ASSIGNMENT 4: GATE 2020
GG : Geology and Geophysics

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GA - General Aptitude

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.

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a) in, of b) from, of c) during, from d) from, from

2) He was not only accused of theft _____ of conspiracy.

(GATE GG 2020)

a) rather b) but also c) but even d) rather than

3) Select the word that fits the analogy:
Explicit: Implicit :: Express: _____

(GATE GG 2020)

a) Impress b) Repress c) Compress d) Suppress

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

(GATE GG 2020)

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.

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 $x > 1$?

(GATE GG 2020)

a) e^x b) $\sqrt{x}$ c) $\frac{1}{x}$ d) e^{-x}

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?

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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.

7) It is quarter past three in your watch. The angle between the hour hand and the minute hand is
(GATE GG 2020)

a) 0° b) 7.5° c) 15° d) 22.5°

8) A degreele with centre O is shown in the figure. A rectangle PQRS of maximum possible area is inscribed in the degreele. If the radius of the degreele is a, then the area of the shaded portion is
(GATE GG 2020)

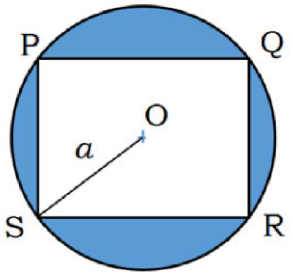

Fig. 1

a) $\pi a^2 - a^2$
b) $\pi a^2 - \sqrt{2}a^2$
c) $\pi a^2 - 2a^2$
d) $\pi a^2 - 3a^2$

9) a, b, c are real numbers. The quadratic equation $ax^2 - bx + c = 0$ has equal roots, which is β, then
(GATE GG 2020)

a) $\beta = b/a$
b) $\beta^2 = ac$
c) $\beta^3 = bc/(2a^2)$
d) $b^2 \neq 4ac$

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
(GATE GG 2020)

a) 8:23 b) 23:8 c) 23:31 d) 31:23

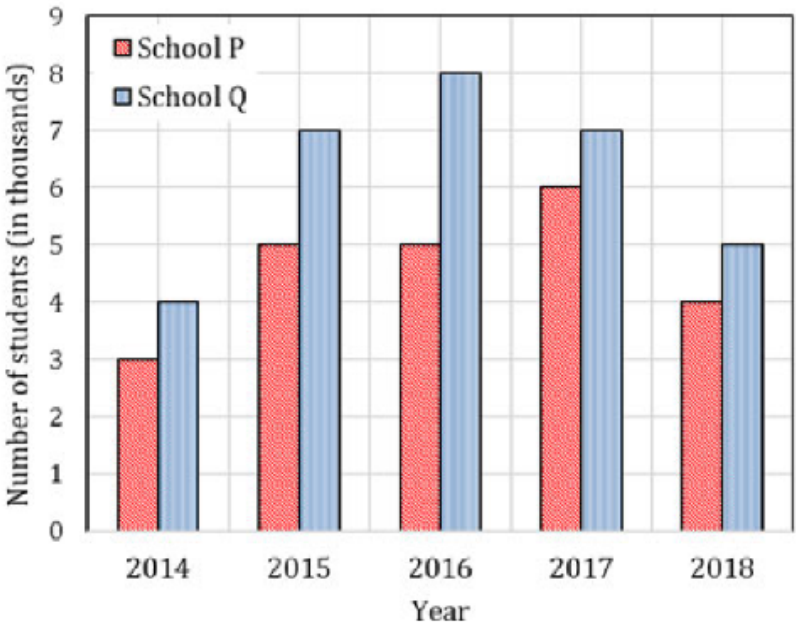

Fig. 2

Part A - Compulsory Section For All Candidates

11) A plagioclase with $\frac{Na^+}{Na^+ + Ca^{2+}} = 0.8$ is

(GATE GG 2020)

a) albite b) anorthite c) oligoclase d) bytownite

12) Tillite is an important constituent of the

(GATE GG 2020)

a) Talchir Formation
b) Barakar Formation
c) Pachmarhi Formation
d) Lameta Formation

13) 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

(GATE GG 2020)

a) 2X b) X/2 c) 4X d) X/8

14) Which of the following is NOT a point group?

(GATE GG 2020)

a) 222 b) 422 c) 432 d) 632

15) Mississippian is an Epoch within the

(GATE GG 2020)

a) Permian Period
b) Carboniferous Period
c) Triassic Period
d) Jurassic Period

16) The given stereoplot of the axial plane and the axis of a fold represents an/a

(GATE GG 2020)

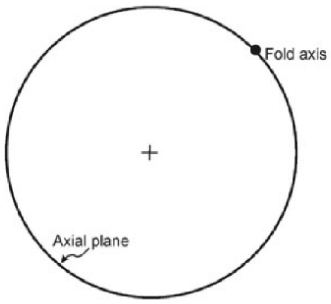

Fig. 3

a) upright fold
b) vertical fold
c) reclined fold
d) recumbent fold

17) A siliciclastic sedimentary rock with <5% matrix and QFL composition of 60% quartz, 30% rock fragments and 10% feldspar, is called

(GATE GG 2020)

a) quartz wacke
b) lithic arenite
c) quartz arenite
d) feldspathic wacke

18) 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?

(GATE GG 2020)

a) Gravity and Electrical methods
b) Electrical and Electromagnetic methods
c) Seismic and Gravity methods
d) Seismic and Magnetic methods

19) The ratio of bridging to non-bridging oxygen atoms is zero in case of

(GATE GG 2020)

a) nesosilicates
b) inosilicates
c) phyllosilicates
d) tectosilicates

20) Lahar is a geomorphic feature associated with

(GATE GG 2020)

a) wind activity
b) river activity
c) glacial activity
d) volcanic activity

21) Kepler's second law of planetary motion follows the principle of conservation of

(GATE GG 2020)

a) energy
b) momentum
c) angular momentum
d) moment of inertia

22) Which one of the following options shows the internal structural units of the Earth arranged in the CORRECT sequence of increasing volume?

(GATE GG 2020)

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

23) Which one of the following is NOT an earthquake intensity scale?

(GATE GG 2020)

a) Richter scale
b) JMA scale
c) Modified Mercalli scale
d) Rossi-Forel scale

24) The dimension of transmissivity of an aquifer is

(GATE GG 2020)

a) $M^0L^1T^{-1}$
b) $M^0L^0T^0$
c) $M^1L^{-1}T^{-2}$
d) $M^0L^2T^{-1}$

25) During 'K-capture' nuclear transmutation process

(GATE GG 2020)

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

26) Which one amongst the following logs has the maximum depth of investigation?

(GATE GG 2020)

a) Neutron log
b) Natural Gamma-ray log
c) Lateral log
d) Density log

27) 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 _____.

(GATE GG 2020)

28) 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)

(GATE GG 2020)

29) 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 _____.

(GATE GG 2020)

30) 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).

(GATE GG 2020)

31) 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.

(GATE GG 2020)

32) 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)

(GATE GG 2020)

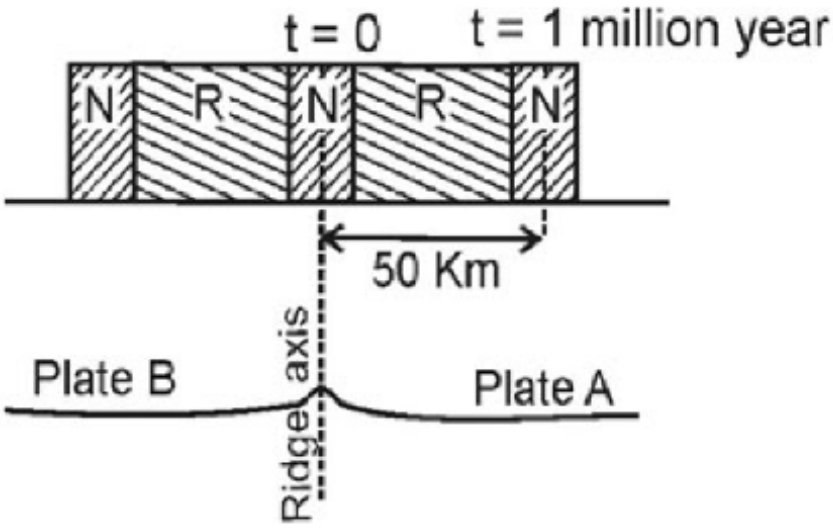

Fig. 4

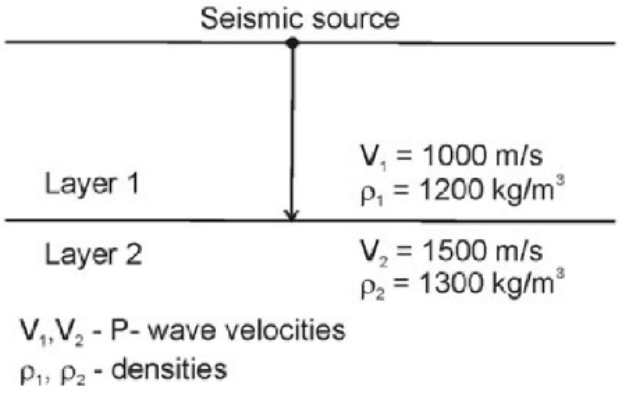

Fig. 5

33) The geometrical factor for the electrode configuration given below will be _____ m. (Round off to 2 decimal places) (Use $\pi = 3.14$)
(C_1 and C_2 are current electrodes; P_1 and P_2 are potential electrodes)

(GATE GG 2020)

34) 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)

(GATE GG 2020)

35) 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.

(GATE GG 2020)

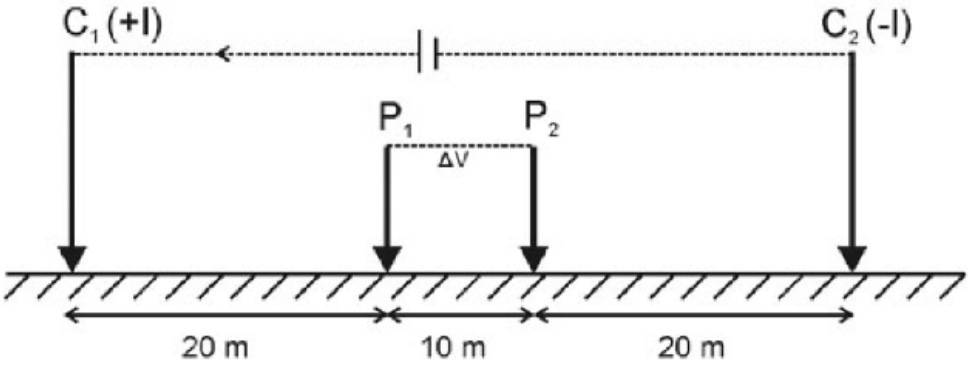

Fig. 6

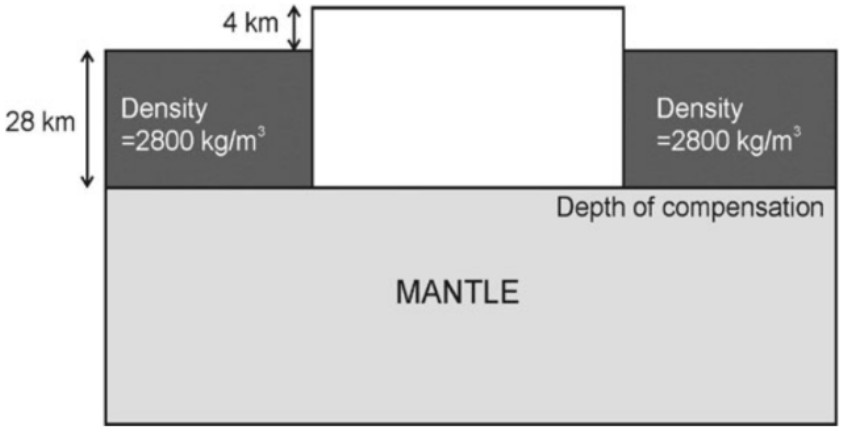

Fig. 7

PART B (SECTION 1): FOR GEOLOGY CANDIDATES ONLY

36) "Point Group" in crystallography is characterized by a set of symmetry operations such that
(GATE GG 2020)

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

37) What are the Miller indices of a plane that intercepts each of the crystallographic axes X, Y and Z, at 2 Å? (Assume a primitive unit-cell with the dimensions $a = 5$ Å, $b = 2$ Å and $c = 4$ Å.)
(GATE GG 2020)

a) (111) b) (524) c) (425) d) (542)

38) Which one of the following processes is associated with the emission of X-rays?
(GATE GG 2020)

a) alpha decay
b) beta decay
c) electron capture decay
d) positron decay

39) Which one of the following radioisotopes has the longest half-life?

(GATE GG 2020)

a) ^{87}Rb b) ^{147}Sm c) ^{232}Th d) ^{238}U

40) The given geological map represents

(GATE GG 2020)

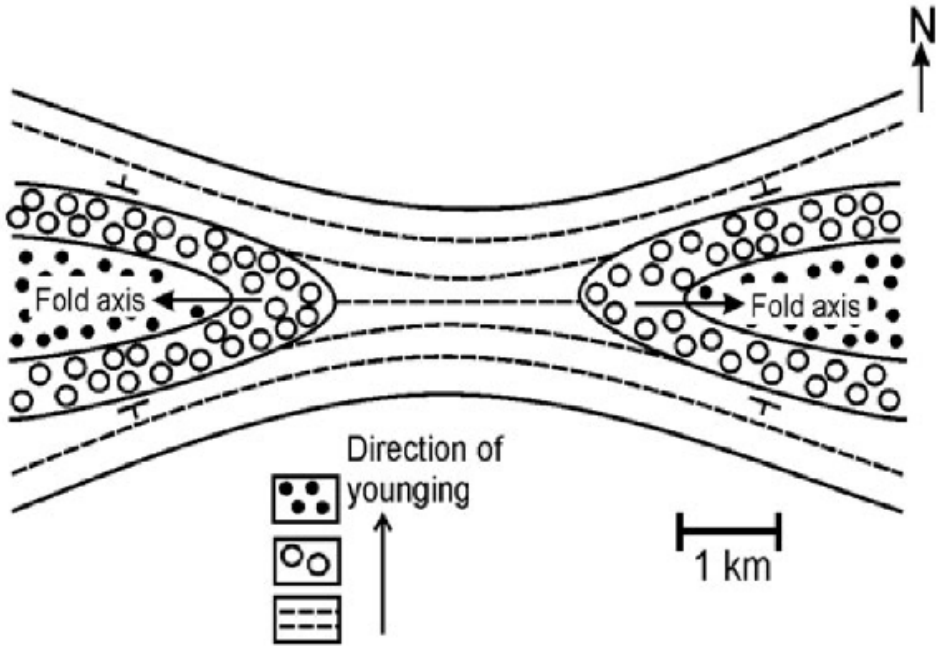

Fig. 8

a) culmination of an antiformal anticline
b) culmination of an antiformal syncline
c) depression of a synformal anticline
d) culmination of a synformal syncline

41) On a fault plane, the net slip is parallel to the bedding trace. Then, the apparent movement will be recognizable

(GATE GG 2020)

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

42) The CORRECT sequence of the given electromagnetic radiations in order of increasing wavelength is

(GATE GG 2020)

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

43) Choose the CORRECT combination of foraminiferal tests and types of coiling.

(GATE GG 2020)

a) Test 1-Trochospiral, Test 2 - Planispiral, Test 3 - Milioline
b) Test 1-Milioline, Test 2- Planispiral, Test 3- Trochospiral

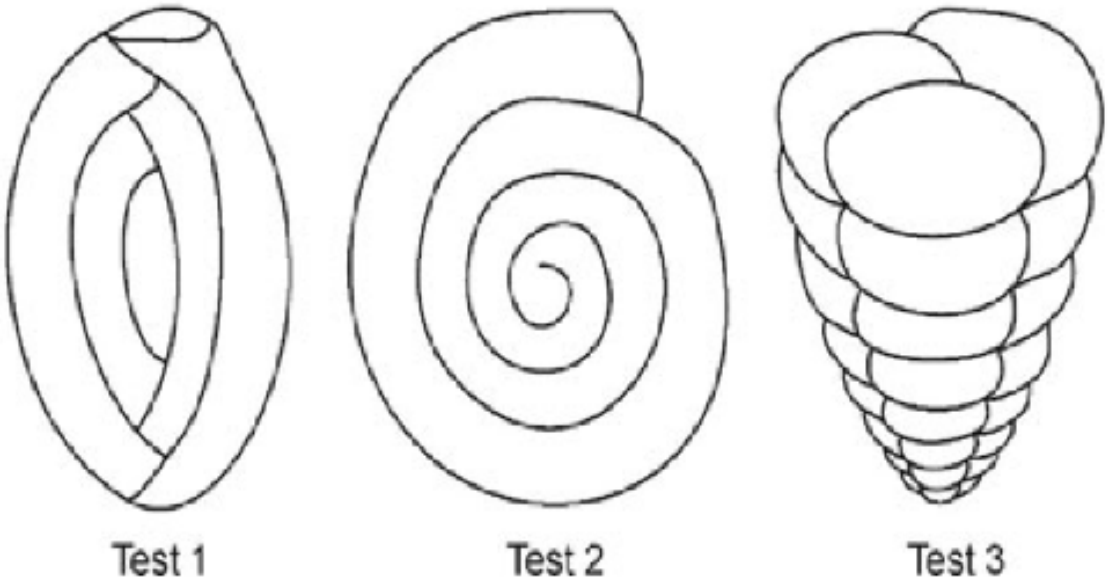

Fig. 9

c) Test 1- Milioline, Test 2 - Trochospiral, Test 3- Planispiral
d) Test 1- Trochospiral, Test 2- Milioline, Test 3- Planispiral

44) 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?

(GATE GG 2020)

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) $w = 1, x = 1, y = 1, z = 2$

45) Match the basins (Group I) with the corresponding stratigraphic units (Group II).

(GATE GG 2020)

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

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

46) In the metamorphic reaction
Quartz + Muscovite = X + Sillimanite + Water, 'X' represents

(GATE GG 2020)

a) Garnet
b) Staurolite
c) Orthoclase
d) Cordierite

47) The talc-kyanite assemblage can stabilize in

(GATE GG 2020)

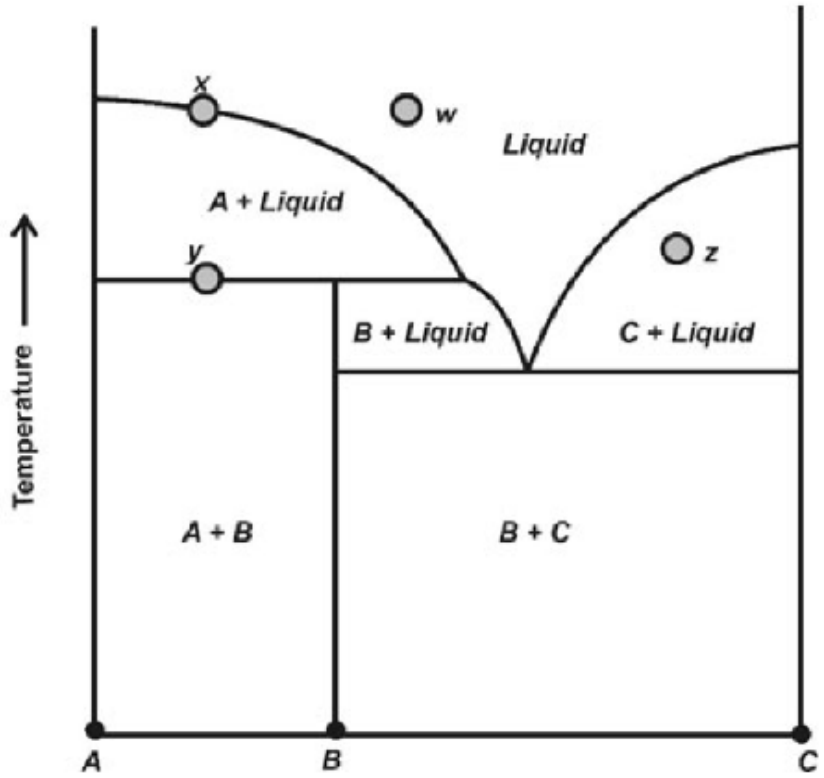

Fig. 10

a) greenschist facies marly rocks
b) amphibolite facies mafic rocks
c) eclogite facies pelitic rocks
d) sanidinite facies ultramafic rocks

48) Which one of the following statements about igneous rocks is CORRECT?

(GATE GG 2020)

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.

49) 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 sinuosity of successive bedforms are either in-phase or out-phase.

(GATE GG 2020)

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

50) 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.

(GATE GG 2020)

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

51) Which one of the following assemblages of plant fossils is known from the Barakar Formation? (GATE GG 2020)

a) Glossopteris, Gangamopteris, Dicroidium
b) Glossopteris, Gangamopteris, Noeggerathiopsis
c) Glossopteris, Gangamopteris, Ptilophyllum
d) Schizoneura, Noeggerathiopsis, Ptilophyllum

52) Match the features (Group I) with the corresponding invertebrate genera (Group II). (GATE GG 2020)

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

53) If the orthogonal thickness is constant along a folded layer, as per Ramsay's morphological classification of folds, it is a (GATE GG 2020)

a) Class 1A fold
b) Class 1B fold
c) Class 1C fold
d) Class 2 fold

54) 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) (GATE GG 2020)

55) 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 _____ $^\circ 2\theta$. (Round off to 3 decimal places) (Wavelength of X-ray used = 1.5418 Å. For orthorhombic system: $1/d^2 = h^2/a^2 + k^2/b^2 + l^2/c^2$) (GATE GG 2020)

56) 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). (GATE GG 2020)

57) 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) (GATE GG 2020)

58) A vertical profile perpendicular to the crest line of an asymmetrical ripple is given in the figure. The calculated Ripple Index is _____. (GATE GG 2020)

59) 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) (GATE GG 2020)

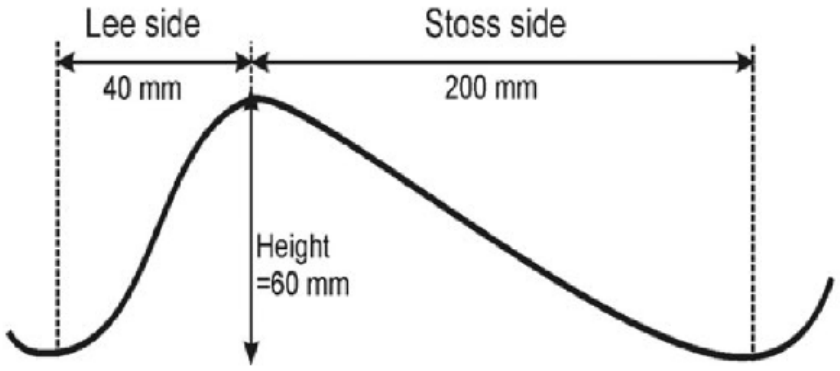

Fig. 11

60) 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.

(GATE GG 2020)

61) 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 $\sigma_1 = 10\text{MPa} + 3\sigma_3$, where σ_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)

(GATE GG 2020)

62) 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.

(GATE GG 2020)

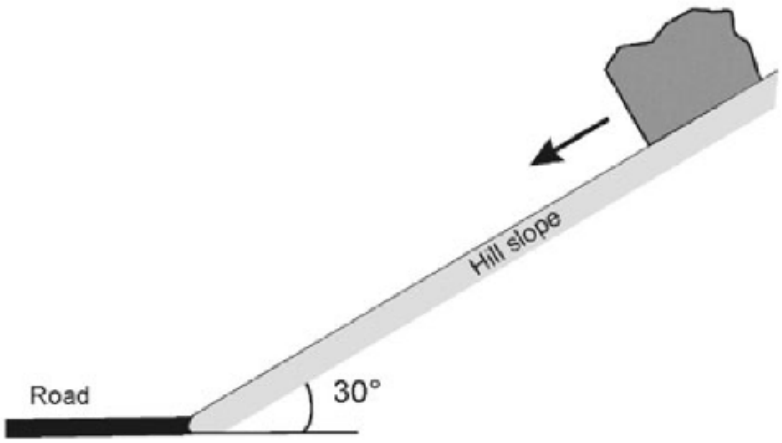

Fig. 12

63) 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 _____.

(GATE GG 2020)

64) 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.

(GATE GG 2020)

65) 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)

(GATE GG 2020)

PART B (Section 2): For Geophysics Candidates Only

66) International gravity formula is based on which one of the following models?

(GATE GG 2020)

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

67) Heat flow equation $\frac{d^2T}{dz^2} = 0$ is valid when

(GATE GG 2020)

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

68) 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)

(GATE GG 2020)

a) Shadow zones of both P-wave and S-wave increase
b) Shadow zone of P-wave increases and that of S-wave remains unchanged
c) Shadow zones of both P-wave and S-wave decrease
d) Shadow zone of P-wave decreases but that of S-wave remains unchanged

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

(GATE GG 2020)

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-1, Q-2, R-4, 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

70) The sensitivity of LaCoste-Romberg gravimeter is proportional to the time period (T) of the spring as

(GATE GG 2020)

a) T^2 b) $1/T^2$ c) $\sqrt{T}$ d) $1/\sqrt{T}$

71) Match the following gravity/magnetic data interpretation techniques (Group I) with the corresponding terms (Group II).

(GATE GG 2020)

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-1, Q-2, R-4, S-3
b) P-3, Q-4, R-1, S-2
c) P-1, Q-2, R-1, S-3
d) P-3, Q-1, R-4, S-2

72) 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

(GATE GG 2020)

a) n b) $1/n$ c) $\sqrt{n}$ d) $1/\sqrt{n}$

73) A waveform with amplitude spectrum A(ω) and phase spectrum $\phi(\omega)$ is auto-correlated. Which one of the options given below correctly represents the information about the original waveform that can be retrieved from the auto-correlated waveform?

(GATE GG 2020)

a) A(ω) can be retrieved but not $\phi(\omega)$
b) $\phi(\omega)$ can be retrieved but not A(ω)
c) Both A(ω) and $\phi(\omega)$ can be retrieved
d) Both A(ω) and $\phi(\omega)$ cannot be retrieved

74) The convolution of A = {4, -2, -1, 2} with B = {1, 0, -1} gives

(GATE GG 2020)

a) {4, -2, -5, 4, 1, -2}
b) {4, 2, -5, 0, 1, -2}
c) {4, -2, -5, 0, -1, -2}
d) {4, -2, 0, 4, 1, -2}

75) 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)

(GATE GG 2020)

a) Increase in shale content
b) Increase in hydrocarbon content
c) Decrease in bed thickness
d) Increase in the salinity of formation water

76) The crossover observed for a hydrocarbon-bearing sandstone formation in the plot of Neutron and Density porosity logs (ϕ_n = Neutron porosity and ϕ_d = Density porosity) is due to

(GATE GG 2020)

a) increase in ϕ_d and decrease in ϕ_n
b) decrease in ϕ_d and increase in ϕ_n
c) increase in both ϕ_d and ϕ_n
d) decrease in both ϕ_d and ϕ_n

77) In which one of the following electromagnetic methods are the amplitude ratio and relative phase difference measured between two receiver coils?

(GATE GG 2020)

a) Fixed vertical loop method
b) Compensator method
c) TURAM method
d) Slingram method

78) 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

(GATE GG 2020)

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

79) Match the inversion methods (Group I) with the associated terms (Group II).

(GATE GG 2020)

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

80) 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

(GATE GG 2020)

a) 7 b) 11 c) 13 d) 15

81) P and R are Jacobian matrices for two different geophysical inverse problems. If their generalized inverses are written as $P^{-g} = (P^T P)^{-1} P^T$ and $R^{-g} = R^T (RR^T)^{-1}$, then

(GATE GG 2020)

a) P represents an overdetermined problem and R represents an underdetermined problem
b) P represents an underdetermined problem and R represents an overdetermined problem
c) Both P and R represent overdetermined problems
d) Both P and R represent underdetermined problems

82) 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?

(GATE GG 2020)

a) 32 b) 16 c) 8 d) 4

83) 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

(GATE GG 2020)

a) $\dfrac{2z^2 - x^2}{(z^2 + x^2)^{5/2}}$
b) $\dfrac{2z^2 - x^2}{(z^2 + x^2)^{3/2}}$
c) $\dfrac{z^2 - x^2}{(z^2 + x^2)^{5/2}}$
d) $\dfrac{z^2 - x^2}{(z^2 + x^2)^{3/2}}$

84) 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 (kPa). (Round off to 2 decimal places)

(GATE GG 2020)

85) 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 $\frac{1}{4}$ 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)

(GATE GG 2020)

86) 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)

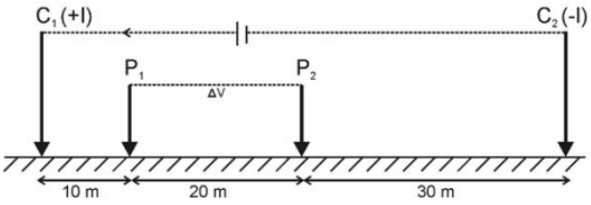

Fig. 13

(GATE GG 2020)

87) 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)

(GATE GG 2020)

88) The mean resistivity of a horizontally stratified cuboid rock sample is $100\,\Omega m$ and coefficient of electrical anisotropy is 1.15. The transverse resistivity of the rock sample is (Ωm). (Round off to 2 decimal places)

(GATE GG 2020)

89) 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).

(GATE GG 2020)

90) A seismic reflection survey is carried out using a $10\,ms$ seismic wavelet over a subsurface medium having an average P-wave velocity of $1600\,m/s$. The best resolution obtained on the basis of Rayleigh criteria is (m). (Assume seismic wavelet contains one cycle)

(GATE GG 2020)

91) 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 ($\times 10$ Hz). (Round off to 2 decimal places) (Assume gyromagnetic ratio of proton as $2.67515 \times 10^8\ s^{-1}T^{-1}$)

(GATE GG 2020)

92) 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 $G = 6.673 \times 10^{-11}\,m^3kg^{-1}s^{-2}$)

(GATE GG 2020)

93) 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 $\left(\times 10^{11}\, kg\right)$. (Round off to 1 decimal place)

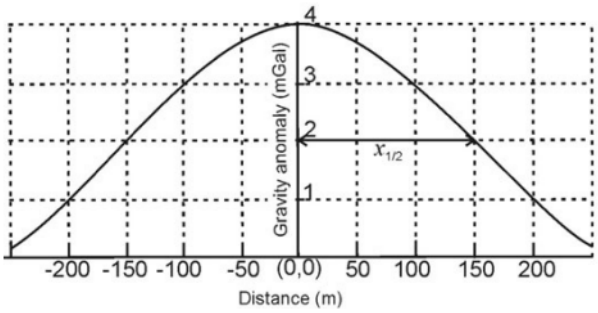

Fig. 14

(GATE GG 2020)

94) 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 ().

(GATE GG 2020)

95) A $10\, Hz$ seismic wave propagates for $40\, km$ through a material with a P-wave velocity of $5\, km/s$ and quality factor $Q = 100$. The percentage of the initial amplitude retained in the attenuated wave is (%). (Round off to 1 decimal place) (Use $\pi = 3.14$)

(GATE GG 2020)

END OF THE QUESTION PAPER