Paper Specific Instructions

1. The examination is of 3 hours duration. There are a total of 60 questions carrying 100 marks. The entire paper is divided into three sections, **A**, **B** and **C**. All sections are compulsory. Questions in each section are of different types.

- 2. Section A contains a total of 30 Multiple Choice Questions (MCQ). Each MCQ type question has four choices out of which only one choice is the correct answer. Questions Q.1 Q.30 belong to this section and carry a total of 50 marks. Q.1 Q.10 carry 1 mark each and Questions Q.11 Q.30 carry 2 marks each.
- 3. Section B contains a total of 10 Multiple Select Questions (MSQ). Each MSQ type question is similar to MCQ but with a difference that there may be one or more than one choice(s) that are correct out of the four given choices. The candidate gets full credit if he/she selects all the correct answers only and no wrong answers. Questions Q.31 Q.40 belong to this section and carry 2 marks each with a total of 20 marks.
- **4. Section C** contains a total of 20 **Numerical Answer Type** (**NAT**) questions. For these NAT type questions, the answer is a real number which needs to be entered using the virtual keyboard on the monitor. No choices will be shown for these type of questions. Questions Q.41 Q.60 belong to this section and carry a total of 30 marks. Q.41 Q.50 carry 1 mark each and Questions Q.51 Q.60 carry 2 marks each.
- 5. In all sections, questions not attempted will result in zero mark. In **Section A** (MCQ), wrong answer will result in **NEGATIVE** marks. For all 1 mark questions, 1/3 marks will be deducted for each wrong answer. For all 2 marks questions, 2/3 marks will be deducted for each wrong answer. In **Section B** (MSQ), there is **NO NEGATIVE** and **NO PARTIAL** marking provisions. There is **NO NEGATIVE** marking in **Section C** (NAT) as well.
- **6.** Only Virtual Scientific Calculator is allowed. Charts, graph sheets, tables, cellular phone or other electronic gadgets are **NOT** allowed in the examination hall.
- 7. The Scribble Pad will be provided for rough work.

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SECTION - A

MULTIPLE CHOICE QUESTIONS (MCQ)

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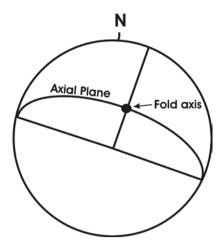
Q.1	Which one among th	ne following planets in	the Solar system is most	similar in size to the Earth?
	(A) Mercury	(B) Venus	(C) Neptune	(D) Uranus
Q.2	In which one of the found?	following tectonic setti	ngs are the highest mour	ntain chains and thickest crust
	(A) Island arc(C) Continental colli	sion	(B) Continental arc (D) Transcurrent	
Q.3	The second-most abo	undant oxide in the Ear	rth's crust is	
	(A) Al ₂ O ₃	(B) SiO ₂	(C) CaO	(D) Na ₂ O
Q.4	The type of dentition	n found in <i>Trigonia</i> is		
	(A) schizodont	(B) taxodont	(C) pachydont	(D) isodont
Q.5	Which one of the fol octahedral coordinat		olated (SiO ₄) ⁴⁻ tetrahedra	a linked by divalent cations in
	(A) Muscovite	(B) Quartz	(C) Beryl	(D) Olivine
Q.6	Which one of the fol	lowing is NOT found i	in an extensional setting	?
	(A) Normal faults	(B) Horsts	(C) Rifts	(D) Thrust faults
Q.7	The texture characte	rized by exsolved lame	ellae of albite in K-feldsp	oar is known as
	(A) myrmekite	(B) graphic	(C) perthite	(D) antiperthite
Q.8	Fissility is best show	n by		
	(A) sandstone	(B) siltstone	(C) shale	(D) limestone
Q.9	Petroleum is NOT co	ommercially produced	from	
	(A) Krishna–Godava (C) Cambay basin	nri basin	(B) Cauvery–Palar (D) Vindhyan basir	

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Q.10	Among the following, the mineral showing acicular habit is			
	(A) kyanite	(B) tourmaline	(C) biotite	(D) sillimanite
Q. 11	– Q. 30 carry two r	narks each.		
Q.11	Isostasy involves	contine	ental mountain belts.	
	(A) compensation in	(B) creation of	(C) destruction of	(D) thrusting in
Q.12	Identify the pair from	the following list	that is NOT correctly matched	l.
	(A) Caldera – stratovo (C) Ropy lava – pahoe		(B) Pillow basalt – su(D) Amygdales – fille	_
Q.13	Wilson orogenic cycle	e in continents is i	initiated by	
	(A) collision	(B) rifting	(C) drifting	(D) subduction
Q.14	Match the processes in	n Group I with co	rresponding geomorphic featur	es in Group II.
	Group I P. Dissolution Q. Abrasion R. Deposition S. Onion skin v	veathering	Group II 1. Mushroom rocks 2. Exfoliation domes 3. Sinkholes 4. Moraines	
	(A) P-1 Q-3 R-2 S-4	(B) P-3 Q-1 R-2 S-4	(C) P-3 Q-1 R-4 S-2	(D) P-2 Q-1 R-4 S-3

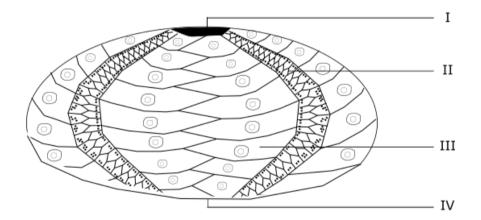
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Q.15 The orientations of the fold axis and axial plane in the given figure indicate



- (A) reclined fold
- (B) vertical fold
- (C) recumbent fold
- (D) horizontal fold

Q.16 Identify the correct morphological features corresponding to numbers I-IV in the echinoid illustrated below:



(A) I-Periproct	II-Ambulacra	III-Interambulacra	IV-Peristome
(B) I-Periproct	II-Interambulacra	III-Ambulacra	IV-Peristome
(C) I-Peristome	II-Interambulacra	III-Ambulacra	IV-Periproct
(D) I-Peristome	II-Ambulacra	III-Interambulacra	IV-Periproct

- Q.17 The correct order of marine benthic habitats with increasing water depths is
 - (A) abyssal, bathyal, neritic

(B) neritic, abyssal, bathyal

(C) neritic, bathyal, abyssal

- (D) bathyal, abyssal, neritic
- Q.18 Which one of the following invertebrates has the most primitive visual system?
 - (A) Ammonites
- (B) Brachiopods
- (C) Gastropods
- (D) Trilobites

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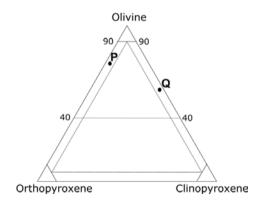
Q.19 The correct chronological sequence (older to younger) of the Precambrian stratigraphic units listed below is

- (A) Sargur Group, Chitradurga Group, Alwar Group, Kaimur Group
- (B) Chitradurga Group, Sargur Group, Kaimur Group, Alwar Group
- (C) Sargur Group, Alwar Group, Chitradurga Group, Kaimur Group
- (D) Sargur Group, Chitradurga Group, Kaimur Group, Alwar Group
- Q.20 Match the Formations in Group I with corresponding characteristic fossils in Group II.

Gre	oup I	Group II	
P. Barakar	Formation	1. Stegodon	
Q. Uttatur F	ormation	2. Sauropoda	
R. Dhok Pat	han Formation	3. Belemnites	
S. Lameta F	ormation	4. Glossopteris	
(A)	(B)	(C)	(D)
P-3	P-4	P-3	P-4
Q-1	Q-3	Q-4	Q-3
R-4	R-1	R-1	R-2
S-2	S-2	S-2	S-1

- Q.21 Which one of the following sedimentary structures is NOT used for determining top and bottom of beds?
 - (A) Mud cracks

- (B) Load and flame structures
- (C) Sharp-crested wave ripples
- (D) Plane lamination
- Q.22 Identify the rocks P and Q in the diagram as per the IUGS classification.



- (A) P Websterite, Q Wehrlite
- (B) P Dunite, Q Websterite
- (C) P Websterite, Q Dunite
- (D) P Harzburgite, Q Wehrlite

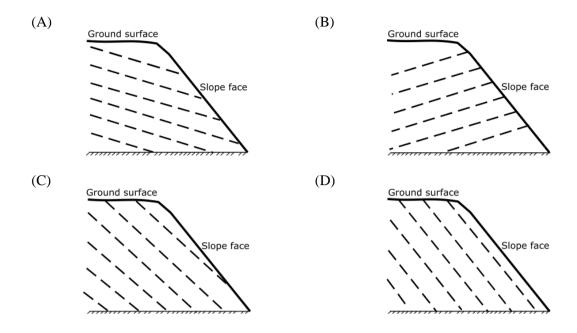
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Q.23	Which one of the following is produced by a closed-system metamorphic reaction between muscovite and quartz?			
	(A) orthoclase + sillimani(C) plagioclase + biotite	te	(B) orthoclase + bioti(D) plagioclase + silli	
Q.24	The assemblage staurolite	+ garnet + biotite + r	nuscovite + quartz in p	pelites is stable in
	(A) greenschist facies(C) granulite facies		(B) amphibolite facie (D) pyroxene hornfel	
Q.25	Conglomerates are comm	only deposited in		
	(A) aeolian dunes(C) alluvial fans		(B) tidal flats(D) river flood plains	
Q.26	Match the mineral deposit	ts in Group I with cor	responding Indian occ	urrences in Group II.
	Group I P. Iron Q. Uranium R. Manganese S. Baryte	2. Balagha	pet, Andhra Pradesh t, Madhya Pradesh ahar, Jharkhand	
		-4 -1 -3	(C) P-3 Q-4 R-2 S-1	(D) P-4 Q-3 R-2 S-1
Q.27	Which one of the following ore in gabbro-noritic rock		sible for the formation	of syngenetic Ni-Cu sulphide
	(A) Hydrothermal replace (C) Liquid immiscibility	ment	(B) Volcanic exhalati (D) Contact metamor	

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Q.28 Dashed lines in the figures given below represent joints. Considering only the orientations of the joints and the slope face, which one of the following represents the most stable slope?



Q.29 Match the morphological features/life processes in Group I with corresponding organisms in Group II.

	Group I	Group II	
	P. Water vascular system	 Cephalopoda 	
	Q. Moulting	2. Echinodermata	
	R. Jet propulsion locomotion	3. Brachiopoda	
	S. Lophophore	4. Trilobita	
(A)	(B)	(C)	(D)
P-2	P-3	P-2	P-4
Q-3	Q-4	Q-4	Q-3
R-1	R-2	R-1	R-2
S-4	S-1	S-3	S-1

Q.30 Match the plutonic rocks in Group I with corresponding volcanic equivalents in Group II.

	Group I	Group II	
	P. Granite	1. Andesite	
	Q. Syenite	2. Basalt	
	R. Diorite	3. Rhyolite	
	S. Gabbro	4. Trachyte	
(A)	(B)	(C)	(D)
P-2	P-3	P-4	P-3
Q-3	Q-4	Q-3	Q-4
R-4	R-1	R-1	R-2
S-1	S-2	S-2	S-1

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SECTION - B

MULTIPLE SELECT QUESTIONS (MSQ)

Q. 31 – Q. 40 carry two marks each.

Q.31 Which of the following change(s) when a dipping bed with a plunging lineation is rotated about a vertical axis?

(A) Dip amount of bed

(B) Plunge amount of lineation

(C) Plunge direction of lineation

(D) Strike of bed

Q.32 Which of the following indicate(s) the presence of directed stress in a rock?

(A) Porphyritic texture

(B) Schistosity

(C) Gneissosity

(D) Mylonitic texture

Q.33 The correct combination(s) of ranks and corresponding categories of stratigraphic units is/are

(A) Formation – Lithostratigraphy

(B) System – Chronostratigraphy

(C) Period – Chronostratigraphy

(D) Group – Biostratigraphy

O.34 The correct order(s) of stability of silica polymorphs with increasing pressure is/are

(A) Quartz – Coesite – Stishovite

(B) Quartz – Stishovite – Coesite

(C) Tridymite – Coesite – Stishovite

(D) Tridymite – Stishovite – Coesite

Q.35 Which of the following statement(s) is/are correct for the upper hemisphere stereographic projection of a crystal given below?



- (A) Angle between the axes, $\alpha = \beta = \gamma = 90^{\circ}$
- (B) Crystal contains 1 tetrad
- (C) Crystal contains 4 diads
- (D) Crystal contains 5 mirror planes
- Q.36 Which of the following statement(s) is/are correct?
 - (A) An isotropic mineral remains dark through 360° rotation of stage under crossed polars
 - (B) Pleochroism is the change of colour of a mineral during rotation under crossed polars
 - (C) Minerals of the Triclinic system are optically uniaxial
 - (D) Melatope in an interference figure marks the emergence of an optic axis

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Q.37	Hermatypic corals are	typically found in		
	(A) the photic zone(C) cool deep water		(B) warm and clear wa (D) reefs	ter
Q.38	Choose the characteris	tic mineral(s) formed in	the supergene enriched	zone of a sulphide deposit.
	(A) Psilomelane	(B) Covellite	(C) Cassiterite	(D) Chalcocite
Q.39	Which of the following magma forming a layer	-	zation of plagioclase phe	nocrysts from a basic
	(A) Cumulus texture at(B) Anorthite-rich earl(C) Albite-rich late pla(D) Quench texture at	y plagioclase at the base gioclase at the top		
Q.40	Major mass extinction	events occurred in the		
	(A) end Silurian(C) end Permian		(B) end Carboniferous (D) early Devonian	

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SECTION - C

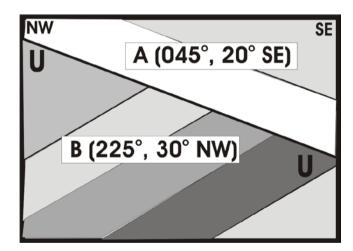
NUMERICAL ANSWER TYPE (NAT)

Q. 41 - Q. 50 carry one mark each.

- Q.41 When plotted on a map of 1:50000 scale, a 2 km long dyke exposed on a horizontal surface has a length of _____cm (answer in one decimal place).
- Q.42 The valency of iron in hematite is _____.
- Q.43 A crustal rock is at a lithostatic pressure of 3 kbar and a temperature of 275°C. If the lithostatic pressure increases at a uniform rate of 0.3 kbar/km, and the surface temperature is 25°C, the geothermal gradient (in °C/km) is_____ (answer in one decimal place).
- Q.44 The absolute difference in the Moh's hardness values of the two silicates among the minerals listed below is _____.

Apatite, Corundum, Gypsum, Talc, Topaz

Q.45 Attitudes of beds in sequences A (younger) and B (older), separated by an unconformity UU, are given in the following sectional view. If UU was horizontal when sequence A was deposited, the dip amount of beds in sequence B at that time was _____ (answer in one decimal place).

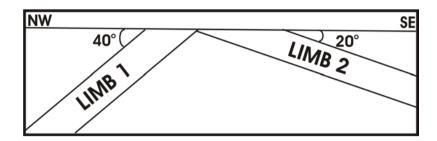


- Q.46 The number of alpha (α) particles emitted to produce a daughter isotope of ²³⁶Pb from a parent isotope of ²³⁸U by radioactive decay is _____.
- Q.47 The dip slip on a fault 000°, 30°E is 10 m. Assuming slip equals separation here, the throw on the fault is _____ m (answer in one decimal place).

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Q.48 A continuous 10 m thick sequence of shale was deposited in 10,000 years at uniform rate of sedimentation. The number of samples that must be collected at equal stratigraphic intervals to sample the succession every 500 years is _____.

Q.49 Attitudes of the two limbs of a non-plunging kink fold shown below are 045°, 20°SE and 045°, 40°NW. The dip amount (in degrees) of the axial plane of the kink fold is _____ (answer in one decimal place).



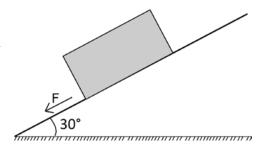
Q.50 In the garnet formula (Fe_{2.5}Mg_{0.3}Ca_x)Al₂Si₃O₁₂, x represents the number of atoms of Ca. The mole % of grossular in the garnet is _____ (answer in one decimal place).

Q. 51 – Q. 60 carry two marks each.

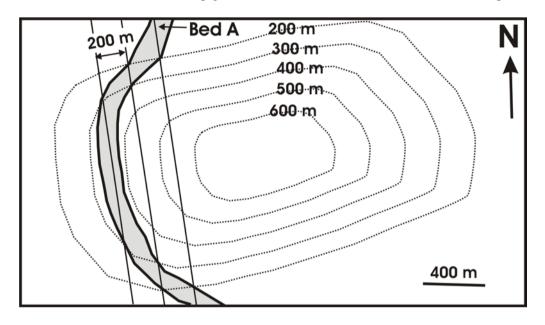
- Q.51 Assuming the Earth to be an ideal sphere, the volume % of the core relative to the total volume of the Earth is _____ (answer in one decimal place).
- Q.52 Based on 8 oxygen atoms, the number of silicon atoms in a plagioclase of composition Ab₂₀An₈₀ is ____ (answer in one decimal place).
- Q.53 600 tons of low grade iron ore (40% Fe) are blended with 400 tons of high grade iron ore (65% Fe). The grade of the blended ore is _____ % Fe (answer in one decimal place).
- Q.54 The mass of a fully dried rock sample of volume 100 cm³ is 300 g. The mass of the sample, when fully saturated with water of density 1.00 g/cm³, is 325 g. Assuming no volume change, the computed porosity of the rock is ______ % (answer in one decimal place).
- Q.55 When a dunite comprising pure forsterite undergoes melting, the weight % of MgO in the melt is _____ (answer in one decimal place; given molecular weights of $SiO_2 = 60.08$; MgO = 40.30).

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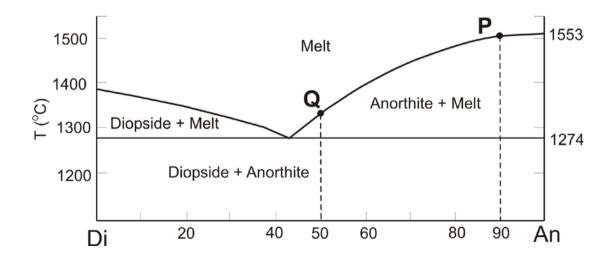
Q.56 A block of rock with a mass of 72 kg slides on a surface inclined at an angle of 30° as shown in the figure. Assuming no cohesion and friction, the force 'F' is _____ Newton (answer in one decimal place; acceleration due to gravity = 9.8 m/s²).



Q.57 The true thickness of Bed A in the map given below is ____ m (answer in one decimal place).



Q.58 A melt containing 900 moles of anorthite and 100 moles of diopside undergoes crystallization. The number of moles of anorthite that crystallizes as the melt composition moves from P to Q is _____.



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Q.59 A confined sandstone aquifer with a uniform cross-sectional area of 7 m² and a hydraulic conductivity of 2 m/s, transmits water across a hydraulic gradient of 3.2. Assuming steady state Darcian flow, the volumetric flow rate through the aquifer is _____ m³/s (answer in one decimal place).

Q.60 A diamondiferous lamproite is ultrapotassic and has a molar K_2O/Na_2O ratio of 11. If the Na_2O content of the rock is 0.62 wt%, the K_2O content is _____ wt% (answer in one decimal place; molecular weight of $Na_2O = 61.98$, and $K_2O = 94.20$).

END OF THE QUESTION PAPER

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	Paper Code : GG					
Q No.	Question Type (QT)	Section	Key/Range (KY)			
1	MCQ	А	В			
2	MCQ	А	С			
3	MCQ	А	А			
4	MCQ	А	А			
5	MCQ	А	D			
6	MCQ	А	D			
7	MCQ	А	С			
8	MCQ	А	С			
9	MCQ	А	D			
10	MCQ	А	D			
11	MCQ	А	А			
12	MCQ	А	В			
13	MCQ	А	В			
14	MCQ	А	С			
15	MCQ	А	А			
16	MCQ	А	А			
17	MCQ	А	С			
18	MCQ	А	D			
19	MCQ	А	А			
20	MCQ	А	В			
21	MCQ	А	D			
22	MCQ	А	D			
23	MCQ	А	А			

	Paper (Code : G	GG .
Q No.	Question Type (QT)	Section	Key/Range (KY)
24	MCQ	А	В
25	MCQ	А	С
26	MCQ	Α	D
27	MCQ	А	С
28	MCQ	А	В
29	MCQ	А	С
30	MCQ	А	В
31	MSQ	В	C,D
32	MSQ	В	B,C,D
33	MSQ	В	A,B
34	MSQ	В	A,C
35	MSQ	В	A,B,C,D
36	MSQ	В	A,D
37	MSQ	В	A,B,D
38	MSQ	В	B,D
39	MSQ	В	A,B,C
40	MSQ	В	С
41	NAT	С	4.0 to 4.0
42	NAT	С	3 to 3
43	NAT	С	25.0 to 25.0
44	NAT	С	7 to 7
45	NAT	С	50.0 to 50.0
46	NAT	С	8 to 8

Paper Code : GG					
Q No.	Question Type (QT)	Section	Key/Range (KY)		
47	NAT	С	5.0 to 5.0		
48	NAT	С	20 to 20		
49	NAT	С	70.0 to 90.0		
50	NAT	С	6.6 to 6.8		
51	NAT	С	14.0 to 18.0		
52	NAT	С	2.2 to 2.2		
53	NAT	С	50.0 to 50.0		
54	NAT	С	25.0 to 25.0		
55	NAT	С	57.0 to 57.5		
56	NAT	С	352.8 to 352.8		
57	NAT	С	89.0 to 90.0		
58	NAT	С	800 to 800		
59	NAT	С	44.8 to 44.8		
60	NAT	С	10.3 to 10.5		