GA - General Aptitude

Q1 - Q5 carry one mark each.

Q.No. 1 The untimely loss of life is a cause of serious global concern as thousands of people get killed_____accidents every year while many other die_____diseases like cardio vascular disease, cancer, etc.

(A) in, of
(B) from, of
(C) during, from
(D) from, from

Q.No. 2 He was not only accused of theft_____of conspiracy.

(A) rather
(B) but also
(C) but even
(D) rather than

Q.No. 3 Select the word that fits the analogy:

Explicit: Implicit :: Express: _____

(A) Impress
(B) Repress
(C) Compress
(D) Suppress

Q.No. 4 The Canadian constitution requires that equal importance be given to English and French. Last year, Air Canada lost a lawsuit, and had to pay a six-figure fine to a French-speaking couple after they filed complaints about formal in-flight announcements in English lasting 15 seconds, as opposed to informal 5 second messages in French.

The French-speaking couple were upset at _____.

(A) the in-flight announcements being made in English.
(B) the English announcements being clearer than the French ones.
(C) the English announcements being longer than the French ones.
(D) equal importance being given to English and French.

Q.No. 5 A superadditive function $f(\cdot)$ satisfies the following property

$$f(x_1 + x_2) \geq f(x_1) + f(x_2)$$

Which of the following functions is a superadditive function for $x > 1$?

(A) e^x
(B) $\sqrt{x}$
(C) $1/x$
(D) e^{-x}

Q.No. 6

The global financial crisis in 2008 is considered to be the most serious world-wide financial crisis, which started with the sub-prime lending crisis in USA in 2007. The sub-prime lending crisis led to the banking crisis in 2008 with the collapse of Lehman Brothers in 2008. The sub-prime lending refers to the provision of loans to those borrowers who may have difficulties in repaying loans, and it arises because of excess liquidity following the East Asian crisis.

Which one of the following sequences shows the correct precedence as per the given passage?

(A) East Asian crisis→ subprime lending crisis →banking crisis→ global financial crisis.

(B) Subprime lending crisis→ global financial crisis→ banking crisis→ East Asian crisis.

(C) Banking crisis→ subprime lending crisis→ global financial crisis → East Asian crisis.

(D) Global financial crisis → East Asian crisis → banking crisis → subprime lending crisis.

Q.No. 7 It is quarter past three in your watch. The angle between the hour hand and the minute hand is _______.

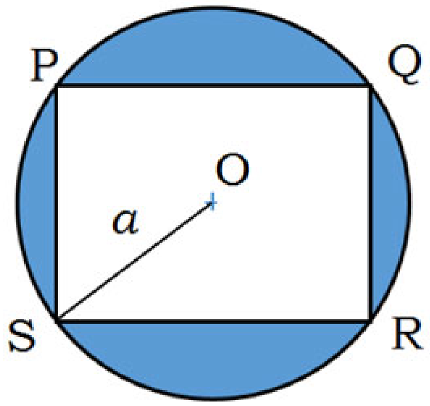
(A) 0°

(B) 7.5°

(C) 15°

(D) 22.5°

Q.No. 8 A circle with centre O is shown in the figure. A rectangle PQRS of maximum possible area is inscribed in the circle. If the radius of the circle is a, then the area of the shaded portion is _____.



(A) $\pi a^2 - a^2$

(B) $\pi a^2 - \sqrt{2}a^2$

(C) $\pi a^2 - 2a^2$

(D) $\pi a^2 - 3a^2$

Q.No. 9 a, b, c are real numbers. The quadratic equation $ax^2 - bx + c = 0$ has equal roots, which is β, then

(A) $\beta = b/a$

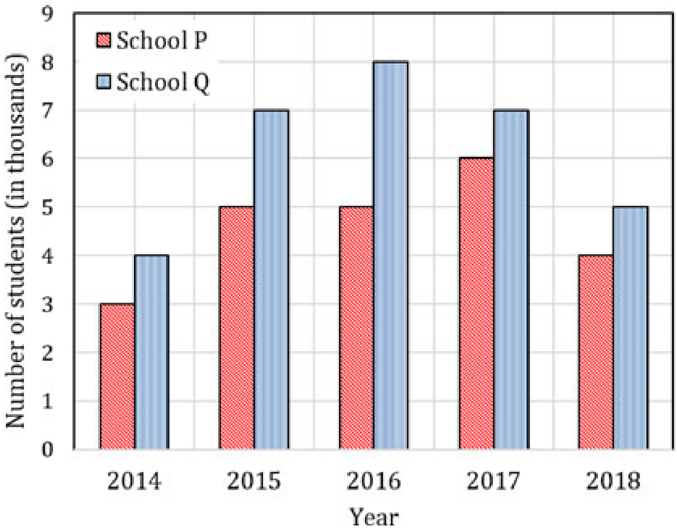
(B) $\beta^2 = ac$

(C) $\beta^3 = bc/(2a^2)$

(D) $b^2 \neq 4ac$

Q.No. 10

The following figure shows the data of students enrolled in 5 years (2014 to 2018) for two schools P and Q. During this period, the ratio of the average number of the students enrolled in school P to the average of the difference of the number of students enrolled in schools P and Q is______.



(A) 8 : 23
(B) 23 : 8
(C) 23 : 31
(D) 31 : 23

GG: Part A - Common Part

Q.No. 1 A plagioclase with $\frac{Na^+}{Na^+ + Ca^{2+}} = 0.8$ is
(A) albite
(B) anorthite
(C) oligoclase
(D) bytownite

Q.No. 2 Tillite is an important constituent of the
(A) Talchir Formation
(B) Barakar Formation
(C) Pachmarhi Formation
(D) Lameta Formation

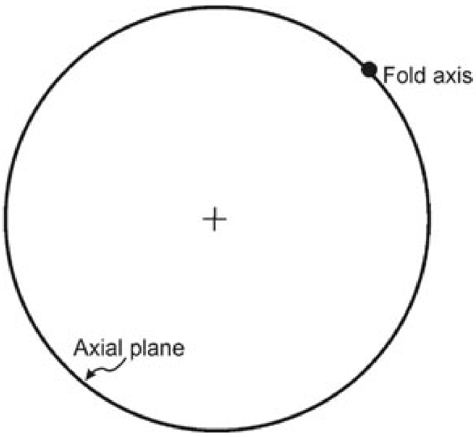
Q.No. 3 If the ratio of gravity to total magnetic field at the equator of the Earth is X, then the ratio of gravity to total magnetic field at the pole of the Earth will be close to
(A) $2X$
(B) $\frac{X}{2}$
(C) $4X$
(D) $\frac{X}{8}$

Q.No. 4 Which of the following is NOT a point group?
(A) 222
(B) 422
(C) 432
(D) 632

Q.No. 5 Mississippian is an Epoch within the

(A) Permian Period
(B) Carboniferous Period
(C) Triassic Period
(D) Jurassic Period

Q.No. 6 The given stereoplot of the axial plane and the axis of a fold represents an/a



(A) upright fold
(B) vertical fold
(C) reclined fold
(D) recumbent fold

Q.No. 7 A siliciclastic sedimentary rock with <5% matrix and QFL composition of 60% quartz, 30% rock fragments and 10% feldspar, is called
(A) quartz wacke
(B) lithic arenite
(C) quartz arenite
(D) feldspathic wacke

Q.No. 8 Which one of the following pairs of geophysical methods is most suitable to delineate chromite ore deposits occurring at a shallow depth in a granitic terrain?
(A) Gravity and Electrical methods
(B) Electrical and Electromagnetic methods
(C) Seismic and Gravity methods
(D) Seismic and Magnetic methods

Q.No. 9 The ratio of bridging to non-bridging oxygen atoms is zero in case of
(A) nesosilicates
(B) inosilicates
(C) phyllosilicates
(D) tectosilicates

Q.No. 10 Lahar is a geomorphic feature associated with
(A) wind activity
(B) river activity
(C) glacial activity
(D) volcanic activity

Q.No. 11 Kepler's second law of planetary motion follows the principle of conservation of
(A) energy
(B) momentum
(C) angular momentum

(D) moment of inertia

Q.No. 12 Which one of the following options shows the internal structural units of the Earth arranged in the CORRECT sequence of increasing volume?

(A) Outer core < Inner core < Upper mantle < Lower mantle
(B) Outer core < Inner core < Lower mantle < Upper mantle
(C) Inner core < Outer core < Upper mantle < Lower mantle
(D) Inner core < Outer core < Lower mantle < Upper mantle

Q.No. 13 Which one of the following is NOT an earthquake intensity scale?

(A) Richter scale
(B) JMA scale
(C) Modified Mercalli scale
(D) Rossi-Forel scale

Q.No. 14 The dimension of transmissivity of an aquifer is

(A) $M^0L^1T^{-1}$
(B) $M^0L^0T^0$
(C) $M^1L^{-1}T^{-2}$
(D) $M^0L^2T^{-1}$

Q.No. 15 During 'K-capture' nuclear transmutation process

(A) both atomic number and atomic mass increase
(B) atomic number decreases but atomic mass remains the same
(C) atomic number increases but atomic mass remains the same
(D) both atomic number and atomic mass decrease

Q.No. 16 Which one amongst the following logs has the maximum depth of investigation?

(A) Neutron log
(B) Natural Gamma-ray log
(C) Lateral log
(D) Density log

Q.No. 17 The scale factor of an aerial photo of a planar ground surface, taken vertically downwards by a camera with a focal length of 300 mm, from a flying height of 3000 m is ____________.

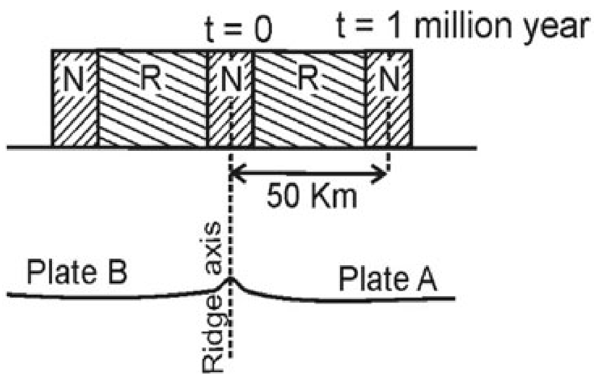
Q.No. 18 In a soil sample, specific gravity of soil particles is 2.5 and the void ratio is 0.5. The density of the soil sample when it is fully saturated with water is __________ kg/m^3. (Assume density of water = 1000 kg/m^3, and no volume change of the soil sample with saturation)

Q.No. 19 Nuclide **A** decays to nuclide **B** exclusively through α and β decay, such that the mass number is reduced by 32 and the atomic number is reduced by 10. The number of β particles emitted during the decay of nuclide **A** to nuclide **B** is ____________.

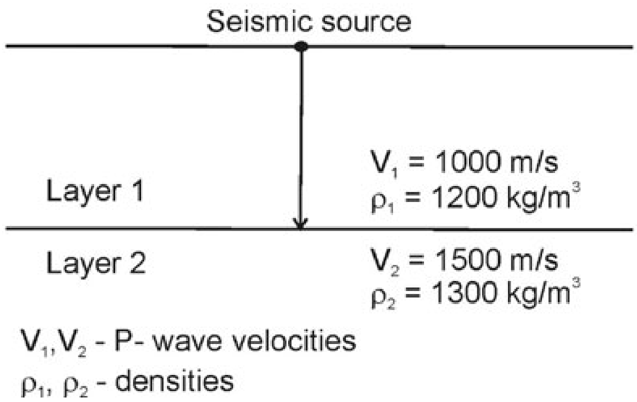
Q.No. 20

A cylindrical specimen (diameter = 54.7 mm; length = 110 mm) of basalt shows linear elastic behavior under uniaxial compression. At an axial stress of 100 Mega-Pascal (MPa), the absolute value of the measured axial strain is 0.2%. The Young's modulus is calculated to be ____________ Giga-Pascal (GPa).

Q.No. 21 A Mid-Oceanic-Ridge has symmetric magnetic anomalies about the ridge axis as shown below. Using the information given in the figure, the average relative velocity between the Plates A and B is calculated to be ____________ cm/year.

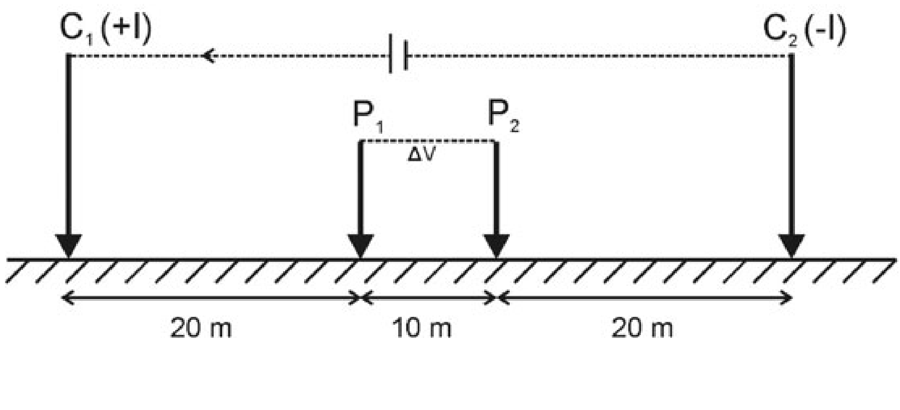


Q.No. 22 The transmission coefficient for the vertically incident seismic wave at the interface between Layer 1 and Layer 2 given in the figure is ________________.
(*Round off to 2 decimal places*)



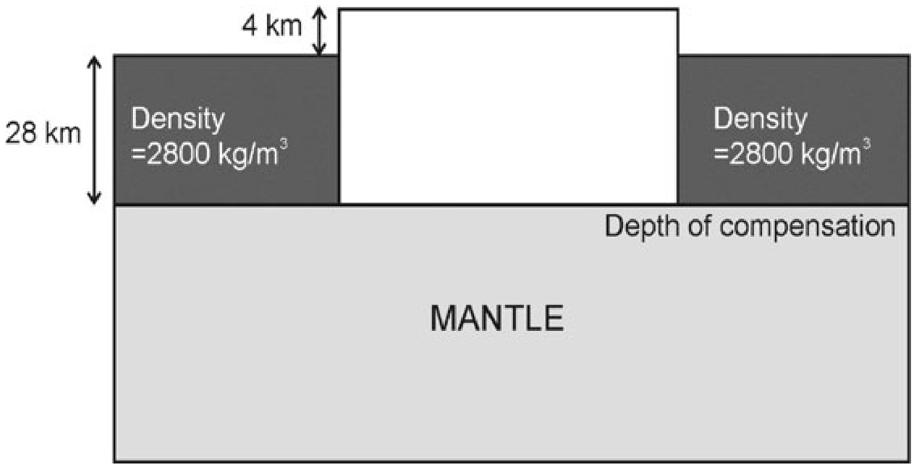
Q.No. 23 The 'geometrical factor' for the electrode configuration given below will be ___________m. (*Round off to 2 decimal places*) (Use π = 3.14)

(C_1 and C_2 are current electrodes; P_1 and P_2 are potential electrodes)



Q.No. 24 In an electromagnetic measurement, the resultant field shows a phase lag of 30° with respect to the primary field at the receiver coil. The ratio of Inphase to Quadrature component of the resultant field is _____________. (*Round off to 2 decimal places*)

Q.No. 25 A 4 km-high plateau is isostatically compensated as shown in the figure. Assuming Pratt's hypothesis of isostasy, the calculated density of the plateau is _______ kg/m^3.



GG: Part B : Section 1 Geology

Q.No. 1 "Point Group" in crystallography is characterized by a set of symmetry operations such that

(A) all points in a crystal are affected by it
(B) no point in a crystal is affected by it
(C) at least one point in a crystal is affected by it
(D) at least one point in a crystal is unaffected by it

Q.No. 2 What are the Miller indices of a plane that intercepts each of the crystallographic axes X, Y and Z, at 20 Å? (Assume a primitive unit-cell with the dimensions a = 5 Å, b = 2 Å and c = 4 Å.)

(A) (111)
(B) (524)
(C) (425)
(D) (542)

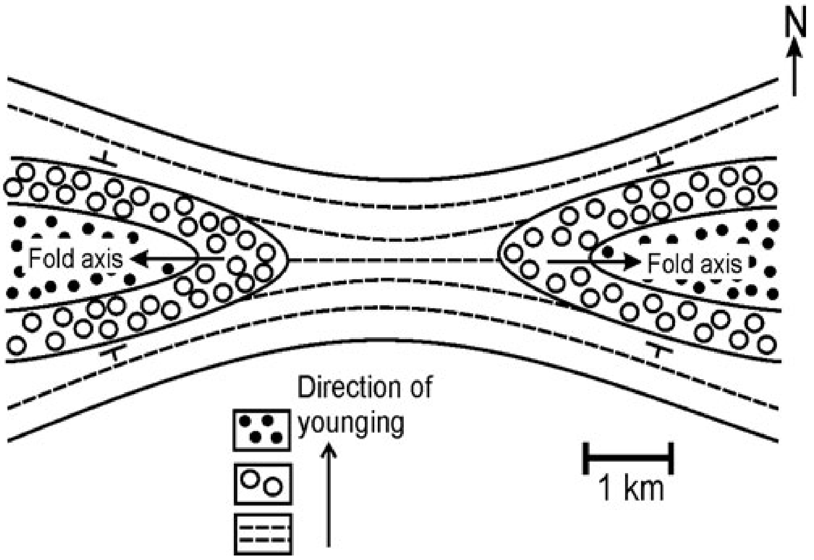
Q.No. 3 Which one of the following processes is associated with the emission of X-rays?

(A) alpha decay
(B) beta decay
(C) electron capture decay
(D) positron decay

Q.No. 4 Which one of the following radioisotopes has the longest half-life?

(A) ^{87}Rb
(B) ^{147}Sm
(C) ^{232}Th
(D) ^{238}U

Q.No. 5 The given geological map represents



(A) culmination of an antiformal anticline
(B) culmination of an antiformal syncline
(C) depression of a synformal anticline
(D) culmination of a synformal syncline

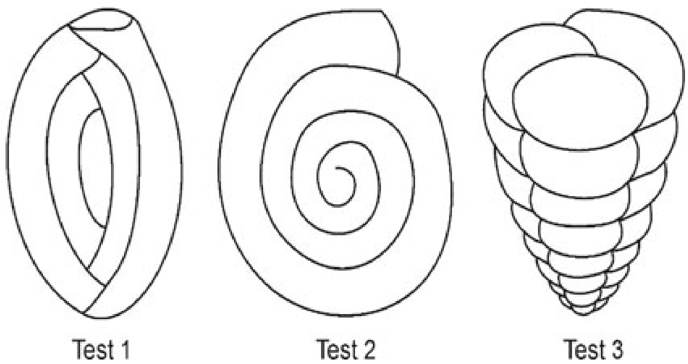
Q.No. 6 On a fault plane, the net slip is parallel to the bedding trace. Then, the apparent movement will be recognizable

(A) both in horizontal and vertical sections
(B) in horizontal, but not in vertical section
(C) in vertical, but not in horizontal section
(D) neither in horizontal nor in vertical section

Q.No. 7 The CORRECT sequence of the given electromagnetic radiations in order of increasing wavelength is

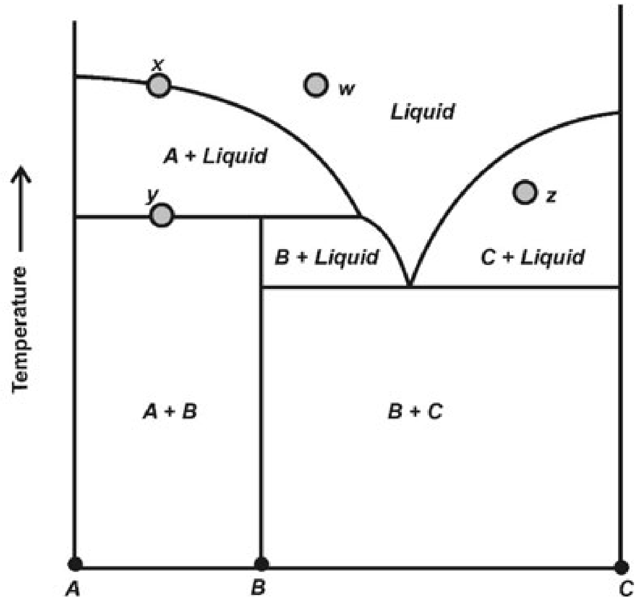
(A) Ultraviolet < Gamma Rays < Radiowave < Near-Infrared
(B) Gamma Rays < Ultraviolet < Near-Infrared < Radiowave
(C) Gamma Rays < Radiowave < Ultraviolet < Near-Infrared
(D) Ultraviolet < Radiowave < Near-Infrared < Gamma Rays

Q.No. 8 Choose the CORRECT combination of foraminiferal tests and types of coiling.



(A) Test 1 – Trochospiral, Test 2 – Planispiral, Test 3 – Milioline
(B) Test 1 – Milioline, Test 2 – Planispiral, Test 3 – Trochospiral
(C) Test 1 – Milioline, Test 2 – Trochospiral, Test 3 – Planispiral
(D) Test 1 – Trochospiral, Test 2 – Milioline, Test 3 – Planispiral

Q.No. 9 The figure below represents an isobaric binary liquidus phase diagram, with the solid phases A, B and C. What are the degrees of freedom associated with equilibrium phase assemblages represented by the bulk compositions w, x, y and z, in the fields indicated in the figure?



(A) $w = 2, x = 1, y = 1, z = 1$
(B) $w = 2, x = 1, y = 0, z = 2$
(C) $w = 1, x = 1, y = 0, z = 1$
(D) $w = 1, x = 1, y = 1, z = 2$

Q.No. 10 Match the basins (Group I) with the corresponding stratigraphic units (Group II).

Group I	**Group II**
P. Cuddapah	1. Kerur Formation
Q. Chattisgarh	2. Dhandraul Quartzite
R. Kaladgi-Badami	3. Bairenkonda Quartzite
S. Vindhyan	4. Gunderdehi Formation

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

Q.No. 11 In the metamorphic reaction Quartz + Muscovite = X + Sillimanite + Water, 'X' represents

(A) Garnet
(B) Staurolite
(C) Orthoclase
(D) Cordierite

Q.No. 12 The talc-kyanite assemblage can stabilize in

(A) greenschist facies marly rocks
(B) amphibolite facies mafic rocks

(C) eclogite facies pelitic rocks
(D) sanidinite facies ultramafic rocks

Q.No. 13 Which one of the following statements about igneous rocks is CORRECT?
(A) Tholeiitic and calc-alkaline rocks are both alkaline in nature.
(B) Tholeiitic rocks are subalkaline, but calc-alkaline rocks are alkaline in nature.
(C) Tholeiitic rocks are alkaline, but calc-alkaline rocks are subalkaline in nature.
(D) Tholeiitic and calc-alkaline rocks are both subalkaline in nature.

Q.No. 14 Based on the three statements given below, choose the CORRECT option.

Statement I: Barchans are crescent-shaped dunes that close in the downwind direction.

Statement II: Parabolic dunes are U-shaped dunes that close in the downwind direction.

Statement III: Barchanoid dunes are sinuous transverse ridges, the crestline sinuousity of successive bedforms are either in-phase or out-phase.
(A) All the statements are correct
(B) Statement I is correct, but statements II and III are incorrect
(C) Statements I and II are correct, but statement III is incorrect
(D) Statements II and III are correct, but statement I is incorrect

Q.No. 15 Based on the three statements given below, choose the CORRECT option.

Statement I: *Barapasaurus* is known from the Jurassic Kota Formation.

Statement II: *Morganucodon* is known from the Tatrot Formation.

Statement III: *Lystrosaurus* is known from the Lameta Formation.
(A) All the three statements are correct
(B) Statement I is correct but statements II and III are incorrect
(C) Statements I and II are correct but statement III is incorrect
(D) Statements II and III are correct but statement I is incorrect

Q.No. 16 Which one of the following assemblages of plant fossils is known from the Barakar Formation?
(A) *Glossopteris, Gangamopteris, Dicroidium*
(B) *Glossopteris, Gangamopteris, Noeggerathiopsis*
(C) *Glossopteris, Gangamopteris, Ptilophyllum*
(D) *Schizoneura, Noeggerathiopsis, Ptilophyllum*

Q.No. 17

Match the features (Group I) with the corresponding invertebrate genera (Group II).

Group I	Group II
P. Cardinal Fossula	1. *Calymene*
Q. Chrondrophore	2. *Rhynchonella*
R. Lophophore	3. *Zaphrentis*
S. Glabella	4. *Mya*

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

Q.No. 18 If the orthogonal thickness is constant along a folded layer, as per Ramsay's morphological classification of folds, it is a
(A) Class IA fold
(B) Class IB fold
(C) Class 2 fold
(D) Class 3 fold

Q.No. 19 If density of quartz is 2650 kg/m^3 and that of orthoclase is 2550 kg/m^3, the lithostatic pressure due to a granite with 68 modal % quartz and 32 modal % orthoclase at a depth of 10 km will be ___________ kbar. (*Round off to 2 decimal places*) (Acceleration due to gravity $g = 9.8$ m/s^2.)

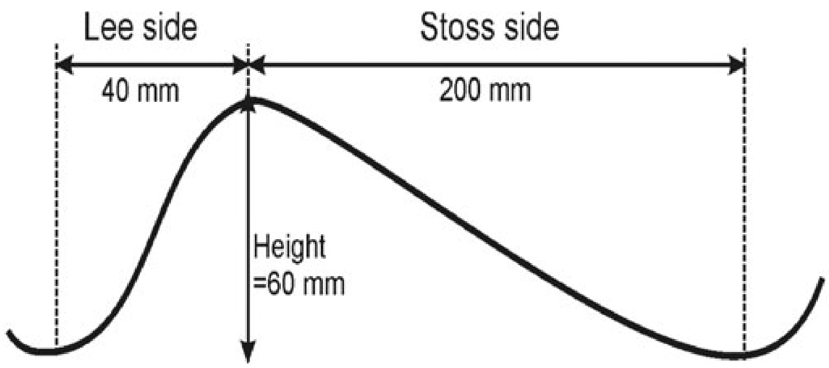
Q.No. 20 The unit-cell of an orthorhombic mineral was compressed during deformation from 5 Å to 4.5 Å along the c-axis, with the other two dimensions remaining unaffected. The absolute value of the shift in the position of the (001) peak in its XRD pattern is __________ °2θ. (*Round off to 3 decimal places*) (Wavelength of X-ray used = 1.5418 Å. For orthorhombic system: $1/d^2 = h^2/a^2 + k^2/b^2 + l^2/c^2$.)

Q.No. 21 The grade of iron in an ore body containing 80 wt. % hematite and 20 wt. % gangue is ________ %. (*Round off to 2 decimal places*) (Atomic wt. of Fe = 55.85, atomic weight of O = 16)

Q.No. 22 The abundances of the isotopes ^{35}Cl (atomic mass = 34.96885 amu) and ^{37}Cl (atomic mass = 36.96590 amu) are 75.77 % and 24.23 %, respectively. The calculated atomic weight of Cl is _______ amu. (*Round off to 3 decimal places*)

Q.No. 23

A vertical profile perpendicular to the crest line of an asymmetrical ripple is given in the figure. The calculated Ripple Index is ______________.

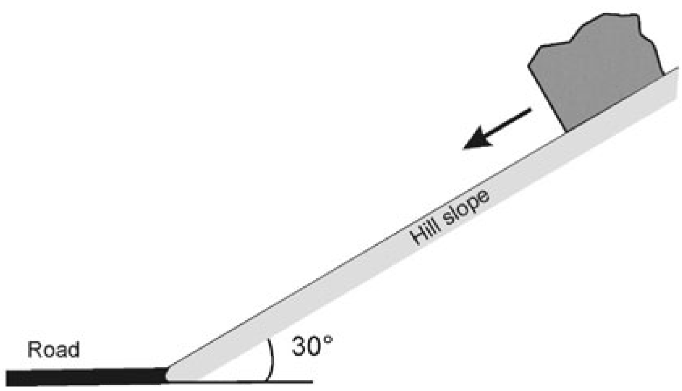


Q.No. 24 A source rock undergoes melting. Assuming batch melting, 5% partial melting and bulk distribution coefficient of 0.045, the enrichment factor (C_L/C_0) of Rb in the melt will be __________. (*Round off to 2 decimal places*)

Q.No. 25 If the ΔH of formation of $CaSiO_3$, SiO_2 and CaO from Ca, Si and O are respectively −1635, −911 and −635 kJ/mol, the enthalpy of formation of $CaSiO_3$ from CaO and SiO_2 is ____________ kJ/mol.

Q.No. 26 The tip-line of an actively propagating thrust fault is located at a depth of 1 km from the horizontal ground surface. The average density of the material from the ground surface to this depth is assumed to be uniform and can be taken as 2700 kg/m^3. The rock at this depth follows the failure criterion given by the equation: $\sigma_1 = 10\ MPa + 3\sigma_3$, where $\sigma_1$and σ_3 are the maximum and minimum principal stresses. Considering Anderson's theory of faulting, the calculated maximum principal stress at this depth is ___________ Mega-Pascal (MPa). (Assume the acceleration due to gravity (g) to be 10 m/s^2.)

Q.No. 27 During a rockslide, a 20 kg granite block gets dislodged from the top of a planar hill slope and starts sliding down the slope as shown in the figure. The slope angle is 30° with the horizontal. After travelling a distance of 40 m in the same direction on the slope, the block hits the road. Assuming zero cohesion and zero friction, and considering acceleration due to gravity (g) as 10 m/s^2, the velocity with which the block hits the road is ____________ m/s.



Q.No. 28 Liquid limit and plastic limit of a soil are 40% and 20%, respectively. If the natural (i.e. *in situ*) water content of the soil is 30%, the liquidity index is ________________.

Q.No. 29 A confined aquifer has a uniform area (‘**A**’) perpendicular to the water flow. The hydraulic gradient and coefficient of permeability are given as 0.005 and 2 m/day, respectively. The total daily flow of water is 250 m^3. Using Darcy’s law, the calculated value of ‘**A**’ is _______________ m^2.

Q.No. 30 The apparent dip amount of a sandstone bed is 45°. The angle between the true dip direction and the apparent dip direction is 60°. The true dip amount of the bed is ______________ degree (°). (*Round off to 2 decimal places*)

GG : Part B : Section 2 Geophysics

Q.No. 1 International gravity formula is based on which one of the following models?

(A) Non-rotating homogeneous spherical Earth model
(B) Non-rotating homogeneous oblate spheroidal Earth model
(C) Rotating homogeneous oblate spheroidal Earth model
(D) Rotating inhomogeneous spherical Earth model

Q.No. 2 Heat flow equation $\frac{d^2T}{dz^2} = 0$ is valid when

[T = Temperature, z is coordinate along z-axis]

(A) steady state heat conduction is considered in an isotropic medium without heat source
(B) steady state heat conduction is considered in an isotropic medium with heat source
(C) steady state heat convection is considered in an isotropic medium without heat source
(D) steady state heat convection is considered in an isotropic medium with heat source

Q.No. 3 Assuming the inner core of the Earth to be one-third of its present size, which one of the following statements is CORRECT? (Radius of the Earth and outer core remain unchanged)

(A) Shadow zone of P-wave increases but that of S-wave decreases
(B) Shadow zone of P-wave increases and that of S-wave remains unchanged
(C) Shadow zone of P-wave increases and that of S-wave increases
(D) Shadow zone of P-wave decreases but that of S-wave remains unchanged

Q.No. 4

Match the following instruments (Group I) with their corresponding physical principle (Group II)

Group I	Group II
P. Fluxgate magnetometer	1. Hooke's law
Q. LaCoste-Romberg gravimeter	2. Zeeman effect
R. Proton Precession magnetometer	3. Faraday's law of EM-induction
S. Optically pumped magnetometer	4. Nuclear magnetic resonance

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

Q.No. 5 The sensitivity of LaCoste-Romberg gravimeter is proportional to the time period (T) of the spring as

(A) T^2
(B) $\frac{1}{T^2}$
(C) $\sqrt{T}$
(D) $\frac{1}{\sqrt{T}}$

Q.No. 6 Match the following gravity/magnetic data interpretation techniques (Group I) with the corresponding terms (Group II)

Group I	Group II
P. Euler deconvolution	1. Symmetry
Q. Power spectrum analysis	2. Source response enhancement
R. Reduced to pole transformation	3. Equation of homogeneity
S. Downward continuation	4. Basement depth

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

Q.No. 7 Assuming uncorrelated noise, the improvement in the signal to noise ratio in a reflection seismic survey with 'n' geophones spaced equally along the profile is proportional to

(A) n
(B)

$\frac{1}{n}$

(C) $\sqrt{n}$

(D) $\frac{1}{\sqrt{n}}$

Q.No. 8 A waveform with amplitude spectrum A(ω) and phase spectrum ϕ(ω) is auto-correlated. Which one of the options given below correctly represents the information about the original waveform that can be retrieved from the autocorrelated waveform?

(A) A(ω) can be retrieved but not ϕ(ω)

(B) ϕ(ω) can be retrieved but not A(ω)

(C) Both A(ω) and ϕ(ω) can be retrieved

(D) Both A(ω) and ϕ(ω) cannot be retrieved

Q.No. 9 The convolution of A (4, 2, −1, 2) with B (1, 0, −1) gives

(A) {−4, 2, −5, 0, 1, 2}

(B) {4, 2, −5, 0, 1, −2}

(C) {−4, −2, 5, 0, −1, −2}

(D) {4, 2, 5, 0, −1, 2}

Q.No. 10 Which one of the following does NOT contribute to the suppression of SP log response for a thin, shaly, gas-bearing sandstone formation? (Resistivity of mud filtrate > resistivity of formation water)

(A) Increase in shale content

(B) Increase in hydrocarbon content

(C) Decrease in the thickness of the bed

(D) Increase in the salinity of formation water

Q.No. 11 The crossover observed for a hydrocarbon-bearing sandstone formation in the plot of Neutron and Density porosity logs ($\emptyset_n$ - Neutron porosity and $\emptyset_d$ - Density porosity) is due to

(A) increase in $\emptyset_d$ and decrease in $\emptyset_n$

(B) decrease in $\emptyset_d$ and increase in $\emptyset_n$

(C) increase in both $\emptyset_d$ and $\emptyset_n$

(D) decrease in both $\emptyset_d$ and $\emptyset_n$

Q.No. 12 In which one of the following electromagnetic methods are the amplitude ratio and relative phase difference measured between two receiver coils?

(A) Fixed vertical loop method

(B) Compensator method

(C) TURAM method

(D) Slingram method

Q.No. 13 If four impedance tensors Z_{xx}, Z_{yy}, Z_{xy} and Z_{yx} are computed for a 2D body in magneto-telluric method (x is the strike direction), then

(A) $Z_{xx} = 0, Z_{yy} \neq 0, Z_{xy} = Z_{yx}$

(B) $Z_{xx} \neq 0, Z_{yy} = 0, Z_{xy} = Z_{yx}$

(C) $Z_{xx} \neq 0, Z_{yy} \neq 0, Z_{xy} \neq Z_{yx}$

(D) $Z_{xx} = 0, Z_{yy} = 0, Z_{xy} \neq Z_{yx}$

Q.No. 14 Match the inversion methods (Group I) with the associated terms (Group II)

Group I	Group II
P. Genetic algorithm	1. Lagrange multiplier
Q. Simulated annealing	2. Fitness
R. Least squares inverse	3. Energy
S. Minimum norm least squares inverse	4. Damping

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

Q.No. 15 Ten equispaced metal electrodes are arranged along a profile for multi-electrode 2D resistivity imaging survey. If Wenner array is used for data recording, the maximum number of observations will be

(A) 7
(B) 11
(C) 12
(D) 13

Q.No. 16 P and R are Jacobian matrices for two different geophysical inverse problems. If their generalized inverses are written as $P^{-1} = (P^T P)^{-1} P^T$ and $R^{-1} = R^T (R R^T)^{-1}$, then

(A) both P and R deal with over-determined problems
(B) both P and R deal with under-determined problems
(C) P deals with over-determined and R deals with under-determined problem
(D) P deals with under-determined and R deals with over-determined problem

Q.No. 17 In a 3D seismic survey, there are 512 groups of receivers in one line of a patch. Eight groups are moved per line from one patch to the next along the swath. What is the inline fold?

(A) 32
(B) 16
(C) 8
(D) 4

Q.No. 18

The magnetic potential of a uniform vertically magnetized buried spherical body with uniform density is given as $W = \frac{\mu_0}{4\pi G}\frac{I}{\rho}g_z$. Then, the vertical magnetic field B_z is proportional to

[I = intensity of magnetization, ρ = density, g_z = vertical component of gravity field, G = Universal gravitational constant, μ_0 = magnetic permeability of free space, coordinate of the center of the body is (0, z) and that of the observation point is (x, 0)]

(A) $\frac{2z^2 - x^2}{(z^2 + x^2)^{\frac{5}{2}}}$

(B) $\frac{2z^2 - x^2}{(z^2 + x^2)^{\frac{3}{2}}}$

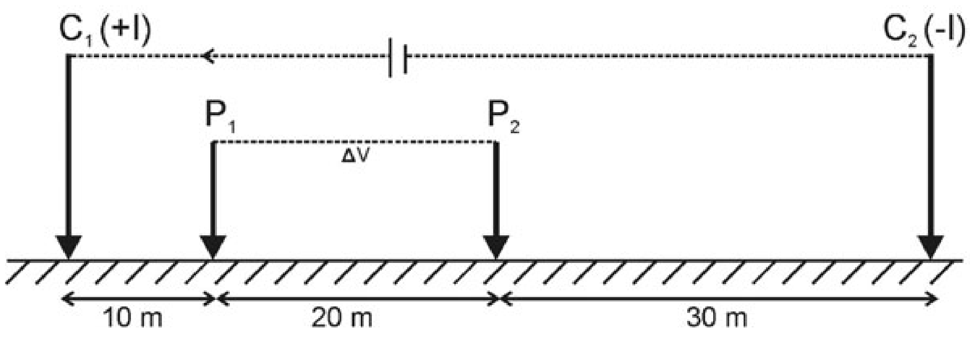
(C) $\frac{z^2 - x^2}{(z^2 + x^2)^{\frac{5}{2}}}$

(D) $\frac{z^2 - x^2}{(z^2 + x^2)^{\frac{3}{2}}}$

Q.No. 19 A sample of granite is observed to have a P-wave velocity of 5 km/s and density of 2600 kg/m^3. The bulk modulus of the granite, assuming it to be a Poisson's solid, is __________kilo-Pascal (kPa). (*Round off to 2 decimal places*)

Q.No. 20 The half-life of a parent radionuclide is 100 yrs. If the parent radionuclide decays to a daughter radionuclide which itself decays with a decay constant of 1/4th that of the parent radionuclide, then radioactive equilibrium will be reached after ________ years. (*Round off to 2 decimal places*) (Assume at time t = 0 the number of daughter radionuclide is zero)

Q.No. 21 Current and potential electrodes in resistivity survey over an inhomogeneous ground is shown in the figure below. If 100 mA current flow between C_1 and C_2 generates 50 mV potential difference between P_1 and P_2, then the apparent resistivity of the medium will be ________ Ωm. (*Round off to 2 decimal places*) (Use π = 3.14)



Q.No. 22

Skin depths in homogeneous media of resistivity ρ_1 and ρ_2 are 100 m and 200 m, respectively, at 1000 Hz frequency. The ratio ρ_1/ρ_2 will be ________. (*Round off to 2 decimal places*)

Q.No. 23 The mean resistivity of a horizontally stratified cuboid rock sample is 100 Ωm and coefficient of electrical anisotropy is 1.15. The transverse resistivity of the rock sample is ______ Ωm. (*Round off to 2 decimal places*)

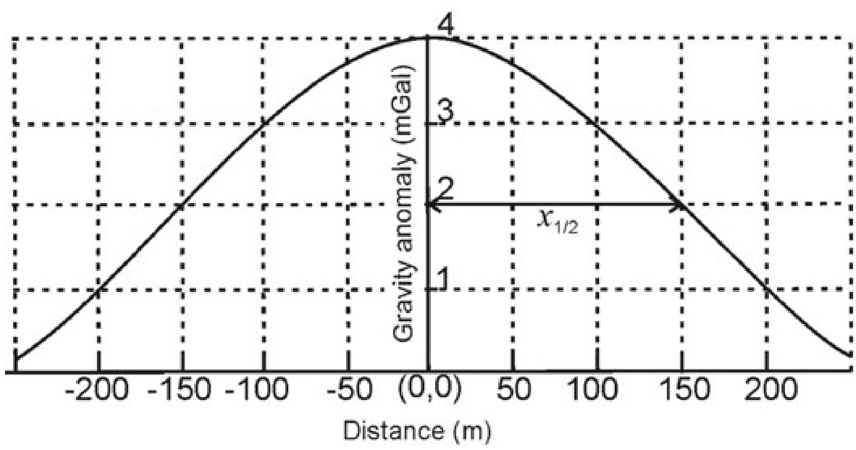
Q.No. 24 A seismic reflection survey is carried out over a 1500 m thick horizontal layer with a P-wave velocity of 2000 m/s. The travel time of a reflected wave at a surface detector placed 1000 m from a surface source is _________milliseconds.

Q.No. 25 A seismic reflection survey is carried out using a 10 milliseconds seismic wavelet over a subsurface medium having an average P-wave velocity of 1600 m/s. The best resolution which is obtained on the basis of Rayleigh criteria is ___________ m. (Assume seismic wavelet contains one cycle)

Q.No. 26 To detect a 0.01 nT change in magnetic field using a proton precession magnetometer, the sensitivity required in the frequency measurement of the instrument is ____________$\times10^{-4}$ Hz. (*Round off to 2 decimal places*) (Assume gyromagnetic ratio of proton as 2.67515×10^{8} $s^{-1}T^{-1}$)

Q.No. 27 A micro-gravity survey with appropriate station spacing is performed to detect a subsurface spherical cavity in a bedrock of density 2500 kg/m^3. The depth to the center of the cavity is 4 m from the surface and the elevation measurement accuracy of the surveying instrument is 0.1 m. The smallest cavity that can be detected by the survey must have a radius greater than _______ m. (*Round off to 1 decimal place*) (Assume G = 6.673×10^{-11} $m^3kg^{-1}s^{-2}$)

Q.No. 28 The gravity anomaly over a spherical ore body is shown in the figure below. The calculated excess mass due to the ore body will be __________ $\times10^{10}$ kg. (*Round off to 1 decimal place*) (Assume $z = 1.3 \times x_{1/2}$; G = 6.673×10^{-11} $m^3kg^{-1}s^{-2}$)



Q.No. 29

A scalar potential field in 3D space is expressed as $U(x, y, z) = x^2 + yz^2$. The magnitude of the maximum rate of change in $U(x, y, z)$ at a point (1, 1, 2) is

______________.

Q.No. 30 A 10 Hz seismic wave propagates for 40 km through a material with a P-wave velocity of 5 km/s and quality factor (Q) of 100. The percentage of the initial amplitude retained in the attenuated wave is __________. (*Round off to 1 decimal place*) (Use $\pi = 3.14$)