GATE 2026 Geology and Geophysics - Geology (GG-1) Question Paper

General Instructions

(i) This question paper contains 65 questions. All questions are compulsory.

(ii) It comprises 34 single-correct multiple-choice questions, 15 multiple-correct questions and 16 numerical / integer-type questions.

(iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

(iv) For multiple-correct questions, all correct options must be selected to earn full marks.

(v) For numerical questions, report the answer rounded exactly as asked.

1. Suresh said, "I did it yesterday." Which one of the following options is the correct form of this sentence in indirect speech?

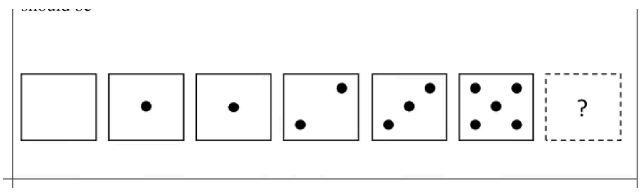
(A) Suresh said that I did it yesterday.

(B) Suresh says I did it yesterday.

(C) Suresh says that he did it the day before.

(D) Suresh said that he had done it the day before.

2. To continue the sequence of tiles shown, the tile indicated by the question mark should be



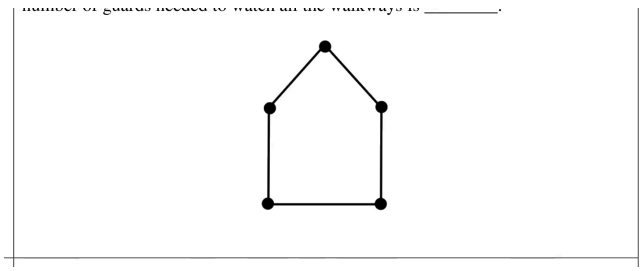
(A)

(B)

(C)

(D)

3. Consider an art gallery whose walkways are shown as lines in the diagram. A black dot represents a junction of two walkways. A guard may be placed at a junction to watch over the walkways that join at that junction. The minimum number of guards needed to watch all the walkways is _____.



(A) 2

(B) 3

(C) 4

(D) 5

4. The 2nd of June is a Thursday in a certain year. Which day of the week is the 3rd of July in that year?

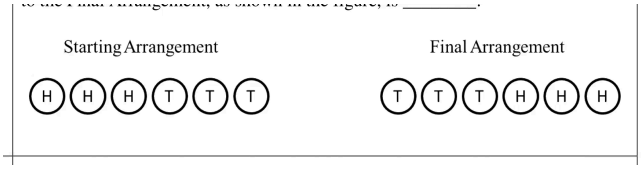
(A) Thursday

(B) Friday

(C) Saturday

(D) Sunday

5. A coin with heads facing up is shown as H and a coin with tails facing up is shown as T.
Six coins are placed in the Starting Arrangement, as shown in the figure below. A "step" is defined as interchanging a pair of adjacent coins without flipping them. The minimum number of steps needed to go from the Starting Arrangement to the Final Arrangement, as shown in the figure, is _____.



(A) 3

(B) 6

(C) 9

(D) 12

6. Exacerbate : Mitigate :: _____

Choose the option with the correct pair of words to fill the blank.

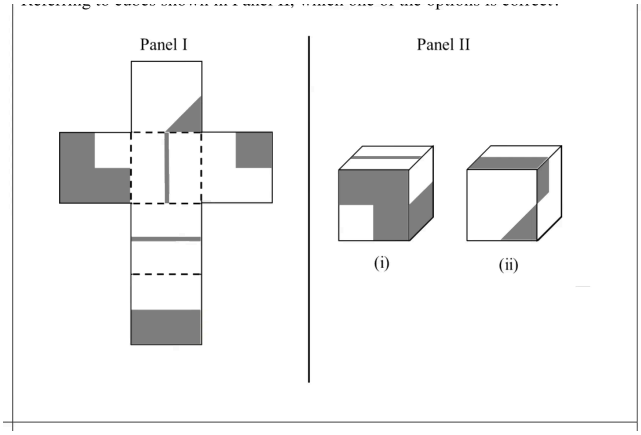
(A) Aggravate : Alleviate

(B) Alleviate : Precipitate

(C) Aggravate : Precipitate

(D) Emancipate : Exonerate

7. A paper shown in Panel I is folded along the dashed lines (- - -) to construct a cube. The shaded regions shown in Panel I appear on the outer surface of the cube. Referring to cubes shown in Panel II, which one of the options is correct?



(A) Only (i) can correspond to the unfolded cube in Panel I.

(B) Only (ii) can correspond to the unfolded cube in Panel I.

(C) Both (i) and (ii) can correspond to the unfolded cube in Panel I.

(D) Neither (i) nor (ii) can correspond to the unfolded cube in Panel I.

8. In a population, patients who have high cholesterol also have high blood pressure (BP). Some patients with high BP also have diabetes. There are no patients who have both high cholesterol and diabetes. Furthermore,
1. the total number of patients with at least one of these conditions is 75,
2. the number of patients with high cholesterol is 10,
3. the number of patients with high BP is 45, and
4. the number of patients with only high BP and no other conditions is 20.
Then the number of patients who have both diabetes and high BP is _____

(A) 0

(B) 15

(C) 20

(D) 10

9. Four people P, Q, R, and S, of different ages, make the following observations.
P: I am younger than S.
Q: I am neither the youngest nor the oldest.
R: P is older than me.
Based on these observations, the youngest person is _____.

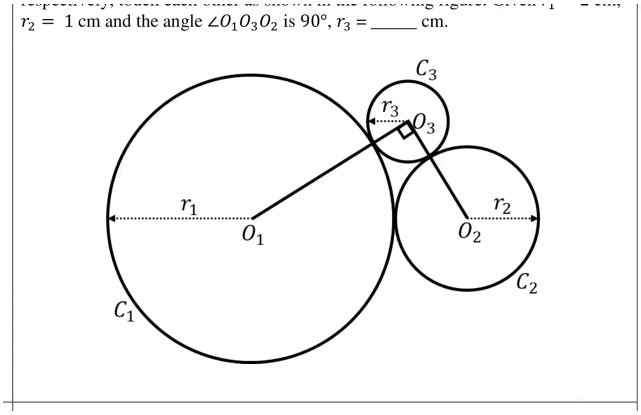
(A) P

(B) Q

(C) R

(D) S

10. Circles C_1, C_2, and C_3, with centers O_1, O_2, and O_3, and radii r_1, r_2, and r_3, respectively, touch each other as shown in the following figure. Given $r_1 = 2$ cm, $r_2 = 1$ cm and the angle $\angle O_1O_3O_2$ is 90 degrees, $r_3 =$ _____ cm.



(A) $\frac{1}{2}\left(-3+\sqrt{17}\right)$

(B) $\frac{1}{2}\left(3+\sqrt{17}\right)$

(C) $\frac{1}{2}\left(-2+\sqrt{17}\right)$

(D) $\frac{1}{2}\left(-3+2\sqrt{17}\right)$

11. Which one of the following increases over time when the soil is fully saturated?

(A) Infiltration

(B) Runoff

(C) Porosity

(D) Permeability

12. In which one of the following layers inside the Earth, the velocity of the P-wave exceeds 13 km/s?

(A) Upper mantle

(B) Outer core

(C) Lower mantle

(D) Inner core

13. Which one of the following is NOT a volcanic igneous rock?

(A) Dacite

(B) Syenite

(C) Trachyte

(D) Komatiite

14. If r_1 and r_2, respectively, denote the equatorial and polar radii of a reference ellipsoid, then the radius, R, of its equivalent sphere is given by

(A) $(r_1 r_2^2)^{2/3}$

(B) $r_1 r_2^2$

(C) $(r_1^2 r_2)^{1/3}$

(D) $r_1^2 r_2$

15. Which of the following sources is/are used in land seismic surveys?

(A) Vibrosis

(B) Dynamite

(C) Airgun

(D) Thumper

16. A pebble has an average diameter of 8 mm. Its ϕ-value on the Udden-Wentworth scale is _____ (answer in integer).

17. A quartz vein in a granitic outcrop has an initial length of 20 cm. If it undergoes uniform stretching resulting in a longitudinal strain of 0.45, the length of the vein post deformation is _____cm (answer in integer).

18. Which one of the following is the CORRECT pair of radioactive parent isotope and the corresponding radiogenic daughter isotope?

(A) $^{87}Rb \rightarrow {}^{86}Sr$

(B) $^{147}Sm \rightarrow {}^{143}Nd$

(C) $^{235}U \rightarrow {}^{206}Pb$

(D) $^{238}U \rightarrow {}^{207}Pb$

19. Which one of the following pairs of geophysical signatures most commonly indicates volcanogenic massive sulphide deposits?

(A) High gravity and low resistivity

(B) Low gravity and high resistivity

(C) Low gravity and low resistivity

(D) High gravity and high resistivity

20. Which one of the following is a physical weathering process?

(A) Oxidation

(B) Hydrolysis

(C) Exfoliation

(D) Carbonation

21. Which of the following statements is/are CORRECT according to the laws of electromagnetic induction in the Earth?

(A) Current density in a region of finite conductivity is solenoidal

(B) Magnetic vector potential is irrotational

(C) Magnetic field is solenoidal

(D) Curl of electric field is negative time rate of change of curl of magnetic vector potential

22. Which of the following is/are REE-bearing mineral(s)?

(A) Monazite

(B) Natrolite

(C) Spodumene

(D) Gibbsite

23. Which of the following pair(s) of well logs does/do NOT exhibit crossover for gas-bearing zones in hydrocarbon reservoirs?

(A) Neutron and density

(B) Caliper and resistivity

(C) Neutron and self-potential

(D) Caliper and gamma-ray

24. If the diameter of a scaled-down model of the Earth is 45 cm, then the equivalent length on the surface of the Earth for 1 cm on the model is _____ km (rounded off to two decimal places).
[Use: Radius of the Earth = 6371 km]

25. The wavelength of a certain portion of the electromagnetic spectrum ranges from 2000 nm to 3000 nm. The highest frequency associated with the above portion of the spectrum is_____$\times 10^8$ MHz (rounded off to one decimal place).

26. Consider that the upper continental crust is 10 km thick and made up of granitic rock having density of 2800 kg/m^3. The surface heat flow due to radiogenic heat from the granitic rock having heat production value of 10^{-9} W/kg is_____ mW/m^2 (answer in integer).

27. Which one of the following stereographic projections represents a reclined fold?

(A)

(B)

(C)

(D)

28. A mineral has X = c, Y = b, Z = a, where X, Y, Z denote optical directions and a, b, c denote crystallographic axes. If X is the fast vibration direction and the mineral is optically positive, a {001} section will show which one of the following interference figures?

(A) Obtuse bisectrix

(B) Acute bisectrix

(C) Centered uniaxial

(D) Off-centered uniaxial

29. Which one of the following minerals is NOT formed by chemical weathering?

(A) Limonite

(B) Kaolinite

(C) Graphite

(D) Gibbsite

30. Which one of the following is NOT a diagnostic parameter in identifying a crystalline phase using powder X-ray diffraction data?

(A) Peak width at half-maximum

(B) Relative intensity

(C) Fluorescence

(D) Peak position

31. If a dextral strike-slip fault system has a right step-over, which one of the following features will develop?

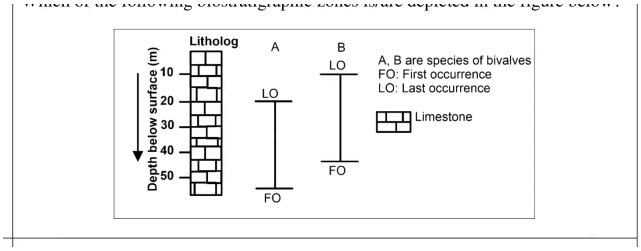
(A) Zone of reverse fault

(B) Releasing bend

(C) Restraining bend

(D) Contractional duplex

32. Which of the following biostratigraphic zones is/are depicted in the figure below?



(A) Concurrent range zone

(B) Interval zone

(C) Assemblage zone

(D) Acme zone

33. Which of the following fossils was/were completely extinct by the end of Permian?

(A) Favosites

(B) Phacops

(C) Aulacopleura

(D) Lingula

34. Which of the following microfossils has/have a geological range from Cambrian to Recent?

(A) Foraminifera

(B) Diatoms

(C) Radiolaria

(D) Dinoflagellates

35. Which of the following statements is/are CORRECT in terms of dentition in bivalves?

(A) Teeth are numerous, sub-parallel, or radially arranged in taxodont

(B) Small simple teeth near the edge of the valve characterize dysodont

(C) Teeth have many parallel grooves normal to axis of tooth in isodont

(D) Teeth are very reduced or absent in desmodont

36. Which of the following deposits is/are linked to magmatic-hydrothermal fluids derived from granitic plutons?

(A) Mississippi Valley-type (MVT) Pb-Zn deposit

(B) Ophiolite-hosted chromite deposit

(C) Komatiite-hosted Ni-Cu sulfide deposit

(D) Greisen related Sn-W deposit

37. Which of the following statements related to crystal defects is/are CORRECT?

(A) Screw dislocation is a type of planar defect

(B) Edge dislocation is a type of line defect

(C) Stacking fault is a type of line defect

(D) Cation vacancy is a type of point defect

38. Choose the CORRECT factor(s) from the following, which affect(s) the $^{18}O/^{16}O$ isotopic ratio in foraminifera growing in an ocean.

(A) Temperature

(B) Oxygen isotopic composition of water

(C) Growth of continental ice sheets

(D) Continental detritus input

39. Which of the following sedimentological processes lead(s) to time averaging of fossil record?

(A) Bioturbation

(B) Erosion and redeposition of sediments

(C) Compaction

(D) Formation of pellets

40. A sandstone bed has an orientation of 360/45W. If the true thickness of the bed is 50 m, the width of the outcrop exposed on a flat surface is _____ m (rounded off to one decimal place).

41. For a chemical system with 5 phases at the invariant point, the number of possible univariant reactions in pressure-temperature space is _____ (answer in integer).

42. Two tectonic plates, P and Q, move in opposite directions along a transform fault boundary. If the plate velocity of P is 8 cm/year and of Q is 6 cm/year with respect to a fixed reference frame, the relative velocity between P and Q is _____ cm/year (answer in integer).

43. If the atomic mass units of ^{85}Rb and ^{87}Rb are 84.912 and 86.901, respectively, then the abundance of ^{87}Rb is _____ % (rounded off to nearest integer).
[Use: Average atomic mass of Rb = 85.467 amu]

44. A mineral under crossed nicols displays second order greenish-yellow ($M = 740$ nm) interference colour. On introduction of a gypsum plate ($A = 550$ nm) along the length of the mineral orientation, first order grey interference colour is displayed. The net retardation is _____ nm (answer in integer).

45. Which one of the following mineral reactions will result in the formation of a diagnostic granulite facies assemblage during regional metamorphism of a pelite?

(A) muscovite + staurolite + chlorite = biotite + kyanite + quartz + H_2O

(B) muscovite + quartz = K-feldspar + sillimanite + melt

(C) biotite + sillimanite + quartz = cordierite + garnet + K-feldspar + melt

(D) staurolite + quartz = garnet + sillimanite + H_2O

46.

The given table shows modal volume percentage of quartz, alkali feldspar and plagioclase in coarse-grained rocks, X and Y. Which of the following rock names of X and Y are CORRECT according to the IUGS classification?

Mineral	X (volume %)	Y (volume %)
Quartz	15	25
Plagioclase	20	60
Alkali feldspar	65	15

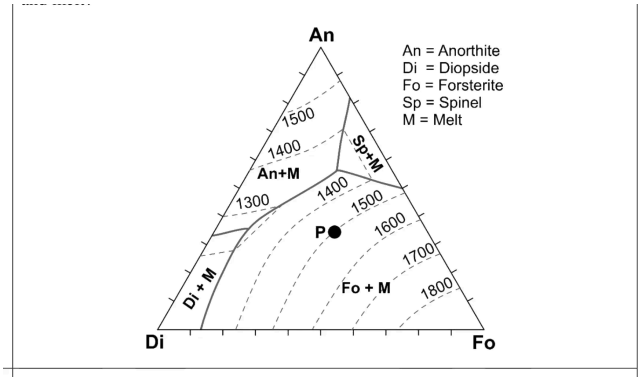
(A) X - Alkali feldspar granite; Y - Tonalite

(B) X - Granodiorite; Y - Granite

(C) X - Alkali feldspar granite; Y - Quartz monzonite

(D) X - Quartz syenite; Y - Granodiorite

47. The ternary diagram given below shows phase relations for the Anorthite-Diopside-Forsterite system at 1 bar pressure. Broken lines represent isotherms with temperature in °C. If 'P' is the initial melt composition, which one of the following is the CORRECT sequence of crystallization assuming equilibrium between crystal and melt?



(A) [Fo] -> [Fo + Di] -> [Fo + Di + An]

(B) [Fo] -> [Fo + An] -> [Fo + An + Di]

(C) [Fo] -> [Fo + Sp] -> [Fo + Sp + An]

(D) [Fo] -> [Fo + An] -> [Fo + An + Sp]

48. Accumulation of which one of the following minerals can explain positive Eu and positive Sr anomalies in the primitive mantle-normalized multielement pattern of an igneous rock?

(A) Orthoclase

(B) Apatite

(C) Orthopyroxene

(D) Olivine

49.

Match the minerals in Group I with the corresponding elements in Group II.

Group-I	Group-II
P. Smithsonite	1. Lead
Q. Azurite	2. Iron
R. Crocite	3. Zinc
S. Marcasite	4. Copper

(A) P-4; Q-1; R-2; S-3

(B) P-2; Q-4; R-1; S-3

(C) P-3; Q-1; R-4; S-2

(D) P-3; Q-4; R-1; S-2

50.

Match the stratigraphic Formations in Group I with the corresponding Geologic Periods in Group II.

Group-I	Group-II
P. Kopili Shale	1. Permian
Q. Raniganj Formation	2. Eocene
R. Quilon Formation	3. Cretaceous
S. Dalmiapuram Formation	4. Miocene

(A) P-3; Q-1; R-2; S-4

(B) P-2; Q-1; R-4; S-3

(C) P-4; Q-1; R-3; S-2

(D) P-1; Q-3; R-2; S-4

51. Which one of the following chrons of Neogene and Quaternary geomagnetic polarity time scale is arranged in the order from oldest to youngest?

(A) Brunhes → Matuyama → Gauss → Gilbert

(B) Matuyama → Brunhes → Gauss → Gilbert

(C) Brunhes → Gauss → Gilbert → Matuyama

(D) Gilbert → Gauss → Matuyama → Brunhes

52.

Match the mineral names in Group I with corresponding space groups in Group II.

Group-I	Group-II
P. Diamond	1. $P6_3/mmc$
Q. Coesite	2. $R\bar{3}c$
R. Graphite	3. $Fd\bar{3}m$
S. Calcite	4. C2/c

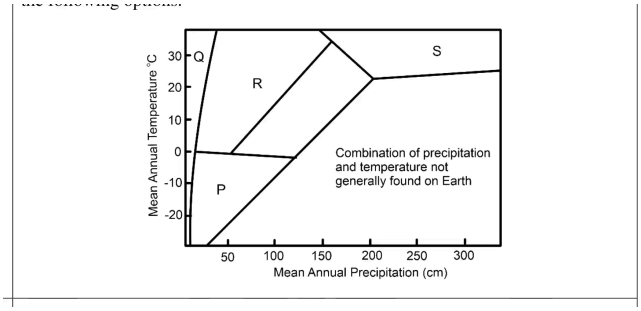
(A) P-4; Q-2; R-3; S-1

(B) P-1; Q-3; R-2; S-4

(C) P-3; Q-4; R-1; S-2

(D) P-2; Q-1; R-4; S-3

53. Choose the marked climate zones P, Q, R and S in the figure CORRECTLY from the following options.



(A) P - Glacial; Q - Arid; R- Tropical; S - Semiarid

(B) P - Arid; Q - Semiarid; R- Tropical; S - Glacial

(C) P - Glacial; Q - Arid; R- Semiarid; S - Tropical

(D) P - Tropical; Q - Arid; R- Semiarid; S - Glacial

54. Which of the following statements CORRECTLY describe(s) a parallel fold?

(A) Inner and outer arcs of the folded layer have same curvature

(B) Dip isogons are parallel to the axial plane

(C) Orthogonal thickness of the folded layer is constant

(D) Dip isogons converge towards core of the fold

55. A hydrothermal solution contains dissolved ions of Ca^{2+} and SO_4^{2-}. If the Saturation Index (SI) of the solution is negative, which of the following statements is/are CORRECT if gypsum is added to the solution?

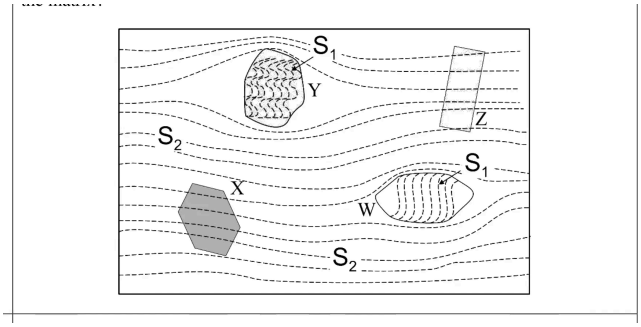
(A) Gypsum will precipitate from the solution

(B) Gypsum will dissolve in the solution

(C) The concentration of Ca^{2+} will increase and SO_4^{2-} will decrease in the solution

(D) The concentrations of both Ca^{2+} and SO_4^{2-} will increase in the solution

56. The given schematic diagram shows different stages of development of S_2 foliation after the formation of S_1 foliation. Which of the following statements CORRECTLY interpret(s) the relationships of porphyroblasts W, X, Y and Z with the matrix?



(A) 'W' formed at an early stage of S_2 foliation

(B) 'W' formed after the growth of porphyroblast 'Y'

(C) 'X' and 'Z' are post-tectonic to S_2 foliation

(D) The sequence of porphyroblast growth is W → Y → X and Z

57. In remote sensing, the parameter(s) that can be estimated in the Thermal Infrared region (3 - 14 μm) is/are

(A) Forest fire

(B) Rainfall pattern

(C) Ground surface temperature

(D) Emissivity

58. Which of the following is/are diagnostic morphological feature(s) of brachiopods?

(A) Skeleton has pentameral symmetry

(B) Dorsal valve

(C) Thoracic segments

(D) Deltidial plate

59. Which of the following is/are diagenetic process(es)?

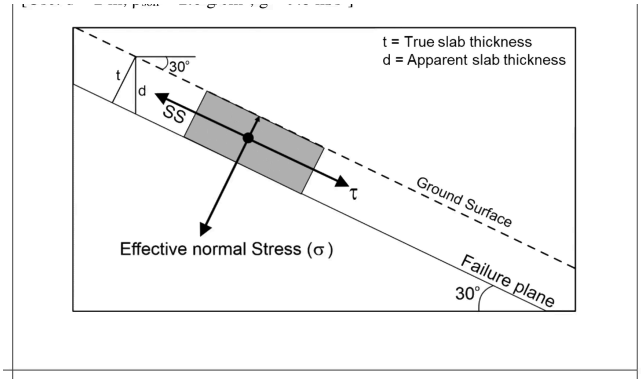
(A) Dolomitization

(B) Flocculation

(C) Neomorphism

(D) Cementation

60. The figure below shows an infinite-slope model. If τ and SS denote the driving shear stress and the resisting shear strength, respectively, then τ along the failure plane is $\times 10^3$ kg/ms^2 (round off to two decimal places). [Use: $d = 2$ m; $\rho_{soil} = 2.0$ g/cm^3; $g = 9.8$ m/s^2]



61. An oblique-slip normal fault dipping 60°E shows a net slip of 100 m. If the net slip vector has a pitch of 30°, then the heave of the fault is m (answer in integer).

62. A mafic magma with 'Sr' concentration of 400 ppm has undergone 60% fractional crystallization. If 'Sr' is incompatible in the mineral assemblage that crystallizes from the magma with a bulk distribution coefficient of 0.2, the concentration of 'Sr' in the residual liquid is ppm (rounded off to nearest integer).

63. The Fe-Mg exchange reaction between olivine and spinel is the following:

$$Mg_2SiO_4 + 2FeAl_2O_4 \rightleftharpoons Fe_2SiO_4 + 2MgAl_2O_4$$

(Forsterite) (Fe-spinel) (Fayalite) (Mg-spinel)

Assuming ideal solid solutions, the temperature of equilibration between olivine and spinel using the following data is °C (round off to nearest integer).

[Assume that ΔH_r^0 and ΔS_r^0 are independent of P and T, and K_d is independent of P]

$$K_d = \left[\frac{(X_{Fe}^{Ol})(X_{Mg}^{Sp})}{(X_{Mg}^{Ol})(X_{Fe}^{Sp})} \right]^2$$

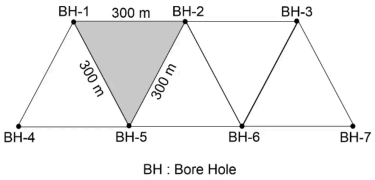
ΔH^o_r (kJ/mol)	ΔS^o_r (J/mol.K)	K_d	R (J/mol.K)
-10.91	-3.90	3.024	8.314

64. The bore hole distribution of a massive sulphide deposit represented in the form of an equilateral triangular pattern is given below. If the average thickness of the ore body is 30 m, the tonnage in the shaded area is million tons (rounded off to two decimal places).

[Use: Bulk density of ore body = 4400 kg/m^3]

is 30 m, the tonnage in the shaded area is _____ million tons (*rounded off to two decimal places*).

[Use: Bulk density of ore body = 4400 kg/m^3]



BH : Bore Hole

65. An aquifer has a surface area of 100 km^2. With no recharge, assume that pumping out 2×10^7 m^3 of ground water resulted in a drop of the water table by 6 m. If the aquifer has a specific retention of 15%, then the porosity of the aquifer is % (rounded off to one decimal place).