The Graduate Aptitude Test in Engineering

GATE 2023 Question Paper

GATE is an entrance examination conducted in India that primarily tests the comprehensive understanding of undergraduate subjects in engineering and sciences for admission into technical postgraduate programs.

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General Aptitude (GA)

Q.1 – Q.5 Carry ONE mark Each

Q.1	The village was nestled in a green spot, _____ the ocean and the hills.
(A)	through
(B)	in
(C)	at
(D)	between

Q.2	Disagree : Protest : : Agree : _____ (By word meaning)
(A)	Refuse
(B)	Pretext
(C)	Recommend
(D)	Refute

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Q.3	A ‘frabjous’ number is defined as a 3 digit number with all digits odd, and no two adjacent digits being the same. For example, 137 is a frabjous number, while 133 is not. How many such frabjous numbers exist?
(A)	125
(B)	720
(C)	60
(D)	80

Q.4	Which one among the following statements must be TRUE about the mean and the median of the scores of all candidates appearing for GATE 2023?
(A)	The median is at least as large as the mean.
(B)	The mean is at least as large as the median.
(C)	At most half the candidates have a score that is larger than the median.
(D)	At most half the candidates have a score that is larger than the mean.

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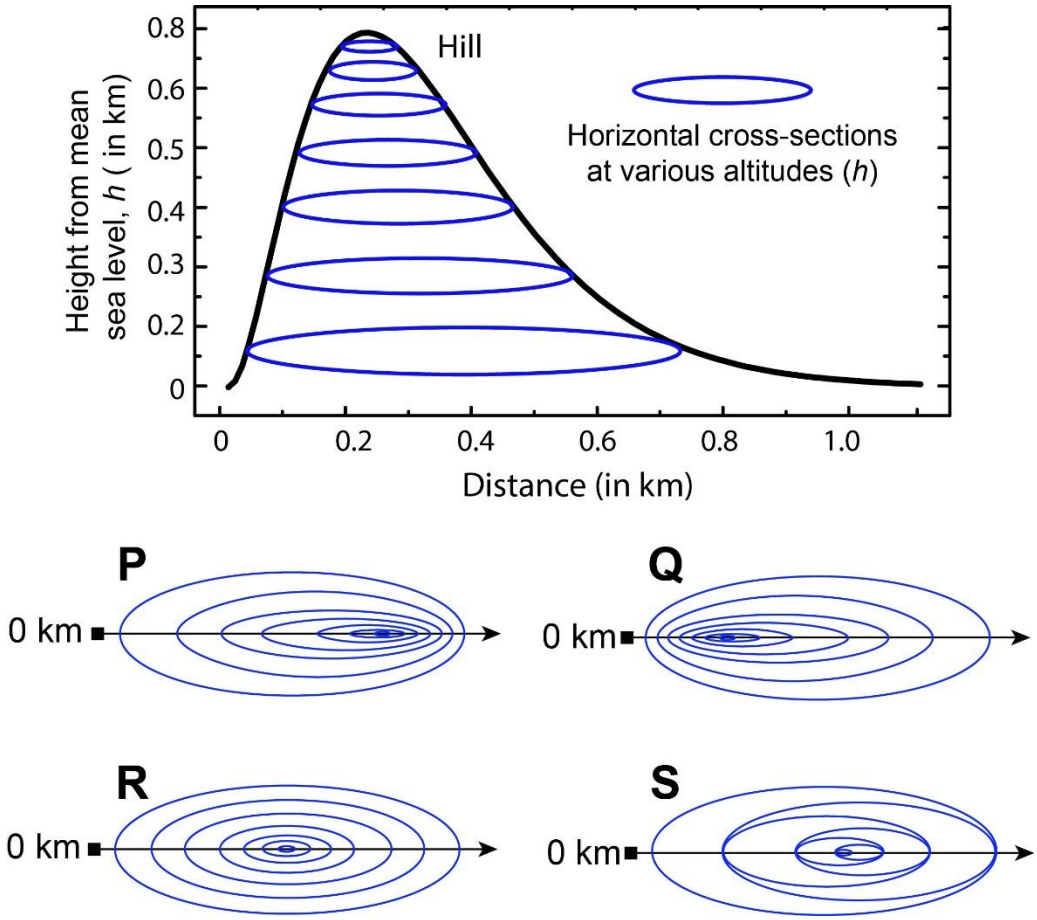
Q.5	In the given diagram, ovals are marked at different heights (*h*) of a hill. Which one of the following options **P**, **Q**, **R**, and **S** depicts the top view of the hill?
	
(A)	**P**
(B)	**Q**
(C)	**R**
(D)	**S**

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Q.6 – Q.10 Carry TWO marks Each

Q.6	Residency is a famous housing complex with many well-established individuals among its residents. A recent survey conducted among the residents of the complex revealed that all of those residents who are well established in their respective fields happen to be academicians. The survey also revealed that most of these academicians are authors of some best-selling books. Based only on the information provided above, which one of the following statements can be logically inferred with *certainty*?
(A)	Some residents of the complex who are well established in their fields are also authors of some best-selling books.
(B)	All academicians residing in the complex are well established in their fields.
(C)	Some authors of best-selling books are residents of the complex who are well established in their fields.
(D)	Some academicians residing in the complex are well established in their fields.

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Q.7	Ankita has to climb 5 stairs starting at the ground, while respecting the following rules: 1. At any stage, Ankita can move either one or two stairs up. 2. At any stage, Ankita cannot move to a lower step. Let $F(N)$ denote the number of possible ways in which Ankita can reach the Nth stair. For example, $F(1) = 1,\ F(2) = 2,\ F(3) = 3$. The value of $F(5)$ is _____.
(A)	8
(B)	7
(C)	6
(D)	5

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Q.8	The information contained in DNA is used to synthesize proteins that are necessary for the functioning of life. DNA is composed of four nucleotides: Adenine (A), Thymine (T), Cytosine (C), and Guanine (G). The information contained in DNA can then be thought of as a sequence of these four nucleotides: A, T, C, and G. DNA has coding and non-coding regions. Coding regions—where the sequence of these nucleotides are read in groups of three to produce individual amino acids—constitute only about 2% of human DNA. For example, the triplet of nucleotides CCG codes for the amino acid glycine, while the triplet GGA codes for the amino acid proline. Multiple amino acids are then assembled to form a protein. Based only on the information provided above, which of the following statements can be logically inferred with *certainty*? (i) The majority of human DNA has no role in the synthesis of proteins. (ii) The function of about 98% of human DNA is not understood.
(A)	only (i)
(B)	only (ii)
(C)	both (i) and (ii)
(D)	neither (i) nor (ii)

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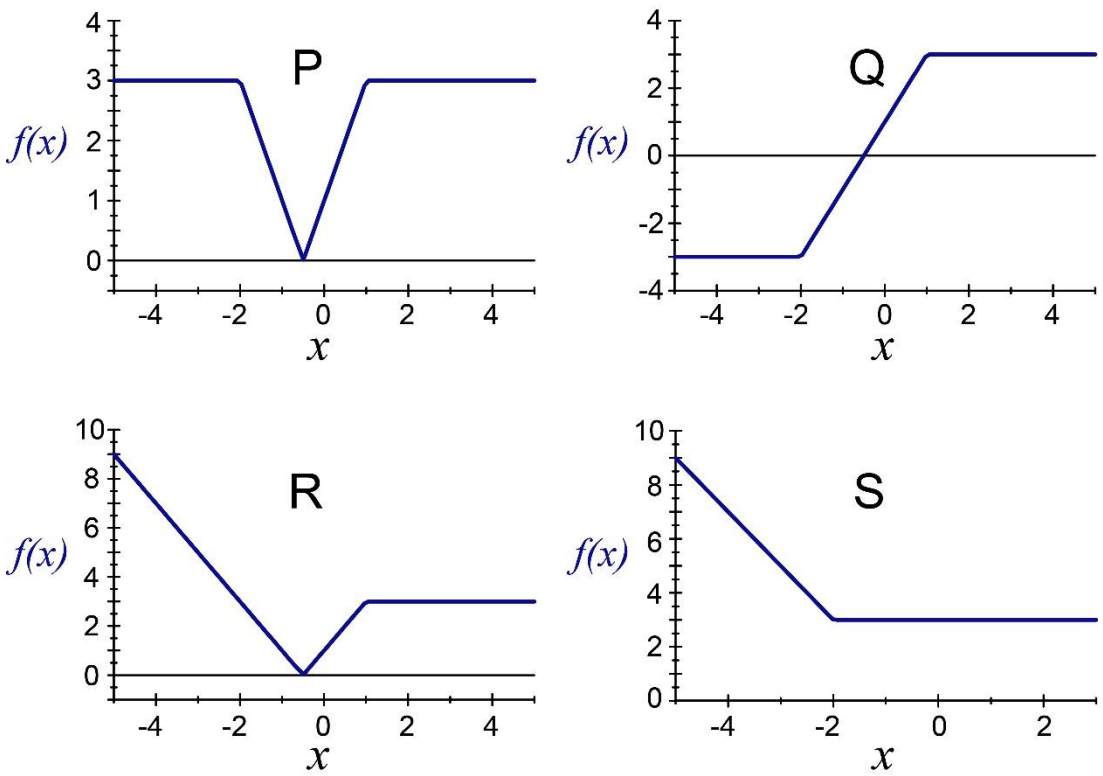
Q.9	Which one of the given figures P, Q, R and S represents the graph of the following function? $$f(x) = \|\,|x+2| - |x-1|\,\|$$
	
(A)	P
(B)	Q
(C)	R
(D)	S

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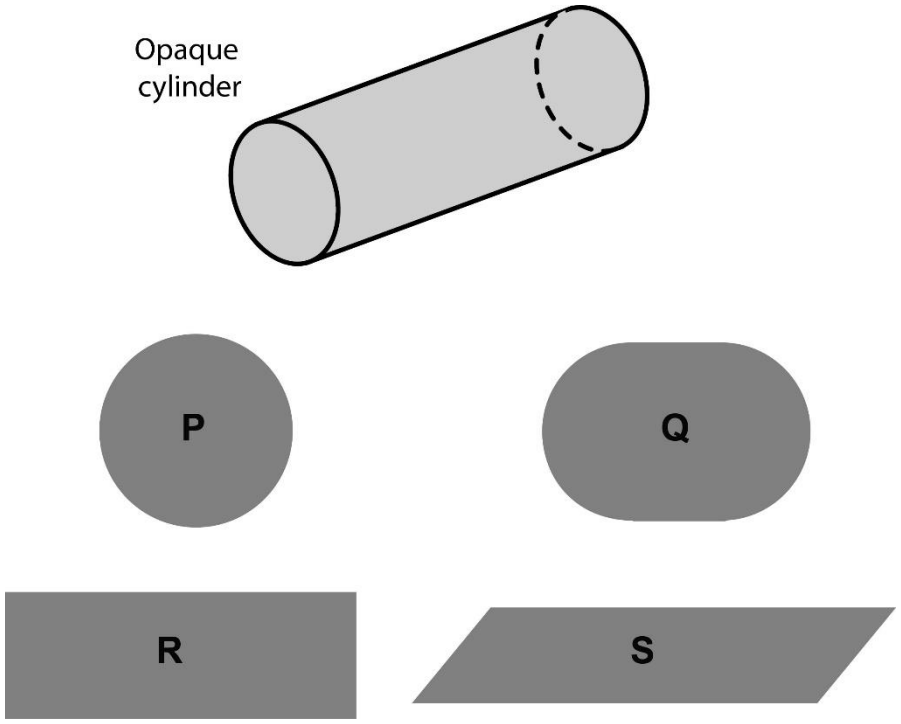
Q.10	An opaque cylinder (shown below) is suspended in the path of a parallel beam of light, such that its shadow is cast on a screen oriented perpendicular to the direction of the light beam. The cylinder can be reoriented in any direction within the light beam. Under these conditions, which one of the shadows **P**, **Q**, **R**, and **S** is NOT possible?
	
(A)	**P**
(B)	**Q**
(C)	**R**
(D)	**S**

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PART A: COMPULSORY SECTION FOR ALL CANDIDATES

Q.11 – Q.17 Carry ONE mark Each

Q.11	Which of the following is a chronostratigraphic unit?
(A)	Member
(B)	Stage
(C)	Acme Zone
(D)	Period
Q.12	During contact metamorphism, with increasing temperature,
(A)	the ratio of volume to surface area of mineral grains increases.
(B)	the ratio of volume to surface area of mineral grains decreases.
(C)	the reaction kinetics becomes slower.
(D)	hydrous minerals become more stable.

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Q.13	The dimension of dynamic viscosity is
(A)	$M^1L^{-1}T^{-2}$
(B)	$M^1L^{-1}T^{-1}$
(C)	$M^0L^2T^{-1}$
(D)	$M^0L^0T^0$
Q.14	At a depth of about 400 km inside the Earth, which one of the following occurs?
(A)	Conversion of most silicates to perovskite structure
(B)	Conversion of plagioclase-peridotite to spinel-peridotite
(C)	Transformation of olivine to spinel structure
(D)	Conversion of spinel-peridotite to plagioclase-peridotite

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Q.15	Equatorial radius of which one of the following planets is closest to that of the Earth?
(A)	Mercury
(B)	Venus
(C)	Mars
(D)	Neptune
Q.16	Variation of Bouguer anomaly obtained along a profile after applying all the necessary corrections is due to
(A)	topographic undulation above the datum plane.
(B)	increase in densities of crustal rocks with depth.
(C)	lateral density variations.
(D)	vertical density contrast across Moho.

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Q.17	The heat production (Q_r) of a granitic rock due to decay of the radioactive elements U, Th and K having concentration C_U, C_{Th}, and C_K, respectively, is given by the expression $$Q_r = \alpha C_U + \beta C_{Th} + \gamma C_K$$ Which one of the following correctly represents the relation between the magnitude of coefficients α, β, γ (in μWkg^{-1})?
(A)	$\alpha > \beta > \gamma$
(B)	$\alpha < \beta > \gamma$
(C)	$\alpha > \beta < \gamma$
(D)	$\alpha < \beta < \gamma$

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Q.18 – Q.26 Carry TWO marks Each

Q.18	Which one of the following Phanerozoic periods has the shortest duration of time?
(A)	Cambrian
(B)	Devonian
(C)	Cretaceous
(D)	Silurian
Q.19	Based on the given mineral proportions, which one of the following statements is CORRECT? **Rock** — **Mineral Proportion** X — Olivine : Orthopyroxene : Clinopyroxene :: 50 : 30 : 20 Y — Plagioclase : Alkali feldspar : Quartz :: 25 : 45 : 30 Z — Biotite : Plagioclase : Alkali feldspar : Quartz :: 20 : 25 : 35 : 20
(A)	Y is more felsic compared to X & Z
(B)	X is more felsic compared to Y & Z
(C)	Z is more felsic compared to X & Y
(D)	Y is the most felsic and Z is the most mafic

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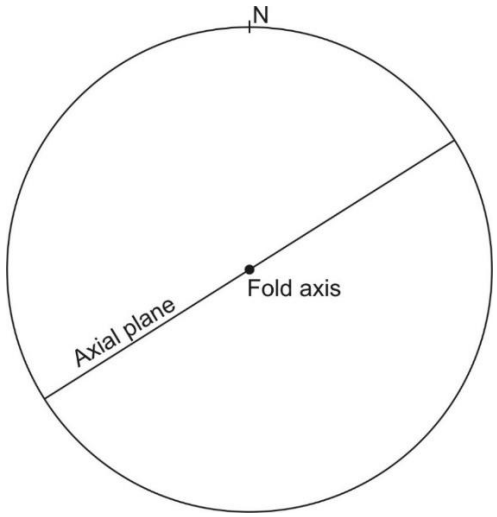
Q.20	The CORRECT sequence(s) of electromagnetic radiations in terms of increasing wavelength is/are
(A)	Gamma ray < UV < Near-IR
(B)	X-ray < Visible light < Thermal IR
(C)	Microwave < Visible light < Radio wave
(D)	Microwave < Thermal IR < Near-IR
Q.21	Which of the given folds is/are represented by the stereoplot?
	
(A)	Horizontal fold
(B)	Vertical fold
(C)	Upright fold
(D)	Recumbent fold

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Q.22	The bulk density and water content of a soil are 1800 kg/m^3 and 18%, respectively. The dry density of the soil calculated from the given information is _____ kg/m^3. [*round off to 2 decimal places*]

Q.23	In a seismic reflection survey over a two-layered Earth model having densities and seismic velocities ρ_1=2000 kg/m^3, V_1=1800 m/s for the first layer and ρ_2=3000 kg/m^3, V_2=2100 m/s for the second layer, the normal incidence P-wave reflection coefficient is _____. [*round off to 3 decimal places*]
Q.24	The resistivity of a rock, 100% saturated with water of resistivity 0.25 Ωm, is 60 Ωm. Assuming tortuosity and cementation exponents to be 1 and 2, respectively, the porosity of the rock is _____ (in %). [*round off to 2 decimal places*]
Q.25	Let us consider that a student misses cancelling the self-potential between potential electrodes before injecting current into the subsurface, in a Wenner electrical resistivity survey using DC resistivity meter over a horizontally stratified Earth. In direct and reverse modes of measurement (when current flows from C1 to C2 and C2 to C1, respectively) with the same magnitude of current flow, the potential differences recorded are +158 mV and −214 mV, respectively. The self-potential between the potential electrodes before injecting current was _____mV. [*in integer*]

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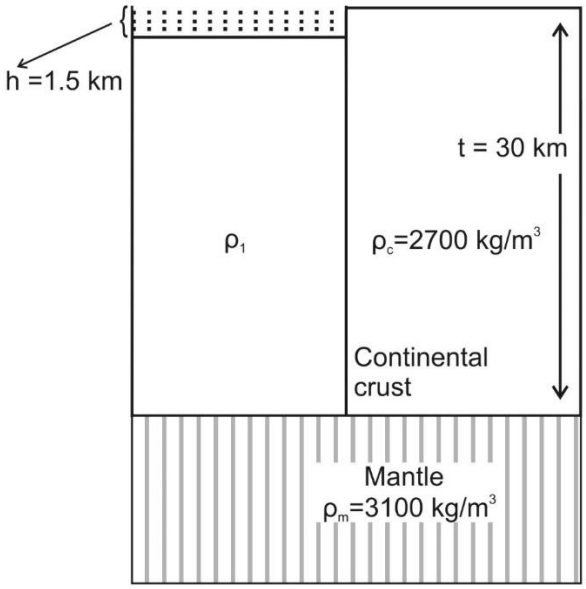
Q.26	For the given figure, considering Pratt's model of isostatic compensation at the crust mantle boundary, the crustal density (ρ_1) that explains 1.5 km deep lake is _____kg/m^3. (Consider density of water $\rho_w = 1000$ kg/m^3) [*round off to 2 decimal places*]
	

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PART B (SECTION 1): FOR GEOLOGY CANDIDATES ONLY

Q.27 – Q.44 Carry ONE mark Each

Q.27	Which one of the following mineral pairs shows solid solubility through coupled substitution of elements?
(A)	Albite - Anorthite
(B)	Albite - Orthoclase
(C)	Grossular - Andradite
(D)	Jadeite - Aegirine
Q.28	The behavior of trace elements in magmatic systems follows
(A)	Henry's Law
(B)	Raoult's Law
(C)	Fick's Second Law
(D)	First Law of Thermodynamics

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Q.29	Choose the CORRECT statement regarding crystallization of a single feldspar of composition $Or_{50}Ab_{50}$ in the Albite-Orthoclase system.
(A)	The mineral can form in hypersolvus but not in subsolvus feldspar system.
(B)	The mineral can form in subsolvus but not in hypersolvus feldspar system.
(C)	The mineral can crystallize in both hypersolvus and subsolvus feldspar system.
(D)	The mineral can crystallize neither in hypersolvus nor in subsolvus feldspar system.
Q.30	Given ΔV_r and ΔS_r are the volume and entropy of reaction, respectively, the most suitable conditions for the reaction to be used as a geothermometer are
(A)	small ΔV_r but large ΔS_r
(B)	small ΔS_r but large ΔV_r
(C)	positive ΔV_r but negative ΔS_r
(D)	negative ΔV_r but positive ΔS_r

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Q.31	In which one of the given mass extinction events, global cooling that resulted in glaciation and lowering of sea level, is considered as major cause of extinction for more than 50% of marine fauna?
(A)	Cretaceous – Paleogene
(B)	Permian – Triassic
(C)	Ordovician – Silurian
(D)	Holocene
Q.32	Processes of fossilization affecting an organism from its death to burial under sediments come under the study of
(A)	Biostratinomy
(B)	Biostratigraphy
(C)	Taphonomy
(D)	Taxonomy

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Q.33	The dip and dip direction of the lee side of a straight crested ripple on modern sediments are found to be 15° and N10°W, respectively. Considering unidirectional water movement, the flow direction is towards
(A)	N10°W
(B)	N70°E
(C)	S10°E
(D)	S70°W
Q.34	Rhodocrosite in hand specimen is most likely to be confused with certain varieties of
(A)	Wollastonite
(B)	Orthoclase
(C)	Gypsum
(D)	Biotite
Q.35	Which of the following is NOT an essential property of a mineral?
(A)	Natural occurrence
(B)	Regular internal structure
(C)	Fixed composition
(D)	Solid state

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Q.36	The number of lattice points in a face-centered cubic unit cell is
(A)	1
(B)	2
(C)	3
(D)	4
Q.37	All the faces of an octahedron can be collectively symbolized by
(A)	111
(B)	[111]
(C)	(111)
(D)	{111}
Q.38	Shallow-focus earthquakes with tensional focal mechanism are characteristic of
(A)	subduction zones.
(B)	continental shear zones.
(C)	transform faults.
(D)	mid-ocean ridges.

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Q.39	90% of the bulk Earth is constituted of Fe, Si, O and
(A)	Al
(B)	Ca
(C)	Mg
(D)	Na
Q.40	Which of the following is/are slope stabilization method(s)?
(A)	Bolting
(B)	Application of shotcrete
(C)	Use of impression packer
(D)	Use of geogrid
Q. 41	The amount of Fe in a sample of 25 g of pyrrhotite (FeS) is _____ g. (Atomic wt. of Fe = 55.85 and S = 32.06) [*round off to 2 decimal places*]

Q.42	The rate of spreading about a symmetric spreading center at the middle of a 4000 km wide sea is 40 mm/year. The spreading began _____ million years before present. [*in integer*]

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Q.43	A vertical aerial photograph is obtained over flat terrain with a 30 cm focal-length camera lens from an altitude of 18288 m. If the width of a dolerite dyke on this vertical photograph is 2 mm, its actual width on the terrain is _____ m. [*round off to 2 decimal places*]
Q.44	The decay constant of a radioactive isotope is 1.21×10^{-4} year^{-1}. The half-life of the isotope is _____ years. [*round off to nearest integer*]

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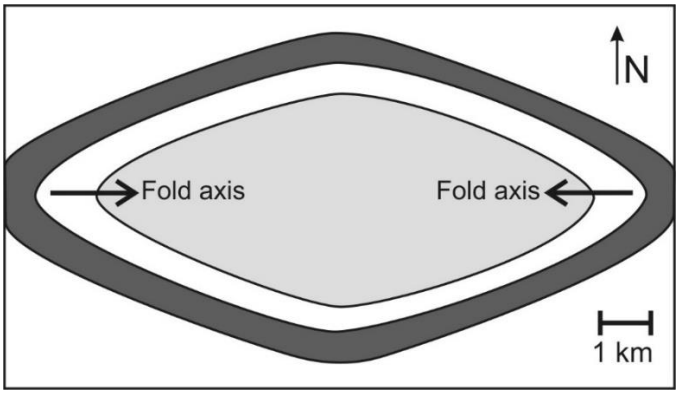
Q.45 – Q.65 Carry TWO marks Each

Q.45	The given outcrop pattern on a flat topography represents
	
(A)	antiform with axial culmination.
(B)	horizontal fold.
(C)	plunging antiform.
(D)	synform with axial depression.

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Q.46	Match the following fossil taxa in Group I with their corresponding features in Group II. **Group I** — **Group II** P. Bryozoa — 1. Denticles Q. Ostracoda — 2. Chamber R. Foraminifera — 3. Carapace S. Conodont — 4. Zooid
(A)	P-4, Q-3, R-2, S-1
(B)	P-3, Q-4, R-2, S-1
(C)	P-4, Q-1, R-2, S-3
(D)	P-3, Q-1, R-4, S-2

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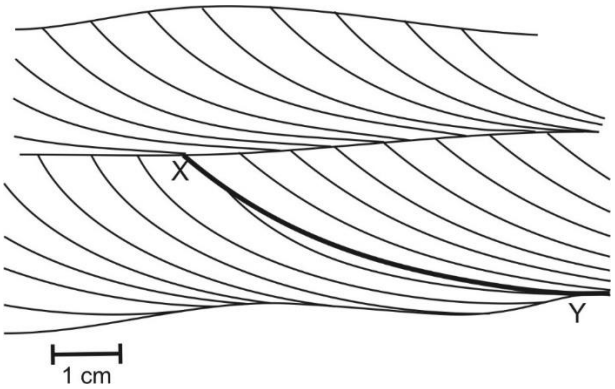
Q.47	In the given schematic diagram, cross beds are exposed on a vertical rock face. The feature XY (bold line) represents a/an
	
(A)	reactivation surface.
(B)	foreset of cross bed.
(C)	scoured channel base.
(D)	angular unconformity.

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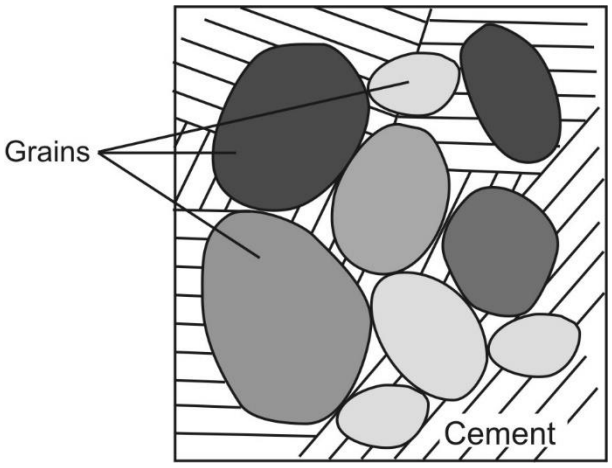
Q.48	The schematic diagram represents thin section of a carbonate rock. The type of cement formed by large calcite crystals is known as
	
(A)	overgrowth cement.
(B)	poikilotopic cement.
(C)	isopachous cement.
(D)	meniscus cement.

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Q.49	Based on the three statements given below, choose the CORRECT option. **Statement I**: Echinoids have water vascular system. **Statement II:** Delthyrium and pedicle foramen are found in the brachial valve of brachiopods. **Statement III**: Cardinal teeth, adductor muscles and chondrophore are found in bivalves.
(A)	Statements I and III are correct, statement II is incorrect.
(B)	Statements II and III are correct, statement I is incorrect.
(C)	Statements I and II are correct, statement III is incorrect.
(D)	Statements I, II and III are correct.

Q.50	The total number of symmetry elements in the crystal class represented by the point group $4/m\bar{3}2/m$ is
(A)	21
(B)	22
(C)	23
(D)	24

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Q.51	The ratio of bridging to non-bridging oxygen atoms in the amphibole structure is
(A)	4:11
(B)	5:6
(C)	2:7
(D)	1:2
Q.52	Match the following basins in Group I with their corresponding formations in Group II. **Group I** — **Group II** P. Cauvery — 1. Lohardih Q. Damodar — 2. Tiratgarh R. Chattisgarh — 3. Raniganj S. Indravati — 4. Kallamedu
(A)	P-4, Q-3, R-1, S-2
(B)	P-3, Q-4, R-2, S-1
(C)	P-4, Q-1, R-3, S-2
(D)	P-2, Q-3, R-1, S-4

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Q.53	Based on the three statements given below, choose the CORRECT option. **Statement I**: *Gigantopithecus* is a genus of the family Hominidae **Statement II:** *Equus* is a living genus of the family Equidae **Statement III**: *Gomphotherium* is a genus belonging to the order Proboscidea
(A)	Statements I and II are correct, statement III is incorrect.
(B)	Statements I and III are correct, statement II is incorrect.
(C)	Statements II and III are correct, statement I is incorrect.
(D)	Statements I, II and III are correct.
Q.54	In porphyry copper deposits, the order of alteration zones from the intrusive body outwards is
(A)	propylitic→argillic→phyllic→potassic
(B)	argillic→phyllic→potassic→propylitic
(C)	potassic→phyllic→argillic→propylitic
(D)	potassic→argillic→phyllic→propylitic

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Q.55	Which is the CORRECT sequence of ore minerals in their increasing order of reflectance?
(A)	Galena, Sphalerite, Magnetite, Pyrite
(B)	Magnetite, Sphalerite, Galena, Pyrite
(C)	Sphalerite, Magnetite, Galena, Pyrite
(D)	Galena, Magnetite, Sphalerite, Pyrite
Q.56	Which of the following stratigraphic successions is/are arranged in CORRECT chronological order?
(A)	Muth Quartzite-Syringothyris Limestone-Fenestella Shale-Panjal Volcanics
(B)	Barakar Formation-Bijori Formation-Pachmarhi Formation-Bagra Formation
(C)	Chiravati Group-Papaghni Group-Nallamalai Group-Kurnool Group
(D)	Kaimur Group-Semri Group-Bhander Group-Rewa Group

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Q.57	Which of the following options represent(s) simultaneous crystallization of two minerals in the given feature(s) ?
(A)	Granophyric texture
(B)	Myrmekite
(C)	Corona of orthopyroxene around anhedral olivine
(D)	Cumulate pyroxene with interstitial plagioclase
Q.58	Which of the following textures suggest(s) post-kinematic growth of the mentioned mineral?
(A)	Randomly oriented chlorite grain aggregates pseudomorphing porphyroblast
(B)	Garnet porphyroblast wrapped by external foliation
(C)	Foliation defining biotite wrapping around a porphyroblast
(D)	Porphyroblastic garnet containing helicitic fold as internal schistosity

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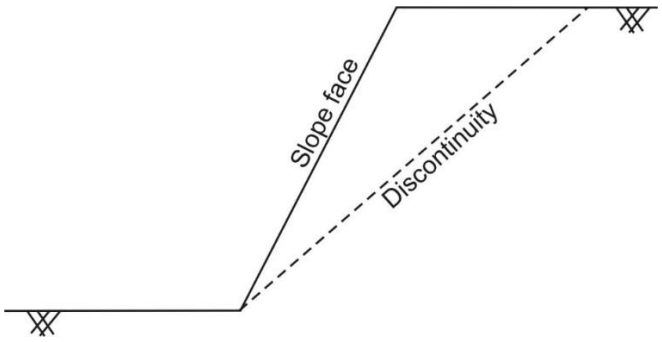
Q.59	In the schematic cross-section of a hill, a planar discontinuity intersects a planar slope face. Using kinematic analysis, which of the following conditions favor(s) plane failure to occur?
	
(A)	The dip of the discontinuity surface is less than that of the slope face.
(B)	Friction angle on the discontinuity surface is more than the dip of the slope face.
(C)	Friction angle on the discontinuity surface is less than the dip of the discontinuity.
(D)	The dip direction of the discontinuity surface is same as that of the slope face.

Q.60	In a drainage basin, the number of the 1st, 2nd, 3rd, 4th and 5th order streams are 240, 40, 8, 2 and 1, respectively. The average of all calculated bifurcation ratios is _____. [*round off to 2 decimal places*]
Q.61	A sandstone follows Mohr-Coulomb failure criterion. If the uniaxial compressive strength and the angle of the internal friction of the sandstone are 7 MPa and 30°, respectively, the calculated cohesion of the rock is _____ MPa. [*round off to 2 decimal places*]

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Q.62	At a certain depth in the crust, the maximum and minimum principal compressive stresses are 150 MPa and 75 MPa, respectively, which lead to normal faulting. If the average density of the crust is 2700 kg/m^3, the crustal depth of fracture initiation according to Anderson's theory of faulting is _____ km. ($g = 10$ m/s^2) [*round off to one decimal place*]
Q.63	A cylindrical soil sample of 10 cm diameter is tested in a constant-head permeameter. A volume of 250 cm^3 of water is collected in 5 minutes when the constant-head difference between tapping points 15 cm apart is 5 cm. Considering Darcy flow, the absolute value of coefficient of permeability in cm/s is _____. ($\pi = 3.14$) [*round off to 3 decimal places*]
Q.64	The minimum anion-to-cation radius ratio at which a 3-fold coordination becomes possible is _____. [*round off to 2 decimal places*]
Q.65	The mole fraction of jadeite in the pyroxene of composition $(Ca_{0.667}Na_{0.333}Fe^{2+}_{0.121}Fe^{3+}_{0.125}Mg_{0.546}Al_{0.208})Si_2O_6$ is _____. [*round off to 3 decimal places*]

END OF QUESTION PAPER

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