gg Gate 2015

ai25btech11014-Gooty Suhas

GATE 2019 – General Aptitude (GA)

1) The fishermen, the flood victims owed their lives, were rewarded by the government.

a) whom b) to which c) to whom d) that

2) Some students were not involved in the strike. If the above statement is true, which of the following conclusions is/are logically necessary?
   1. Some who were involved in the strike were students.
   2. No student was involved in the strike.
   3. At least one student was involved in the strike.
   4. Some who were not involved in the strike were students

a) 1 and 2 b) 3 c) 4 d) 2 and 3

3) The radius as well as the height of a circular cone increases by 10%. The percentage increase in its volume is

a) 17.1 b) 21.0 c) 33.1 d) 72.8

4) Five numbers 10, 7, 5, 4 and 2 are to be arranged in a sequence from left to right following the directions given below:
   1. No two odd or even numbers are next to each other.
   2. The second number from the left is exactly half of the left-most number.
   3. The middle number is exactly twice the right-most number.
   Which is the second number from the right?

a) 2 b) 4 c) 7 d) 10

5) Until Iran came along, India had never been_in kabaddi.

a) defeated b) defeating c) defeat d) defeatist

6) Since the last one year, after a 125 basis point reduction in repo rate by the Reserve Bank of India, banking institutions have been making a demand to reduce interest rates on small saving schemes. Finally, the government announced yesterday a reduction in interest rates on small saving schemes to bring them on par with fixed deposit interest rates. Which one of the following statements can be inferred from the given passage?
   a) Whenever the Reserve Bank of India reduces the repo rate, the interest rates on small saving schemes are also reduced
   b) Interest rates on small saving schemes are always maintained on par with fixed deposit interest rates
   c) The government sometimes takes into consideration the demands of banking institutions before reducing the interest rates on small saving schemes
   d) A reduction in interest rates on small saving schemes follow only after a reduction in repo rate by the Reserve Bank of India

7) In a country of 1400 million population, 70% own mobile phones. Among the mobile phone owners, only 294 million access the Internet. Among these Internet users, only half buy goods from e-commerce portals. What is the percentage of these buyers in the country?

a) 10.50 b) 14.70 c) 15.00 d) 50.00

8) The nomenclature of Hindustani music has changed over the centuries. Since the medieval period dhrupad styles were identified as *baanis*. Terms like *gayaki* and *baaj* were used to refer to vocal and instrumental styles, respectively. With the institutionalization of music education the term *gharana* became acceptable. *Gharana* originally referred to hereditary musicians from a particular lineage, including disciples and grand disciples. Which one of the following pairings is NOT correct?

a) dhrupad, baani
b) gayaki, vocal
c) baaj, institution
d) gharana, lineage

9) Two trains started at 7AM from the same point. The first train travelled north at a speed of 80 km/h and the second train travelled south at a speed of 100 km/h. The time at which they were 540 km apart is AM.

a) 9 b) 10 c) 11 d) 11.30

10) "I read somewhere that in ancient times the prestige of a kingdom depended upon the number of taxes that it was able to levy on its people. It was very much like the prestige of a head-hunter in his own community." Based on the paragraph above, the prestige of a head-hunter depended upon

a) the prestige of the kingdom
b) the prestige of the heads
c) the number of taxes he could levy
d) the number of heads he could gather

GATE 2019 – PART A: COMMON SECTION

11) On the present-day global plate tectonic map, the Reunion hotspot is located in the

a) Indian Plate
b) Australian Plate
c) African Plate
d) Antarctic Plate

12) Which one of the following statements about the planetary motion of the Solar system is INCORRECT?

a) The orbital-radius of planets sweep out equal areas in equal intervals of time.
b) The orbital speed of planets is constant throughout their respective orbits.
c) Planets revolve in anticlockwise direction relative to a point above the plane of planetary motion.
d) At least one focus of the elliptical orbit of each planet lies at the same point.

13) Choose the CORRECT combination for the following two statements:
Statement–I: The correct order of magnetic chrons from the oldest to the youngest is Gilbert–Gauss–Matuyama–Bruhnes.
Statement–II: Magnetic chrons Gilbert and Matuyama are reverse whereas Gauss and Bruhnes are normal.

a) Both statements I and II are correct.
b) Both statements I and II are incorrect.
c) Statement I is correct and statement II is incorrect.
d) Statement I is incorrect and statement II is correct.

14) Body waves

a) can travel through vacuum
b) have cylindrical wavefronts
c) are mechanical waves
d) are known as ground roll

15) The acceleration due to gravity (g) begins to fall sharply towards the centre of the Earth from the _____ discontinuity.

a) Conrad
b) Mohorovicic
c) Gutenberg
d) Lehmann

16) Which one of the following lists ONLY kinematic parameters?

a) Force, translation, rotation
b) Translation, rotation, distortion
c) Stress, distortion, translation
d) Force, stress, strain

17) The plunge of the normal to the axial planes of vertical and upright folds is

a) 0°
b) 45°
c) 60°
d) 90°

18) Which one of the following rocks is associated with metamorphic thermal aureoles?

a) Chlorite schist
b) Amphibolite
c) Hornfels
d) Glaucophane schist

19) Which one of the following clay minerals contain potassium (K)?

a) Illite
b) Kaolinite
c) Montmorillonite

d) Vermiculite

20) Which one of the following sequences of minerals correctly lists an increasing rate of dissolution during chemical weathering?
a) Olivine–Quartz–Pyroxene–Orthoclase
b) Quartz–Orthoclase–Pyroxene–Olivine
c) Olivine–Pyroxene–Orthoclase–Quartz
d) Quartz–Olivine–Orthoclase–Pyroxene

21) Which one of the following combinations of reservoir and cap rock, respectively, is suitable for oil accumulation?
a) Limestone–Sandstone
b) Dolomite–Evaporite
c) Sandstone–Conglomerate
d) Shale–Limestone

22) Bituminous coal is found in

a) Neyveli b) Panandhro c) Singareni d) Vastan

23) Extinction of Trilobites is associated with which one of the following geological time boundaries?
a) Ordovician–Silurian
b) Permian–Triassic
c) Triassic–Jurassic
d) Cretaceous–Palaeogene

24) Transmissivity of an aquifer is the product of
a) saturated thickness and storativity
b) hydraulic conductivity and storativity
c) saturated thickness and hydraulic conductivity
d) saturated thickness and hydraulic head

25) Which one of the following is only a correction and not a reduction in the computation of gravity anomalies with respect to a datum?

a) Free air b) Bouguer c) Terrain d) Isostatic

26) The difference in the mobility of ions in the electrolyte and electrons in metallic conductors in the sub–surface due to applied external electric field gives rise to
a) electrode polarization
b) membrane polarization
c) electro–kinetic potential
d) electro–chemical potential

27) A high frequency acoustic wave propagating in a gas–saturated sandstone formation exhibits an increase in

a) frequency b) velocity c) wavelength d) wave number

28) Which one of the following logging methods uses a radioactive source in the sonde?
a) Natural gamma ray
b) Gamma–Gamma
c) Natural gamma ray spectroscopy
d) Nuclear Magnetic Resonance (NMR)

29) Isodynamic contours of the geomagnetic field represent lines of equal

a) inclination
b) declination
c) total field intensity
d) magnetic potential

30) A Very Low Frequency (VLF) electromagnetic survey is conducted for the delineation of 2–D conducting mineralization located at 50m depth from the surface with different geological formations as the overburden layer. For which of the following overburden layers will the VLF method fail to yield response?
a) Granite
b) Snow
c) Dry sand
d) Saline–water–saturated sand

21) Assuming Airy isostatic compensation, the depth to the Moho from a point located 2 km above the mean sea level is ___ km. (round off to 1 decimal place). (The depth of compensation T for the crust at mean sea level is 30 km, the density of crust and upper mantle are 2.67 gm/cc and 3.30 gm/cc, respectively).

22) On Survey of India Toposheet number 45 D 16' the distance between two points is 18 cm. The actual ground distance between these two points is ___ km.

23) For a dam site investigation, drilling was carried out up to a depth of 20 m. The total length of recovered core pieces, each over 100 mm, add up to 16 m. The Rock Quality Designation (RQD) of the foundation rock mass is ___ %.

24) Given that $\delta^{18}O = 2005.2 \times 10^{-6}$, the $\delta^{18}O$ of a sample whose $(\delta^{18}O)_V = +25\%$ is ___ $\times 10^{-6}$ (round off to 1 decimal place).

25) The shear wave velocity in an igneous rock with a density of 2.7 gm/cc and rigidity modulus of 24.3 GPa is ___ km/s. (round off to 1 decimal place).

I. PART B: FOR GEOLOGY CANDIDATES ONLY

26) Stream power is the product of specific weight of water with
a) hydraulic radius and Manning roughness coefficient
b) wetted perimeter and slope
c) slope and discharge
d) discharge and Manning roughness coefficient

27) Match the landforms given in Group I to the causative process in Group II:

Group I	**Group II**
P. Seif	1. Coastal
Q. Spit	2. Aeolian
R. Levee	3. Glacial
S. Drumlin	4. Fluvial

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

28) In a thrust fault exhibiting ramp and flat geometry, which one of the following pairs defines a Flat?

Fault Dip and Bedding Dip	**Options**
P. 0°, 20°N	1. P
Q. 30°N, 30°S	2. Q
R. 40°S, 40°N	3. R
S. 60°N, 60°N	4. S

a) P
b) Q
c) R
d) S

29) In the given diagram, which one of the combinations correctly lists structures typically developed at I, II, III, IV?

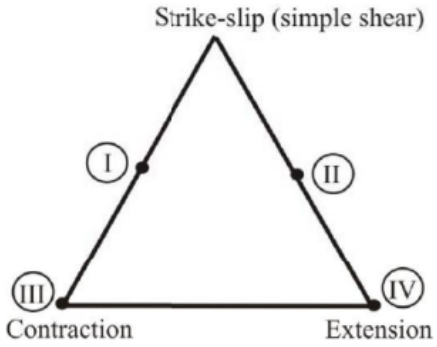

Fig. 1. Image for questions 29

a) I–pressure ridge, II–thrust, III–horst, IV–pull-apart basin
b) I–pull-apart basin, II–thrust, III–horst, IV–pressure ridge
c) I–pressure ridge, II–pull-apart basin, III–thrust, IV–horst
d) I–pull-apart basin, II–pressure ridge, III–horst, IV–thrust

30) The best developed lineation and foliation traces in a L–S tectonite will be observed on a plane
a) parallel to the lineation and foliation
b) perpendicular to the lineation and foliation
c) perpendicular to the foliation but parallel to the lineation
d) perpendicular to the lineation but parallel to the foliation

31) Match the type of twinning (Group I) with the mineral (Group II) that best exhibits it:

Group I	**Group II**
P. Carlsbad	1. Rutile
Q. Pericline	2. Quartz
R. Brazil	3. Orthoclase
S. Geniculated (elbow)	4. Plagioclase

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

32) On inserting a first order red interference filter in SE–NW direction, the interference figure of quartz shows
a) blue in NE, SW quadrants and yellow in NW, SE quadrants
b) yellow in NE, SW quadrants and blue in NW, SE quadrants

c) blue in NE, NW quadrants and yellow in SW, SE quadrants
d) yellow in NE, NW quadrants and blue in SW, SE quadrants

33) Choose the CORRECT combination for the following two statements: Statement I: Four elements that make up about 90% of the bulk Earth are Fe, O, Si and Mg (in decreasing order of wt% abundance). Statement II: The four most abundant elements in the Earth's crust (in decreasing order of wt% abundance) are O, Si, Al and Fe.
a) Both Statements I and II are correct.
b) Both Statements I and II are incorrect.
c) Statement I is correct and Statement II is incorrect.
d) Statement I is incorrect and Statement II is correct.

34) Choose the CORRECT combination for the following four statements: I: Anhydrous partial melting of peridotites produces basaltic magma. II: Hydrous melting of peridotites produces andesitic magma. III: Congruent melting of minerals produces liquids of compositions identical to the minerals. IV: Incongruent melting of minerals produces liquids of different compositions and new solids.

a) All I to IV are correct.
b) I, II and III are correct but IV is incorrect.
c) I and II are correct but III and IV are incorrect.
d) All I to IV are incorrect.

35) The value of salinity, in terms of wt.% NaCl equivalent, of an aqueous saline bi-phase liquid–vapour fluid inclusions is determined by measurement of ___ during microthermometry.
a) last ice–melting temperature
b) dissolution temperature of halite
c) eutectic temperature
d) homogenization temperature

36) Which of the following case(s) represent(s) textural inversion in sandstone? Case I: Rounded grains in clayey matrix. Case II: Rounded, but poorly sorted grains.
a) Only Case I
b) Only Case II
c) Both Case I and II
d) Neither Case I nor Case II

37) Which one of the following set of statements regarding the overall nature of marine shelf succession is CORRECT?
- Statement A Transgressive systems tract deposit is deepening upward.
- Statement B Highstand systems tract deposit is deepening upward.
- Statement C Falling stage systems tract deposit is deepening upward.
- Statement D Lowstand systems tract deposit is overall shallowing upward.

a) I and II
b) II and III
c) III and IV
d) I and IV

38) Which of the following set of statements is CORRECT?
- Statement I: A well sorted sandstone bed showing current ripple, planar laminae, convolute laminae and prod marks.
- Statement II: A poorly sorted sandstone bed showing wave ripples, dish structure, pillar structure and groove casts.
- Statement III: A well sorted sandstone bed showing desiccation cracks, current crescent planar laminae and convolute laminae.
- Statement IV: A poorly sorted sandstone bed showing current ripple, planar laminae, skip marks and load casts.

a) I, II and III
b) II, III and IV
c) I, III and IV
d) I, II and IV

39) In metamafites, which one of the following mineral assemblages is stable under green schist facies conditions?
a) Albite + Chlorite + Actinolite + Epidote
b) Andesine + Biotite + Hornblende
c) Oligoclase + Biotite + Hornblende
d) Oligoclase + Epidote + Biotite + Hornblende

40) Match the type of metamorphism listed in Group I with their products in Group II:

Group I	**Group II**
P. Contact metamorphism	1. Impactite
Q. Shear zone metamorphism	2. Spillite
R. Ocean floor metamorphism	3. Mylonite
S. Shock metamorphism	4. Skarn

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

41) Glaucophane schist forms in
a) subduction zones
b) pull-apart basins
c) continental rifts
d) mid-oceanic ridges

42) Which one of the following statements is CORRECT about bivalve habitat?
a) Gryphaea is a burrowing variety.
b) Pholas is a free lying form.
c) Lucina is a boring variety.
d) Mytilus is a bysally attached form.

43) Match foraminifera in Group I with its wall structure in Group II:

Group I	**Group II**
P. Fusulina	1. Hyaline
Q. Cibicides	2. Porcellaneous
R. Textularia	3. Microgranular
S. Quinqueloculina	4. Agglutinated

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

44) Which one of the following stratigraphic units represents the CORRECT order of younging?
a) Trichinopally Group – Uttatur Group – Ariyalur Group – Niniyur Group
b) Kopili Formation – Sylhet Formation – Barail Formation – Boka Bil Formation
c) Chinji Formation – Nagri Formation – Dhok Pathan Formation – Tatrot Formation
d) Barakar Formation – Talchir Formation – Barren Measures – Raniganj Formation

45) Match the Formation names in Group I with their dominant lithology in Group II:

Group I	**Group II**
P. Hanseran Formation	1. Sandstone
Q. Nagthat Formation	2. Limestone
R. Bijli Formation	3. Evaporite
S. Shahbad Formation	4. Volcanics

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

46) Match the economic deposits in Group I with their occurrence in stratigraphic units in Group II:

Group I	**Group II**
P. Phosphate	1. Sargur Group
Q. Manganese	2. Nallamalai Group
R. Chromite	3. Udaipur Formation
S. Barite	4. Mansar Formation

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

47) Match the basin type in Group I with Indian example in Group II:

Group I	**Group II**
P. Foreland basin	1. Kerala–Konkan
Q. Passive margin	2. Cambay
R. Fore-arc	3. Ganga
S. Failed rift	4. Andaman

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

48) Choose the CORRECT set of statements. Statement I: The hydrocarbon source rock in Cambay basin is of Jurassic age. Statement II: Borholla field is in Assam basin. Statement III: Toulene is an aromatic hydrocarbon. Statement IV: Porosity of a reservoir rock increases with increase in sorting.

a) I, II and III
b) II, III and IV
c) I and IV
d) I and III only

49) The figure given below represents a scattered Band 5 of a satellite imagery. The fields rectangular boxes along with their class n point P by Minimum Distance to Mean (M are

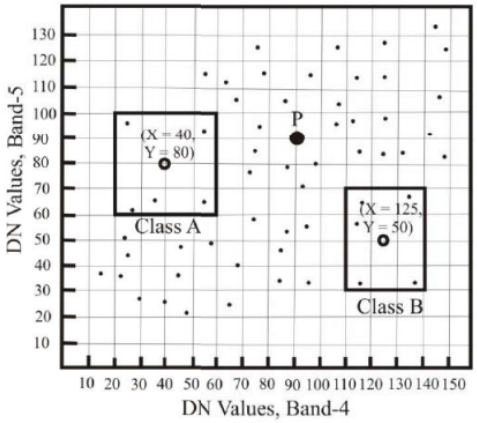

Fig. 2. Image for questions 49

a) Class A by MDM and Class B by NN
b) Class A by NN and Class B by MDM
c) Class A by both MDM and NN
d) Class B by both MDM and NN

50) The hydraulic head at the contact (X–Y) is ___ m. (round off to 2 decimal places).

51) The Concavity Index of the river is ___ %.

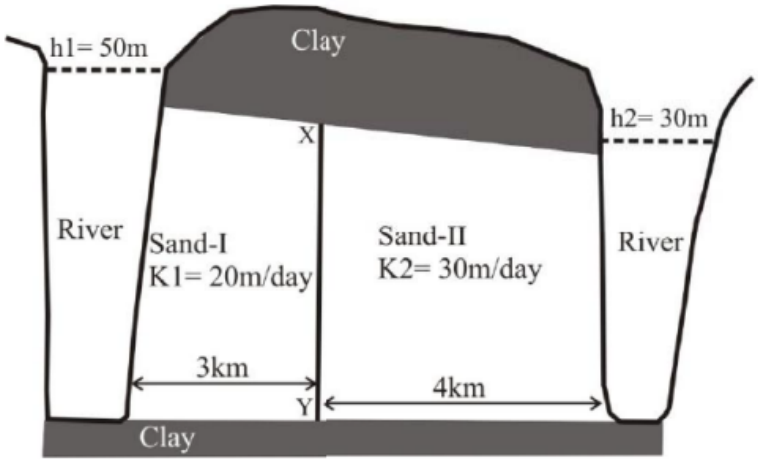

Fig. 3. Image for questions 50

52) For producing 1 kg of gold from an ore having an assay of 2 ppm Au, ___ $\times 10^3$ kg of ore needs to be processed.

53) The uncorrected point load strength index is ___ MPa.

54) A hypothetical garnet peridotite composed of 60% olivine, 25% orthopyroxene, 10% clinopyroxene and 5% garnet undergoes 10% batch melting described by $C_L = \frac{C_0}{F + D - F \cdot D}$ where F is the degree of melting and D is the bulk partition coefficient. The ratio of Ce in the melt to the original rock

will be ___. (round off to 2 decimal places). (The K_D values of Ce for olivine, orthopyroxene, clinopyroxene and garnet are 0.001, 0.003, 0.10 and 0.02, respectively.)

55) ^{87}Rb decays to ^{87}Sr with a decay constant $\lambda = 1.42 \times 10^{-11}$ per year. If at the time of formation, a system contains 8×10^4 atoms of ^{87}Rb and 10^3 atoms of ^{87}Sr, the number of ^{87}Sr atoms in this system at the end of 4 half–lives will be ___ $\times 10^3$. Assume closed system evolution for the parent–daughter pair.

56) The Young's modulus E is related to the LamÃ© parameter λ for a Poisson solid as:

a) $E = 2.5\,\lambda$ b) $E = 1.5\,\lambda$ c) $E = 2\,\lambda$ d) $E = 0.5\,\lambda$

57) Which one of the following seismic phases is the earliest arrival in the P shadow zone?

a) PKiKP b) PPP c) Pdiff d) PKIKP

58) A reversed refraction survey was done over a two layered medium with the interface between them dipping at an angle of 15°. The velocities in the upper and lower medium are V_1 and V_2 respectively, with $V_2 > V_1$. If the critical angle is 45°, then which one of the following is CORRECT? (Vu and Va are updip and downdip velocities).

a) $V_1 = V_a = V_u$ b) $V_u > V_a > V_1$ c) $V_1 > V_a < V_u$ d) $V_u < V_a > V_1$

59) In a migrated seismic time section:
a) both synclines and anticlines appear tighter
b) both synclines and anticlines appear broader
c) synclines appear tighter and anticlines appear broader
d) synclines appear broader and anticlines appear tighter

60) Which one of the following is **CORRECT** for the density porosity (ϕ_D) and neutron porosity (ϕ_N) estimated for a finely interbedded organic–rich, shaly sandstone formation relative to those for a shale–free sandstone formation at shallow depths?
a) ϕ_N decreases and ϕ_D increases
b) ϕ_N increases and ϕ_D decreases
c) both ϕ_N and ϕ_D decrease
d) both ϕ_N and ϕ_D increase

61) Which one of the following statements is INCORRECT with regard to Nuclear Magnetic Resonance (NMR) logging? (ϕ_{NMR} – NMR derived total porosity, ϕ_D – Density porosity)
a) The relaxation time (T_2) decreases with decrease in pore size.
b) ϕ_{NMR} is greater than ϕ_D in a water saturated sandstone formation.
c) NMR logs provide lithology–independent measurement of total porosity.
d) ϕ_{NMR} is less than ϕ_D in a gas saturated shaly sandstone formation.

62) A 3–D seismic tomography experiment was carried out with an interstation spacing of X km. The subsurface velocity perturbations in three–dimensional blocks were estimated with block sizes of $2X$ km and $0.5X$ km in case 1 and case 2, respectively. Which one of the following statements is **CORRECT**?
a) Spatial resolution is poor and variance is small for case 1.
b) Spatial resolution is good and variance is small for case 2.
c) Spatial resolution is good and variance is large for case 1.
d) Spatial resolution is poor and variance is large for case 2.

63) A shallow–focus, great earthquake with a seismic moment of 2.5×10^{40} dyne·cm is recorded at an epicentral distance of 50°. The body–wave magnitude (m_b), surface–wave magnitude (M_s), and moment magnitude (M_w) were estimated. Which one of the following is **CORRECT**is

a) $m_b > M_s > M_w$
b) $m_b = M_s = M_w$
c) $m_b < M_s < M_w$
d) $m_b < M_s > M_w$

64) A pair of current electrodes C_1 ($+I$) and C_2 ($-I$) is placed 50 m apart over a homogeneous structure of resistivity 100 Ω m. A current of 1 A flows through the subsurface. Which one of the following is **CORRECT** for the potential (V_p) and the horizontal component of electric field (E_x) at a point P located exactly below the midpoint between C_1 and C_2 at a depth of 10 m?

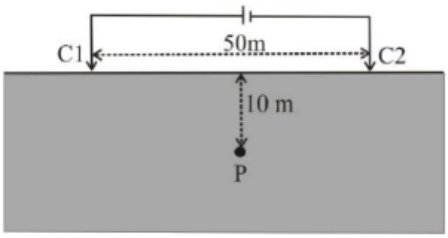

Fig. 4. Image for questions 64

a) $V_p = 0$ and $E_x = 0$
b) $V_p = 0$ and $E_x \neq 0$
c) $V_p \neq 0$ and $E_x = 0$
d) $V_p \neq 0$ and $E_x \neq 0$

65) A massive sulphide body in the subsurface is partially above the water table. According to the pH variation hypothesis for the origin of Self Potential, which one of the following statements is CORRECT for such a body?

a) Acidic above and basic below the water table
b) Basic above and acidic below the water table
c) Acidic above and below the water table
d) Basic above and below the water table

66) The phase difference between the input and output signals for a "Compensator device" used in electromagnetic prospecting to nullify the effect of the primary field at the receiver coil is:

a) 0° b) 45° c) 90° d) 180°

67) In an electromagnetic scale modeling experiment in the lab, the relation between the field and lab geometrical scaling factor (n) with the field and lab resistivity (ρ_f & ρ_m) as well as frequencies (f_f & f_m) will be (subscripts f and m refer to field and lab systems and $n \gg 1$):

a) $n^2 = \dfrac{\rho_f f_f}{\rho_m f_m}$
b) $n^2 = \dfrac{\rho_f f_m}{\rho_m f_f}$
c) $n^2 = \dfrac{\rho_m f_m}{\rho_f f_f}$
d) $n^2 = \dfrac{\rho_m f_f}{\rho_f f_m}$

68) If $G(\omega)$ is the Fourier transform of $g(t)$, then the Fourier transform of $g(t + \ln 2)$ will be:

a) $e^{-2j\omega}G(\omega)$
b) $e^{2j\omega}G(\omega)$
c) $2e^{j\omega}G(\omega)$
d) $2e^{-j\omega}G(\omega)$

69) The primary objective of "Regularization" in geophysical inversion is to:

a) improve the resolution
b) reduce the non–uniqueness
c) enhance the condition number
d) stabilize the inversion process

70) Let P be a point on the Earth's surface defined by radius r, colatitude θ, and longitude ϕ in a spherical coordinate system. The three components of the magnetic induction $\mathbf{B}$ at P in the Cartesian coordinate system are B_x, B_y, and B_z (x–North, y–East, z–downward). For the relation $\mathbf{B} = -\nabla V$ (where V is the magnetic potential), the quantities B_x, B_y, and B_z can be expressed in spherical coordinates as:

a) $B_x = \frac{\partial V}{\partial \theta}, \quad B_y = \frac{1}{\sin\theta}\frac{\partial V}{\partial \phi}, \quad B_z = \frac{\partial V}{\partial r}$
b) $B_x = -\frac{\partial V}{\partial \theta}, \quad B_y = -\frac{1}{\sin\theta}\frac{\partial V}{\partial \phi}, \quad B_z = -\frac{\partial V}{\partial r}$
c) $B_x = -\frac{\partial V}{\partial \theta}, \quad B_y = -\frac{1}{\sin\theta}\frac{\partial V}{\partial \phi}, \quad B_z = \frac{\partial V}{\partial r}$
d) $B_x = \frac{\partial V}{\partial \theta}, \quad B_y = \frac{1}{\sin\theta}\frac{\partial V}{\partial \phi}, \quad B_z = -\frac{\partial V}{\partial r}$

71) In gravity anomalies, the "Indirect effect" mainly arises from:
a) sources outside the area of investigation
b) improper instrument drift
c) effect of mass lying between the geoid and ellipsoid
d) short–wavelength uncompensated masses in the subsurface

72) For defining the axial geocentric magnetic dipole of the Earth's magnetic field using the spherical harmonic expression for magnetic potential, the three non–zero Gauss coefficients for $n = 1$ are

a) g_1^0, g_1^2, h_1^0
b) g_1^2, g_1^1, h_1^1
c) g_1^1, g_1^0, h_1^2
d) g_1^2, g_1^1, h_1^0

73) The flexural rigidity (D) of the oceanic lithosphere (assuming no secondary thermal perturbations):
a) increases with both age and plate cooling
b) decreases with age and increases with plate cooling
c) increases with age and decreases with plate thickness
d) decreases with both age and plate thickness

74) If ΔJ and $\Delta\rho$ are the uniform magnetization and density contrasts of a point source, the relation between the vertical components of the gravity (g_z) and magnetic (T_z) anomalies can be expressed (neglecting long–wavelength components) as (where G is the gravitational constant):
a) $T_z = G\,\Delta J\,\partial g_z\,\Delta\epsilon\,\theta_\alpha$
b) $T_z = G\,\Delta J\,\partial g_z\,2\pi\,\Delta\sigma\,\theta_\epsilon$
c) $T_z = \frac{\Delta J}{G\,\Delta\rho}\,\partial g_z$
d) $T_z = \frac{\Delta\rho}{G\,\Delta J}\,\partial g_z$

75) Which one of the following statements about the gravity anomalies on land is CORRECT?

76) Free–air and Bouguer anomalies are always positively correlated with elevation.

77) Isostatic anomalies are not useful to understand the crustal heterogeneities.

78) Vertical derivatives are used to enhance the gravity effects of deep–seated bodies.

79) X–horizontal gradient ($\partial/\partial x$) maps enhance/sharpen anomalies of bodies trending N–S (X–East, Y–North, Z–downward).

80) An aeromagnetic survey is conducted over an area with outcropping magnetic sources. The aircraft is flying at a height of 250 m with a speed of 200 km/hr. In order to fully define the magnetic anomalies along the flight path, the largest sampling interval (Proton Precession Magnetometer) will be _____ seconds.

81) In an abandoned mine–site, three hollow spherical cavities are located below the surface, centered at depths of 50, 100, and 150 m. Assuming each produces ~ 0.05 mGal and do not interfere, the most ideal (largest) grid spacing to correctly delineate these cavities is _____ metres.

82) A split–spread reflection survey is carried out along a profile in the direction of a dipping interface. The difference in arrival times of the reflected waves from the interface at two geophones with an offset of 1000 m on both sides is 20 ms. If the velocity of the upper layer is 3000 m/s, then the dip of the bed is _____ degrees.

83) The bulk resistivity of a carbonate formation having 10% porosity and 75% hydrocarbon saturation is 500 Ω m. The bulk resistivity of the formation when the porosity is doubled and saturation is 100% water is _____ Ω m.

84) In a seismogram of a shallow–focus ($h = 5$ km) earthquake, the S–P time difference is 1.34 s. Given $V_P = 6.0\,\mathrm{km\,s^{-1}}$ and $\nu = 0.27$, the epicentral distance is _____ km

85) A two–electrode array is placed over a vertical contact (strike perpendicular to page). If 1 A current flows, the potential at electrode P_1 will be _____ mV. (Resistivities: $\rho_1 = 100\,\Omega$m, $\rho_2 = 200\,\Omega$m; C_2 and P_2 at infinity.)

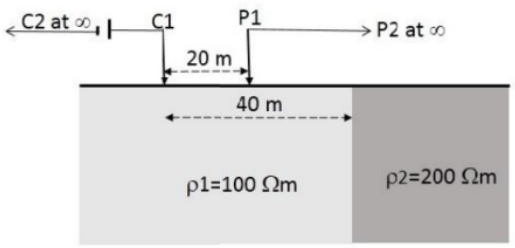

Fig. 5. Image for questions 81

86) In an electrical resistivity imaging survey, an Axial Dipole–dipole array is placed with centre–centre distance 100 m. Dipole length 10 m. If 5 A current and 50 mV potential difference are measured, the apparent resistivity is _____ Ω m.

87) In an EM land survey, the resultant field at point P makes a 60° angle from vertical. A 30 mV signal is observed with a horizontal coil. The magnitude when the coil is perpendicular to the resultant field is _____ mV.

88) A vibroseis source sweeps 10–100 Hz. The maximum sampling interval to recover the signal is _____ milliseconds.

89) The abundance of ^{234}U in secular equilibrium with parent ^{238}U will be _____ $\times 10^{-3}$ %. ($T_{1/2}$: ^{238}U = 4.467×10^9 y; ^{234}U = 2.44×10^5 y; abundance of ^{238}U = 99.28%)