) river terrace (C) pressure ridge (D) sag pond

Q.9 An apatite crystal cut perpendicular to c-axis shows outward movement of isochromes in NE and SW quadrants on insertion of quartz wedge from SE quadrant because apatite is

(A) uniaxial positive
(B) biaxial negative
(C) uniaxial negative
(D) biaxial positive

Q.10 Which of the given minerals is a product of reaction between siliceous magmatic fluid and limestone?

(A) andalusite (B) fayalite (C) muscovite (D) wollastonite

Q.11 Determine the correctness or otherwise of the following **Assertion [a]** and **Reason [r]**.
Assertion: Blueschist can form in the subduction zone.
Reason: Geothermal gradient in the subduction zone is low compared to that in stable cratons.

(A) Both **[a]** and **[r]** are true and **[r]** is the correct reason for **[a]**
(B) Both **[a]** and **[r]** are true but **[r]** is **NOT** the correct reason for **[a]**
(C) Both **[a]** and **[r]** are false
(D) **[a]** is true but **[r]** is false

Q.12 A plutonic rock consisting only of plagioclase, pyroxene and hornblende as major minerals is known as

(A) dunite
(B) lherzolite
(C) granite
(D) diorite

Q.13 Match the feature in **Group I** with appropriate taxon in **Group II**.

Group I	**Group II**
P. Monomyarian	1. Echinoidea
Q. Deltidial plates	2. Anthozoa
R. Corona	3. Pelecypoda
S. Epitheca	4. Brachiopoda

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

Q.14 A normal fault has a dip of 45^{o} towards east, and a throw of 100 metres. The heave of the fault (in metres) is

(A) 50 (B) 100 (C) 200 (D) 400

Q.15 Leakage through rock fractures below a dam can be reduced significantly by

(A) bolting (B) grouting (C) drilling (D) blasting

Q.16 Consider the following statements regarding way-up criteria in sets of trough cross-beds.
P: Cross-beds are concave upwards
Q: Cross-beds are truncated towards the top
R: Cross-beds have tangential contact towards the bottom

(A) **P** is true, **Q** is false and **R** is true
(B) **P** is false, **Q** is true and **R** is true
(C) **P** is true, **Q** is true and **R** is true
(D) **P** is false, **Q** is false and **R** is false

Q.17 Match the fossil group in **Group I** with corresponding stratigraphic unit in **Group II**.

Group I	**Group II**
P. Equidae	1. Triassic of Spiti
Q. Stromatolites	2. Gondwana Supergroup
R. Dinosaurs	3. Siwalik Group
S. Brachiopoda	4. Vindhyan Supergroup

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

Q.18 The correct sequence of rocks from top to bottom in an ophiolite is

(A) radiolarian chert – pillow basalt – dolerite dyke – gabbro – peridotite
(B) peridotite – pillow basalt – gabbro – dolerite dyke – radiolarian chert
(C) pillow basalt – radiolarian chert – dolerite dyke – gabbro – peridotite
(D) gabbro – pillow basalt – dolerite dyke – radiolarian chert – peridotite

Q.19 Extensional regime in an area is characterized by the presence of

(A) synform and antiform (B) thrust fault
(C) normal fault (D) strike-slip fault

Q.20 Adit is an underground excavation, which is

(A) a horizontal opening giving access to main tunnel
(B) a horizontal opening used for transporting water to powerhouse
(C) a vertical opening used for multiple purposes
(D) an inclined opening providing access to main tunnel

Q.21 Match the scale in **Group I** with corresponding parameter in **Group II**.

Group I	**Group II**
P. Richter scale	1. Earthquake damage
Q. Mercalli scale	2. Hardness
R. Moh's scale	3. Particle size
S. Udden-Wentworth scale	4. Earthquake magnitude

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

Q.22 The ratio of volume of underground water released under gravity to the total volume of saturated aquifer is called

(A) transmissivity
(B) permeability
(C) storage coefficient
(D) specific yield

Q.23 Hanging valley is developed when rate of glacial erosion

(A) is greater in the main valley as compared to the side valley
(B) is greater in the side valley as compared to the main valley
(C) is the same in both the main valley and the side valley
(D) has no effect on either the main valley or the side valley

Q.24 Match the geomorphic features in **Group I** with its corresponding details in **Group II**.

Group I	**Group II**
P. Tombol	1. Lowering of sea level
Q. Bajada	2. Sand ridge connecting islands
R. Erratic	3. Coalescence of alluvial fans
S. Rejuvenated valley	4. Rock fragment carried by glacier

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

Q.25 Choose the correct sequence of ore minerals arranged in the increasing order of hardness.

(A) Pyrite < Galena < Sphalerite < Magnetite
(B) Galena < Sphalerite < Magnetite < Pyrite
(C) Pyrite < Magnetite < Sphalerite < Galena
(D) Galena < Sphalerite < Pyrite < Magnetite

Q.26 Ammonoid genus *Macrocephalites* is found in

(A) Talchir Formation of Satpura Basin
(B) Bijori Formation of Satpura Basin
(C) Patcham Formation of Kachchh
(D) Bhuj Formation of Kachchh

Q.27 Match the item in **Group I** with corresponding item in **Group II**.

Group I	**Group II**
P. Compositional zoning	1. High grade metamorphism
Q. Perthitic texture	2. Low grade metamorphism
R. Segregation banding	3. Disequilibrium crystallization
S. Slaty cleavage	4. Exsolution

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

Q.28 Which of the given mineral species of gold is rare to form in nature?

(A) Au-sulfide (B) Au-telluride (C) Native Au (D) Au-Ag alloy

Q. 29 Which of the following sequences of lithostratigraphic units is arranged in the correct order from older to younger age?

(A) Kamlial – Nagri – Chinji – Dhokpathan – Pinjor – Tatrot
(B) Papaghni – Cheyair – Nallamalai – Kistna
(C) Talchir – Barakar – Pachmarhi – Bijori – Motur – Bagra
(D) Banded Gneissic Complex – Raialo – Aravalli – Delhi

Q. 30 Match the lithostratigraphic unit in **Group I** with corresponding time unit in **Group II**.

Group I	**Group II**
P. Kolhan Group	1. Triassic
Q. Kaharbari Formation	2. Proterozoic
R. Kota Formation	3. Permian
S. Kamthi Formation	4. Jurassic

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

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		
11			26		
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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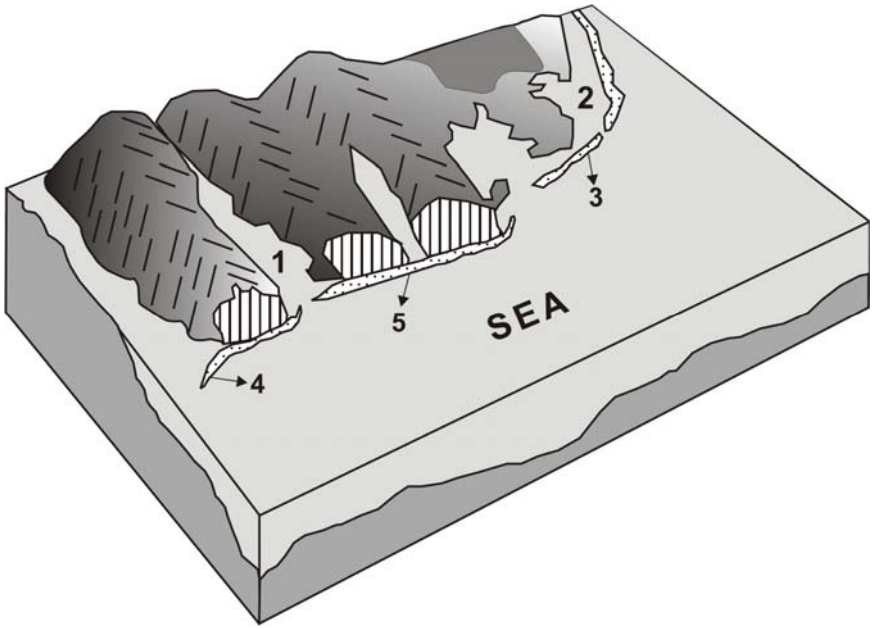
Q.31 (a) Draw a sketch of a Roche moutonnees.

(i) Indicate stoss side and lee side on the sketch. (3)

(ii) Show the direction of movement of glacier on the sketch. (3)

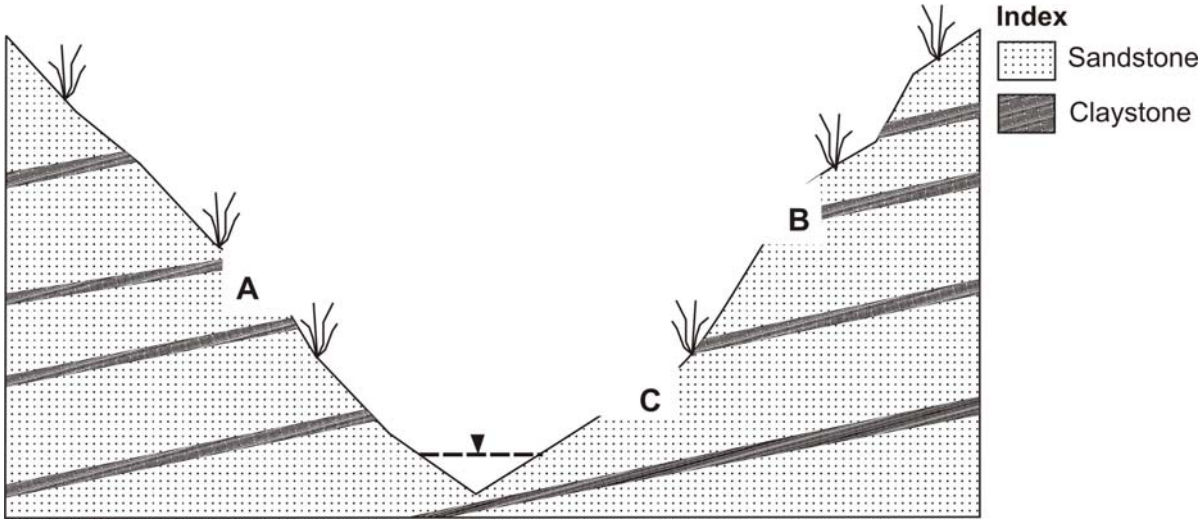
(b) Five features marked 1 to 5 in a coastal environment are shown in the given diagram. Name any three features along with the corresponding numbers. (9)



Q.32 (a) (i) Indicate the range of Reynold`s number for laminar flow of groundwater. (3)

(ii) How does 'acid rain' form in nature? (3)

(b) A section of a valley along with geological formations is shown in the figure below. A road is planned to be constructed in the valley. Three sites A, B and C are marked on the section.



(i) Choose a stable site for road construction out of the three locations. (3)

(ii) State two reasons for the site selection. (6)

Q.33 (a) Name the depositional environment of the following sedimentary structures:

(i) Lateral accretion surfaces (3)

(ii) Herringbone cross stratification (3)

(iii) Hummocky cross stratification (3)

(b) Give the names of the following sedimentary structures.

(i) Fluid-eddy generated erosional scours found at the sole of sandstone beds which are elongate, subconical, bulbous in the up-current direction and flaring out in the down-current direction. (3)

(ii) Intrastratal convolutions of laminae that remain confined within the bed and do not affect overlying and underlying beds. (3)

Q.34 (a) Distinguish between the following:
(i) Septa and sutures of Cephalopoda (3)

ii) Columella and umbilicus of Gastropoda (3)

(b) Name the following features:
(i) Facial suture of trilobite that meets the cephalon margin behind the genal angle. (3)

(ii) Depression on the calyx of a corallite formed due to absence of prosepta. (3)

(iii) Coiling of a shell on the same plane around a vertical median axis. (3)

Q.35 (a) Name the following lithostratigraphic units:

(i) Lower Vindhyan group of rocks (3)

(ii) Early Triassic rocks of the Damodar basin (3)

(iii) Carboniferous rocks of Tethys domain of Himalaya (3)

(b) (i) Distinguish between Assemblage Zone and Acme Zone. (3)

(ii) What is a Formation? Name the unit next higher in rank in lithostratigraphy. (3)

Q.36 (a) (i) Felsic magmas are more likely to give rise to hydrothermal deposits than mafic magmas. Why? Name two metals that form deposits associated with felsic magmatism. (6)

(ii) Mineable humic coal seams occur in the Tertiary rocks of Assam. Name the Group along with its approximate age. (3)

(b) Differentiate between stratiform and podiform chromite deposits in terms of (i) age and (ii) tectonic environment. (6)

Q.37 (a) What do you understand by an inverted sedimentary sequence? How does it develop? (6)

(b) With the help of block diagrams, show how faulting causes repetition of beds. The block diagrams should depict the situations: (i) before displacement, (ii) after displacement but before erosion, and (iii) after erosion. (9)

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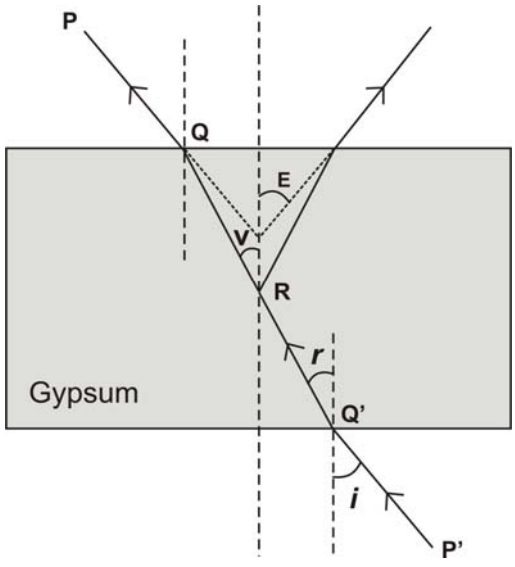
Q.38 (a) A gypsum crystal cleaved along {010} section has ZΛC = 53^o (γ)

i) Name the type of interference figure produced and draw the indicatrix for the above section. (6)

ii) Determine the extinction angle 'α'. (3)

(b) As shown in the following figure, the transmitted ray P′Q′ entering the gypsum crystal makes an incident angle of 40^o and the refracted ray Q′R makes an angle of 25^o with the normal.



i) Determine the 2V optic angle : _____ (3)

ii) Determine the apparent optic angle 2E : _____ (3)

Q.39 (a) The Mg-O and Cr-O bond distances in $MgCr_2O_4$ are 1.98 Å and 2.02 Å respectively. The ionic radius of O^{2-} is 1.40 Å.

i) Determine the ionic radii of Mg^{2+} and Cr^{3+}. (3)

ii) Determine the radius ratio for each of Mg^{2+} and Cr^{3+} ions. Based on the values of radius ratios, comment on the possible coordination number for each cation. (6)

(b) i) Name a polymorph of silica found in impact craters. (3)

ii) Name the minerals resulting from 100% replacement of Mg by Fe in phlogopite and diopside. (3)

Q.40 a) i) Name two common processes of chemical weathering. (3)

ii) Give the chemical reaction that would lead to the formation of caverns in a limestone terrain. (3)

b) i) What is a craton? Give examples of two cratonic blocks of India. (6)

(ii) In the Eastern Ghats Mobile Belt (EGMB), granulites are exposed at the surface. Suggest a mechanism by which these rocks have come to the surface. (3)

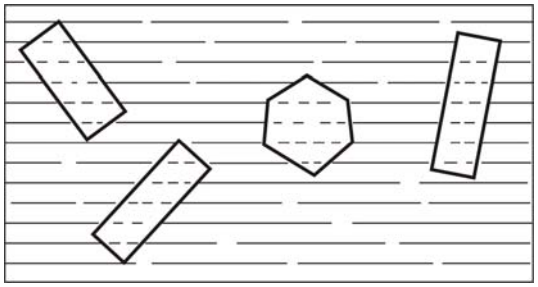
Q.41 (a) A suite of igneous rocks is formed by differentiation of a parental basic magma containing 50 weight % SiO_2 and 6 weight % MgO along with other components. Draw a schematic graph to show the variation of MgO with SiO_2 in these rocks. (6)

(b) A heating experiment is conducted under isobaric condition in a rock containing eutectic proportions of anorthite and diopside. (9)
Draw a schematic T (temperature) – X (composition) diagram and show the following:

(i) beginning of melting;
(ii) end of melting;
(iii) path of evolution of melt with further heating.

Q.42 (a) (i) What is a hornfels?
(ii) In which metamorphic facies does the pelitic assemblage quartz + muscovite + biotite + garnet + kyanite form? (9)
(iii) What metamorphic facies is indicated by the assemblage orthopyroxene + clinopyroxene + plagioclase?

(b) The following figure shows the microtexture of a metamorphic rock. Interpret the temporal relation between external foliation and porphyroblasts. What is this type of porphyroblast called? (6)



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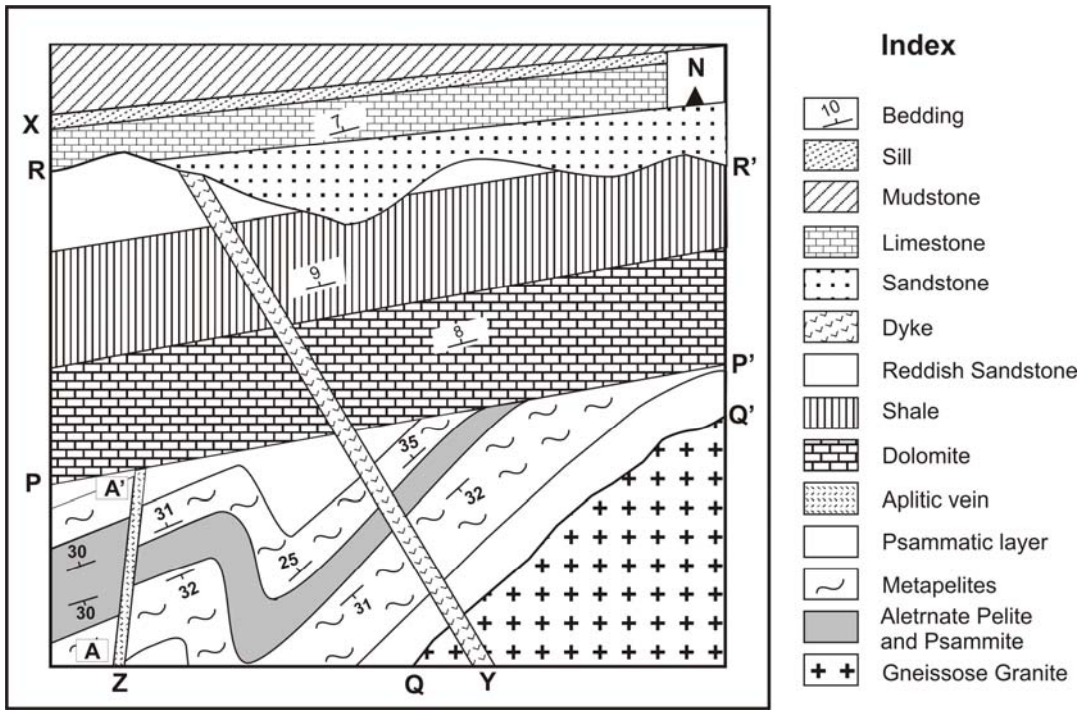
Q.43 The figure given below is the geological map of a flat terrain. It shows three unconformities and four magmatic bodies, one of which has intruded along a fault.



(a) (I) Identify the type of unconformity: (6)

(i) P-P': _____

(ii) Q-Q': _____

(iii) R-R': _____

(II) Identify the type of fault A-A' dipping 42° towards east: _____ (3)

(b) Arrange the three magmatic bodies X, Y and Z from older to younger age. (6)

Youngest: _____

Younger: _____

Older: _____

Q.44 (a) How do we know that Earth's magnetic poles underwent reversals many a time in the geologic past? Explain with a sketch. (9)

(b) (i) Why radiocarbon method cannot be used for dating Precambrian rocks? (3)

(ii) Name two radiometric methods for dating Precambrian rocks. (3)

Space for rough work

Space for rough work

Space for rough work

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2011 - GG Objective Part (Q. Nos. 1 – 30)	
Total Marks	**Signature**

Subjective Part					
Q. No	**Marks**		**Q. No.**	**Marks**	
31			**38**		
32			**39**		
33			**40**		
34			**41**		
35			**42**		
36			**43**		
37			**44**		
Total Marks in Subjective Part					

Total (Objective Part)	
Total (Subjective 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	