A

2012-GG

Test Paper Code: GG

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

INSTRUCTIONS

1. This 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.

A

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

Special Instructions/ Useful Data

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 Y only.**

Q.1 Match the properties in **Group I** with mineral names in **Group II.**

Group I	**Group II**
P. Luminescence under UV light	1. Talc
Q. Pisolitic structure	2. Galena
R. Soapy feel	3. Scheelite
S. High specific gravity	4. Bauxite

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

Q.2 Match the economic deposits in **Group I** with their Indian occurrences in **Group II**.

Group I	**Group II**
P. Coal	1. Balaghat
Q. Manganese	2. Koderma
R. Magnesite	3. Talcher
S. Mica	4. Salem

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

Q.3 Extensive hydrothermal alteration is generally associated with

(A) Stratiform chromite deposit
(B) Quartz-pebble conglomerate-hosted gold deposit
(C) Superior-type iron deposit
(D) Porphyry copper deposit

Q.4 Match the structural processes in **Group I** with their products in **Group II.**

Group I	**Group II**
P. Pressure solution	1. Boudin
Q. Layer-parallel extension	2. Bending fold
R. Layer-perpendicular shortening	3. Ptygmatic fold
S. Layer-parallel shortening	4. Stylolite

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

Q.5 A silica undersaturated plutonic igneous rock is

(A) Nepheline syenite (B) Granodiorite (C) Anorthosite (D) Syenite

Q.6 The metamorphic facies series that best characterizes a subduction-zone tectonic setting is

(A) Prehnite-Pumpellyite → Blueschist → Eclogite

(B) Albite-Epidote hornfels → Hornblende hornfels → Pyroxene hornfels → Sanidinite
(C) Greenschist → Amphibolite → Granulite
(D) Pyroxene hornfels → Granulite → Eclogite

Q.7 Match the fold types in **Group I** with inter-limb angles of folds in **Group II.**

Group I	**Group II**
P. Tight	1. 0°
Q. Open	2. 120° – 70°
R. Isoclinal	3. 70° – 30°
S. Close	4. 30° – 0°

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

Q.8 Match the definitions of magmatic bodies in **Group I** with their nomenclature in **Group II.**

Group I	**Group II**
P. Concordant intrusive body with a flat base and domed roof	1. Phacolith
Q. Plutonic igneous body with an aerial extent > 100 km^2	2. Lopolith
R. Large, conformable, saucer-shaped layered intrusive body	3. Batholith
S. Lens-shaped pluton that occupies the crest of an antiform or trough of a synform	4. Laccolith

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

Q.9 Arrange the following silicate minerals in order of increasing sharing of $(SiO_4)^{4-}$ tetrahedra.

(A) Olivine, Augite, Hornblende, Muscovite, Orthoclase
(B) Orthoclase, Muscovite, Hornblende, Augite, Olivine
(C) Olivine, Hornblende, Augite, Muscovite, Orthoclase
(D) Orthoclase, Augite, Hornblende, Muscovite, Olivine

Q.10 Match the crystallographic axes and their angular orientations in **Group I** with corresponding crystal systems in **Group II**

Group I	**Group II**
P. $a \neq b \neq c$, $\alpha = \beta = \gamma = 90°$	1. Monoclinic
Q. $a = b \neq c$, $\alpha = \beta = \gamma = 90°$	2. Isometric
R. $a \neq b \neq c$, $\alpha = \gamma = 90°$, $\beta \neq 90°$	3. Tetragonal
S. $a = b = c$, $\alpha = \beta = \gamma = 90°$	4. Orthorhombic

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

Q.11 Match igneous rocks in **Group I** with their most common textures in **Group II.**

Group I	**Group II**
P. Komatiite	1. Porphyritic
Q. Dolerite	2. Spinifex
R. Lamprophyre	3. Ophitic
S. Andesite	4. Panidiomorphic

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

Q.12 A snowball garnet is an example of

(A) Inter-kinematic mineral growth
(B) Syn-kinematic mineral growth
(C) Post-kinematic mineral growth
(D) Pre-kinematic mineral growth

Q.13 The number of crystal faces in a rhombohedron is

(A) 4 (B) 6 (C) 12 (D) 16

Q.14 Match the following volcanic stratigraphic units in **Group I** with their given ages in **Group II**

Group I	**Group II**
P. Malani Rhyolite	1. Meso- to Paleoproterozoic
Q. Dalma Volcanics	2. Paleozoic
R. Panjal Trap	3. Mesozoic
S. Rajmahal Trap	4. Neoproterozoic

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

Q.15 Match mineral textures in **Group I** with processes in **Group II.**

Group I	**Group II**
P. Replacement of coesite by quartz	1. Polymorphic transformation
Q. Crystallographically oriented lamellae of albite in orthoclase	2. Exsolution
R. Graphic intergrowth of orthoclase and quartz	3. Eutectic crystallization
S. Cross-hatched twinning in microcline	4. Cation ordering

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

Q.16 Match the lithological units in **Group I** with hydrogeological nomenclature in **Group II.**

Group I	**Group II**
P. Massive granite	1. Aquitard
Q. Shale	2. Aquifer
R. Clayey sandstone	3. Aquiclude
S. Gravelly sandstone	4. Aquifuge

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

Q.17 Geiger Müller counter is commonly used for the exploration of

(A) Bauxite deposit (B) Pb-Zn deposit (C) Uranium deposit (D) Iron ore deposit

Q.18 Decay of which one of the following isotopes can be used for dating Archean rocks?

(A) ^{14}C (B) ^{10}Be (C) ^{147}Sm (D) ^{210}Pb

Q.19 The mass movement process in which cohesive blocks of earth move on a failure plane w concave-up geometry, is known as

(A) Debris flow
(B) Creep
(C) Rotational slide
(D) Translational slide

Q.20 Which one of the following tunnel alignments is considered geologically favorable?

(A) Tunnel through the core of a synform with parallel tunnel- and fold axes
(B) Tunnel through the core of an antiform with parallel tunnel- and fold axes
(C) Tunnel through a synform with tunnel- and fold axes perpendicular to each other
(D) Tunnel through an antiform with tunnel- and fold axes perpendicular to each other

Q.21 Match the landforms in **Group I** with causative processes in **Group II.**

Group I	**Group II**
P. Yardang	1. Aeolian
Q. Drumlin	2. Coastal
R. Doline	3. Dissolution
S. Chenier	4. Glacial

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

Q.22 Which one of the following drainage patterns is typical of a doubly plunging antiformal terrain?

(A) Dendritic (B) Trellis (C) Rectangular (D) Radial

Q.23 Which one of the following features is **NOT** associated with an oceanic subduction?

(A) Sea-mount (B) Benioff zone (C) Back-arc (D) Fore-arc

Q.24 The term isostasy refers to

(A) gravitational equilibrium
(B) thermal equilibrium
(C) magnetic equilibrium
(D) electrical equilibrium

Q.25 Match the sedimentary structures in **Group I** with the processes of their formation in **Group II.**

Group I	**Group II**
P. Flute cast	1. Fluctuating current
Q. Convolute lamination	2. Exposure
R. Rain print	3. Erosion
S. Flaser bedding	4. Syn-depositional deformation

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

Q.26 In which depositional environment are the sand grains best sorted and rounded?

(A) Glacial (B) Aeolian (C) Fluvial (D) Deep marine

Q.27 Which one of the following fossils is found in rocks of Cambrian age?

(A) *Redlichia* (B) *Fenestella* (C) *Syringothyris* (D) *Otoceras*

Q.28 Match the morphological features described in **Group I** with their names listed in **Group II**

Group I	**Group II**
P. Masticatory apparatus in Echinoidea	1. Cameral deposits
Q. Triangular cavity near umbo of Brachiopoda	2. Madreporite
R. Calcareous secretions in siphuncle of Cephalopoda	3. Delthyrium
S. Genital plate in Echinoidea	4. Aristotle's lantern

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

Q.29 Which one of the following flora represents Upper Gondwana?

(A) *Noeggerathiopsis* (B) *Gangamopteris* (C) *Dicroidium* (D) *Vertebraria*

Q.30 Which one of the following is a Primate fossil?

(A) *Hipparion* (B) *Ramapithecus* (C) *Equus* (D) *Stegolophodon*

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			( )

Q.31

(a) Shown below are textures of two magmatic rocks in Figures A and B. These rocks were produced by equilibrium crystallization of two separate melt compositions. An isobaric T-composition phase diagram in the system Mg_2SiO_4-SiO_2 is shown in Figure C. Mineral abbreviations used in the Figures are as follows: Opx = orthopyroxene, Qtz = quartz, Olv = olivine, Fo = Forsterite, En = Enstatite, Cr = Cristobalite, L = Melt.

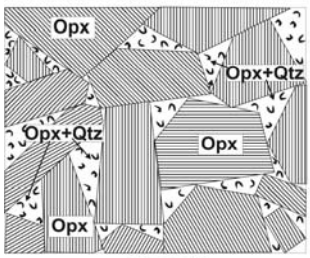


Figure A

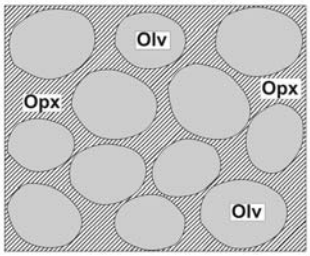


Figure B

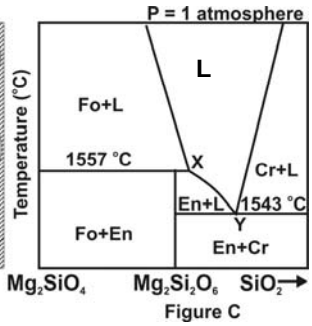


Figure C

Now answer the following questions.

(i) Using the phase diagram in Figure C, write the nature of melt compositions, which has given rise to these rocks.

(ii) Which rock in the above Figures indicates final crystallization at point Y?

(6+3)

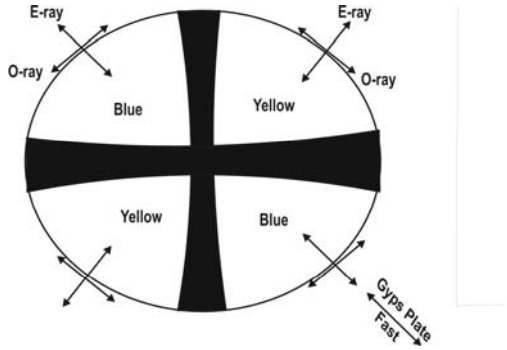
(b) (i) Calculate the variance of the point X in Figure C.

(ii) What is its petrological name?

(3+3)

Q.32

(a) The optic axis interference figure of a hypothetical uniaxial mineral is shown below. The mineral has indices of refraction (R.I.s) of 1.54 and 1.55. The colors in the different quadrants of the interference figure reflect the effects of insertion of gypsum (Gyps) plate, the fast vibration direction of which is marked in the figure.



(i) What is the optic sign of the mineral?
(ii) State the value of the R.I. of the mineral, corresponding to its E-ray (n_ε).
(iii) What is the value of the birefringence of the mineral in the optic orientation shown in the figure above?

(3+3+3)

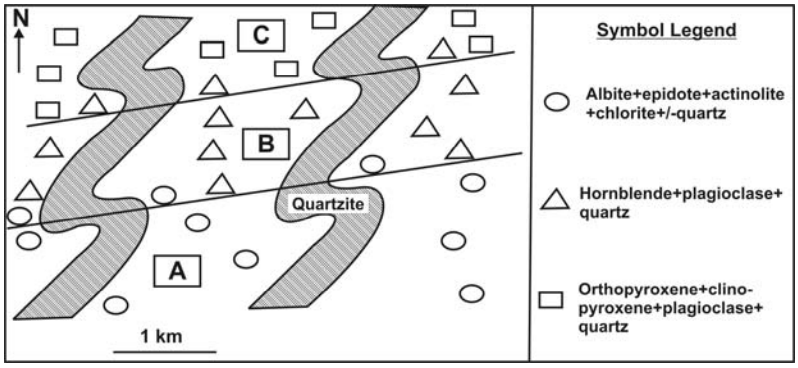
(b) (i) Name the optical indicatrix of garnet.

(ii) State two diagnostic optical properties, which distinguish diopside from hornblende.

(3+3)

Q.33

(a) The schematic map below shows the distribution of mineral assemblages (shown by open symbols) in a regionally metamorphosed rock (X) of uniform bulk rock composition. Also marked in the map are two lines striking ENE-WSW, which mark change-over from one mineral assemblage field to the other. Based on the nature of the mineral assemblages, these lines subdivide the mapped area into three regions: A, B and C.



(i) Name the bulk rock composition of X.

(ii) Name the metamorphic facies for regions A, B and C.

(3+6)

(b) (i) Name the mineral assemblage that is likely to develop in a normal pelite, corresponding to the metamorphic condition in region C of the above figure.

(ii) Name the metamorphic facies series that best explains the progressive variation in metamorphic conditions across regions A, B and C in the figure above.

(3+3)

Q.34

(a) i) Arrange the following formations of Mesozoic succession of Kutch in order of increasing age:
Bhuj Formation, Patcham Formation, Chari Formation, Katrol Formation, and Umia Formation.
ii) Which one of the above mentioned formations contains oolitic limestone?
iii) To which formation does Umia Plant Bed belong?

(3+3+3)

(b) Name the two Cenozoic stratigraphic units of northeastern India, the attributes of which are briefly described below in i) and ii).
i) The unit is of Oligocene age and consists of sandstone, shale and coal.
ii) The Eocene limestone unit containing *Nummulites* and *Discocyclina.*

(3+3)

Q.35

(a) (i) Arrange the following stratigraphic units of northwestern India, in order of younging age:
Erinpura Granite, Banded Gneissic Complex of southern Rajasthan, Delhi Supergroup, Aravalli Supergroup, and Raialo Group.
(ii) In which of the stratigraphic units of (i) does the Jhamarkotra phosphorite deposit occur?

(6+3)

(b) Name an acidic and a mafic volcanic stratigraphic unit in the Nandgaon Group of central India.

(3+3)

Q.36

(a) (i) Write the Goldich Dissolution Series, indicating relative weathering potential of silicate minerals.

(ii) Complete the weathering reaction representing the hydrolysis of orthoclase feldspar.

$2\ KAlSi_3O_8 + 2\ CO_2 + 11\ H_2O = 2\ K^+ +$ ---------- $+ 4\ H_4SiO_4 +$ ----------

(6+3)

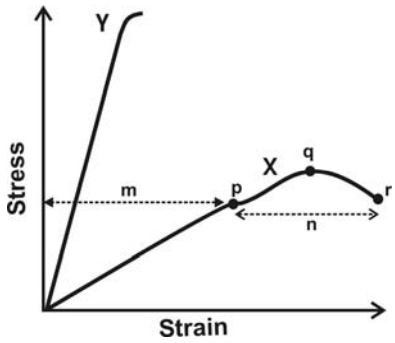
(b) (i) What is a braided river?

(ii) List any three essential conditions that promote its formation.

(3+3)

Q.37

(a) The figure below shows stress-strain curves for two rocks, designated as X and Y. Based on the characteristics of the curves, answer the following questions.



(i) What is the mode of failure for Y?
(ii) What do the regions 'm' and 'n' represent?
(iii) What do the points 'p', 'q' and 'r' represent?

(3+3+3)

(b) A sandstone core of 15 cm length and cross-sectional area of 25 cm^2 was evaluated for permeability, using a constant head permeameter. For a hydraulic head of 5 cm, a total of 100 ml of water was collected in 10 minutes. Estimate hydraulic conductivity (cm/min) using the Darcy's equation, Q = K.A.(dh/dl), where Q = discharge (cm^3/min), K = hydraulic conductivity (cm/min), A = cross-sectional area (cm^2) and (dh/dl) = hydraulic head.

(6)

Q.38

(a) Consider the following bivalves:
Pecten, *Mytilus*, *Lima*, *Lithophaga*, *Spondylus*, *Mya*, *Ostrea*, *Tridacana*, *Posidonia*, *Solen*, *Teredo*.
From the list above, find out one example each of the following types:
(i) a boring bivalve
(ii) an epifaunal, bysally attached bivalve
(iii) an infaunal deep burrowing bivalve

(3+3+3)

(b) Write the distinguishing features of heterodont and desmodont dentitions in Bivalvia.

(6)

Q.39

(a) A bauxite deposit is found to occur above granite. Answer the following questions.

(i) Write the names of two characteristic minerals found in bauxite.

(ii) Which mineral in granite predominantly contributes Al to bauxite?

(iii) What climatic conditions are favorable for the formation of bauxite?

(3+3+3)

(b) (i) Name a diamondiferous igneous rock.

(ii) Name an occurrence of diamond deposit in the Vindhyan Basin.

(3+3)

Q.40

(a) (i) Name four basic allochemical and two orthochemical constituents of limestone.
(ii) Arrange the following limestones in order of decreasing depositional energy conditions:
Packstone, Grainstone, Mudstone, Wackestone

(6+3)

(b) (i) What is textural maturity of sandstone?
(ii) Name a sandstone that is texturally and mineralogically mature.

(3+3)

Q.41

(a) In a sulfur crystal, the face 'A' with Miller indices (111) intersects the mutually perpendicular crystallographic axes at 4, 5 and 10 Å. Calculate the Miller indices of another face 'B' that intersects the crystallographic axes at 12, 15 and 10 Å, respectively?

(9)

(b) (i) What is the form symbol of a dodecahedron?
(ii) How many crystal faces are present in it?

(3+3)

Q.42

(a) The outcrop patterns of three folds are shown in figures p, q and r. The arrow in each figure indicates the attitude of the fold axis.

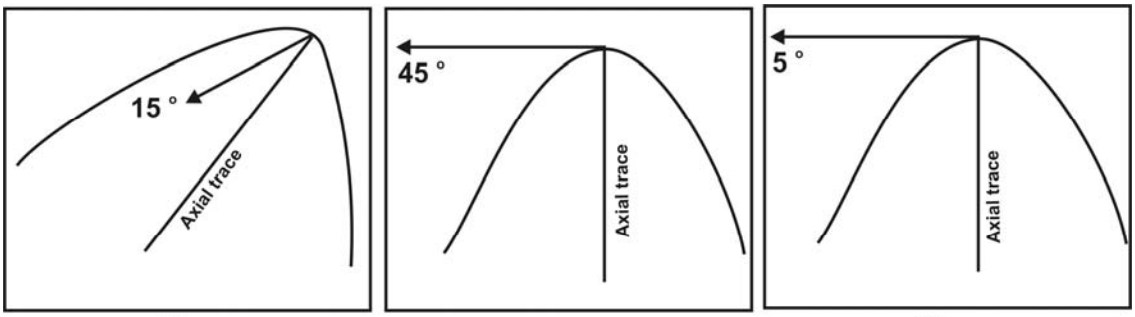


Figure p Figure q Figure r

(i) Name the folds in figures p, q and r. Give justifications.

(3+3+3)

(b) (i) Write the difference between a vertical and an upright fold.

(ii) Define a plane non-cylindrical fold.

(3+3)

Q.43

(a) (i) What is a meteorite?
(ii) What are the two major groups of stony meteorites?

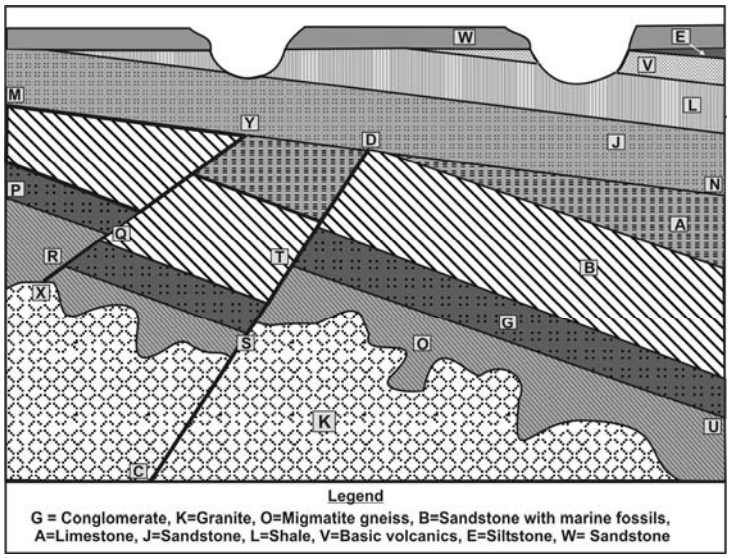
(3+3)

(b) (i) What is a "Seismic Shadow Zone"?
(ii) Give the arc range (in degrees) of S-wave shadow zone.
(iii) What important information about the Earth's core does the S-wave shadow zone provide?

(3+3+3)

Q.44

(a) Shown below is a geological section along with its legend. Examine the section and answer the questions given below.



(i) Name the type of faults X-Y and C-D and give justifications.

(ii) State the temporal relationship of the granite emplacement with the two phases of faulting mentioned above.

[(3+3)+3]

(b) Name the unconformity surfaces P-Q-R-S-T-U and M-N

(3+3)

Space for rough work

Space for rough work

2012 - 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	