IIT JAM 2018 Geology (GG) Question Paper

Time Allowed :3 Hours	**Maximum Marks :**100	**Total questions :**60

General Instructions

General Instructions:

i) All questions are compulsory. Marks allotted to each question are indicated in the margin.

ii) Answers must be precise and to the point.

iii) In numerical questions, all steps of calculation should be shown clearly.

iv) Use of non-programmable scientific calculators is permitted.

v) Wherever necessary, write balanced chemical equations with proper symbols and units.

vi) Rough work should be done only in the space provided in the question paper.

1. Which one among the following planets in the Solar system is most similar in size to Earth?

(A) Mercury

(B) Venus

(C) Neptune

(D) Uranus

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2. In which one of the following tectonic settings are the highest mountain chains and thickest crust found?

(A) Island arc

(B) Continental arc

(C) Continental collision

(D) Transcurrent

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3. The second-most abundant oxide in the Earth's crust is

(A) Al_2O_3

(B) SiO_2

(C) CaO

(D) Na_2O

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4. The type of dentition found in Trigonia is

(A) schizodont

(B) taxodont

(C) pachydont

(D) isodont

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5. Which one of the following minerals has isolated $(SiO_4)^{4-}$ tetrahedra linked by divalent cations in octahedral coordination?

(A) Muscovite

(B) Quartz

(C) Beryl

(D) Olivine

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6. Which one of the following is NOT found in an extensional setting?

(A) Normal faults

(B) Horsts

(C) Rifts

(D) Thrust faults

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7. The texture characterized by exsolved lamellae of albite in K-feldspar is known as

(A) myrmekite

(B) graphic

(C) perthite

(D) antiperthite

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8. Fissility is best shown by

(A) sandstone

(B) siltstone

(C) shale

(D) limestone

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9. Petroleum is NOT commercially produced from

(A) Krishna–Godavari basin

(B) Cauvery–Palar basin

(C) Cambay basin

(D) Vindhyan basin

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10. Among the following, the mineral showing acicular habit is

(A) kyanite

(B) tourmaline

(C) biotite

(D) sillimanite

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11. Isostasy involves ..... continental mountain belts.

(A) compensation in

(B) creation of

(C) destruction of

(D) thrusting in

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12. Identify the pair from the following list that is NOT correctly matched.

(A) Caldera – stratovolcano

(B) Pillow basalt – subaerial eruption

(C) Ropy lava – pahoehoe flow

(D) Amygdales – filled vesicles

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13. Wilson orogenic cycle in continents is initiated by

(A) collision

(B) rifting

(C) drifting

(D) subduction

---

14. Match the processes in Group I with corresponding geomorphic features in Group II.

Group I

P. Dissolution

Q. Abrasion

R. Deposition

S. Onion skin weathering

Group II

1. Mushroom rocks
2. Exfoliation domes
3. Sinkholes
4. Moraines

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

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

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

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

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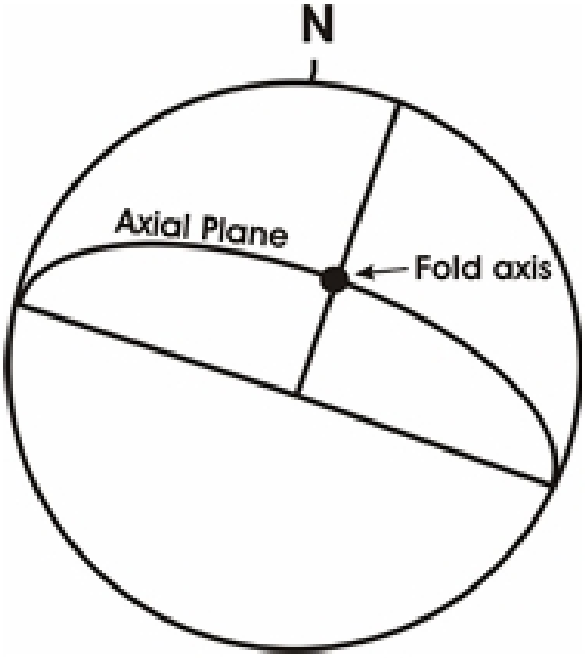
15. The orientations of the fold axis and axial plane in the given figure indicate



(A) reclined fold

(B) vertical fold

(C) recumbent fold

(D) horizontal fold

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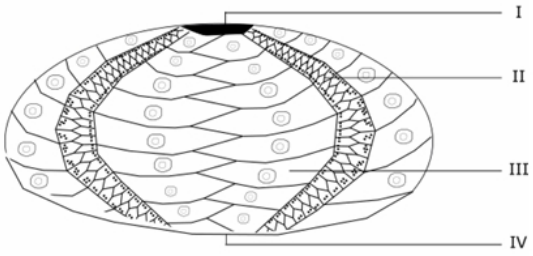
16. Identify the correct morphological features corresponding to numbers I – IV in the echinoid illustrated below:



(A) I-Periproct II-Ambulacra III-Interambulacra IV-Peristome

(B) I-Periproct II-Interambulacra III-Ambulacra IV-Peristome

(C) I-Peristome II-Interambulacra III-Ambulacra IV-Periproct

(D) I-Peristome II-Ambulacra III-Interambulacra IV-Periproct

17. The correct order of marine benthic habitats with increasing water depths is

(A) abyssal, bathyal, neritic

(B) neritic, abyssal, bathyal

(C) neritic, bathyal, abyssal

(D) bathyal, abyssal, neritic

---

18. Which one of the following invertebrates has the most primitive visual system?

(A) Ammonites

(B) Brachiopods

(C) Gastropods

(D) Trilobites

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19. The correct chronological sequence (older to younger) of the Precambrian stratigraphic units listed below is

(A) Sargur Group, Chitradurga Group, Alwar Group, Kaimur Group

(B) Chitradurga Group, Sargur Group, Kaimur Group, Alwar Group

(C) Sargur Group, Alwar Group, Chitradurga Group, Kaimur Group

(D) Sargur Group, Chitradurga Group, Kaimur Group, Alwar Group

---

20. Match the Formations in Group I with corresponding characteristic fossils in Group II.

Group I

P. Barakar Formation

Q. Uttar Formation

R. Dhok Pathan Formation

S. Lameta Formation

Group II

1. Stegodon
2. Sauropoda
3. Belemnites
4. Glossopteris

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

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

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

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

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21. Which one of the following sedimentary structures is NOT used for determining top and bottom of beds?

(A) Mud cracks

(B) Load and flame structures

(C) Sharp-crested wave ripples

(D) Plane lamination

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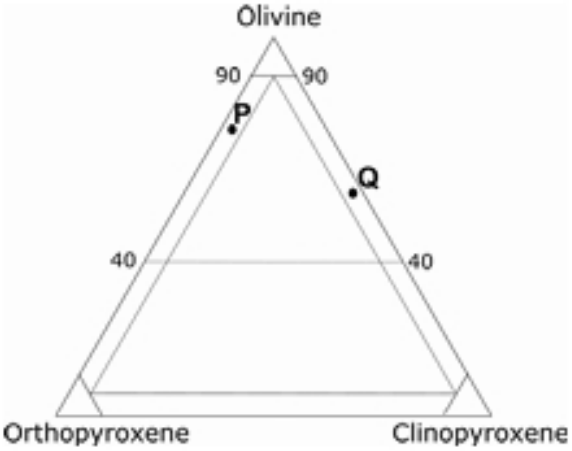
22. Identify the rocks P and Q in the diagram as per the IUGS classification.



(A) P – Webstetite, Q – Wehrlite

(B) P – Dunite, Q – Webstetite

(C) P – Webstetite, Q – Dunite

(D) P – Harzburgite, Q – Wehrlite

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23. Which one of the following is produced by a closed-system metamorphic reaction between muscovite and quartz?

(A) orthoclase + sillimanite

(B) orthoclase + biotite

(C) plagioclase + biotite

(D) plagioclase + sillimanite

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24. The assemblage staurolite + garnet + biotite + muscovite + quartz in pelites is stable in

(A) greenschist facies

(B) amphibolite facies

(C) granulite facies

(D) pyroxene hornfels facies

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25. Conglomerates are commonly deposited in

(A) aeolian dunes

(B) tidal flats

(C) alluvial fans

(D) river flood plains

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26. Match the mineral deposits in Group I with corresponding Indian occurrences in Group II.

Group I

P. Iron

Q. Uranium

R. Manganese

S. Baryte

Group II

1. Mangampet, Andhra Pradesh
2. Balaghat, Madhya Pradesh
3. Narwa Pahar, Jharkhand
4. Hospet, Karnataka

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

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

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

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

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27. Which one of the following processes is responsible for the formation of syngenetic Ni-Cu sulphide ore in gabbro-norite rocks?

(A) Hydrothermal replacement

(B) Volcanic exhalation

(C) Liquid immiscibility

(D) Contact metamorphism

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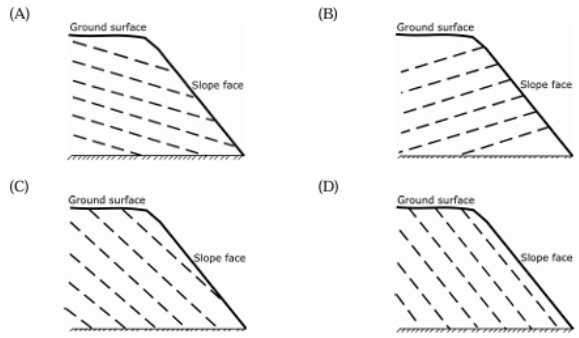
28. Dashed lines in the figures given below represent joints. Considering only the orientations of the joints and the slope face, which one of the following represents the most stable slope?



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29. Match the morphological features/life processes in Group I with corresponding organisms in Group II.

Group I

P. Water vascular system

Q. Molting

R. Jet propulsion locomotion

S. Lophophore

Group II

1. Cephalopoda
2. Echinodermata
3. Brachiopoda
4. Trilobita

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

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

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

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

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30. Match the plutonic rocks in Group I with corresponding volcanic equivalents in Group II.

Group I

P. Granite

Q. Syenite

R. Diorite

S. Gabbro

Group II

1. Andesite
2. Basalt
3. Rhyolite
4. Trachyte

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

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

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

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

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31. Which of the following change(s) when a dipping bed with a plunging lineation is rotated about a vertical axis?

(A) Dip amount of bed

(B) Plunge amount of lineation

(C) Plunge direction of lineation

(D) Strike of bed

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32. Which of the following indicate(s) the presence of directed stress in a rock?

(A) Porphyritic texture

(B) Schistosity

(C) Gneissosity

(D) Mylonitic texture

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33. The correct combination(s) of ranks and corresponding categories of stratigraphic units is/are

(A) Formation – Lithostratigraphy

(B) System – Chronostratigraphy

(C) Period – Chronostratigraphy

(D) Group – Biostratigraphy

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34. The correct order(s) of stability of silica polymorphs with increasing pressure is/are

(A) Quartz – Coesite – Stishovite

(B) Quartz – Stishovite – Coesite

(C) Tridymite – Coesite – Stishovite

(D) Tridymite – Stishovite – Coesite

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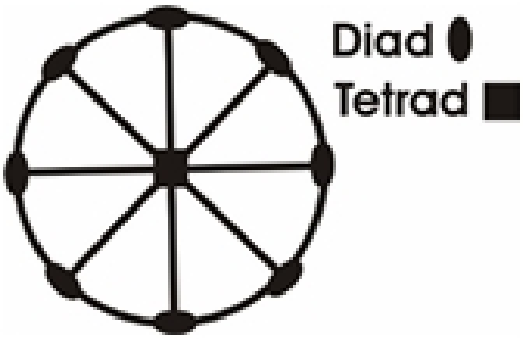
35. Which of the following statement(s) is/are correct for the upper hemisphere stereographic projection of a crystal given below?



(A) Angle between the axes, $\alpha = \beta = \gamma = 90^{\circ}$

(B) Crystal contains 1 tetrad

(C) Crystal contains 4 diads

(D) Crystal contains 5 mirror planes

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36. Which of the following statement(s) is/are correct?

(A) An isotropic mineral remains dark through 360° rotation of stage under crossed polars

(B) Pleochroism is the change of colour of a mineral during rotation under crossed polars

(C) Minerals of the Triclinic system are optically uniaxial

(D) Melatrope in an interference figure marks the emergence of an optic axis

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37. Hermatypic corals are typically found in

(A) the photic zone

(B) warm and clear water

(C) cool deep water

(D) reefs

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38. Choose the characteristic mineral(s) formed in the supergene enriched zone of a sulphide deposit.

(A) Psilomelane

(B) Covellite

(C) Cassiterite

(D) Chalcocite

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39. Which of the following is/are true for crystallization of plagioclase phenocrysts from a basic magma forming a layered intrusion?

(A) Cumulus texture at the base

(B) Anorthite-rich early plagioclase at the base

(C) Albite-rich late plagioclase at the top

(D) Quench texture at the base

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40. Major mass extinction events occurred in the

(A) end Silurian

(B) end Carboniferous

(C) end Permian

(D) early Devonian

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41. When plotted on a map of 1:50000 scale, a 2 km long dyke exposed on a horizontal surface has a length of ..... cm (answer in one decimal place).

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42. The valency of iron in hematite is .....

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43. A crustal rock is at a lithostatic pressure of 3 kbar and a temperature of 275°C. If the lithostatic pressure increases at a uniform rate of 0.3 kbar/km, and the surface temperature is 25°C, the geothermal gradient (in °C/km) is ..... (answer in one decimal place).

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44. The absolute difference in the Moh's hardness values of the two silicates among the minerals listed below is .....

Apatite, Corundum, Gypsum, Talc, Topaz

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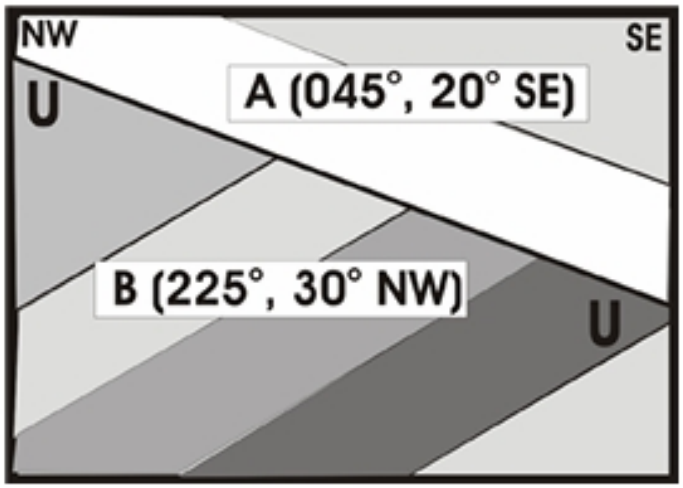
45. Attitudes of beds in sequences A (younger) and B (older), separated by an unconformity UU, are given in the following sectional view. If UU was horizontal when sequence A was deposited, the dip amount of beds in sequence B at that time was ..... (answer in one decimal place).



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46. The number of alpha (α) particles emitted to produce a daughter isotope of ^{206}Pb from a parent isotope of ^{238}U by radioactive decay is .....

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47. The dip slip on a fault $000°, 30°E$ is 10 m. Assuming slip equals separation here, the throw on the fault is ..... m (answer in one decimal place).

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48. A continuous 10 m thick sequence of shale was deposited in 10,000 years at uniform rate of sedimentation. The number of samples that must be collected at equal stratigraphic intervals to sample the succession every 500 years is ..... .

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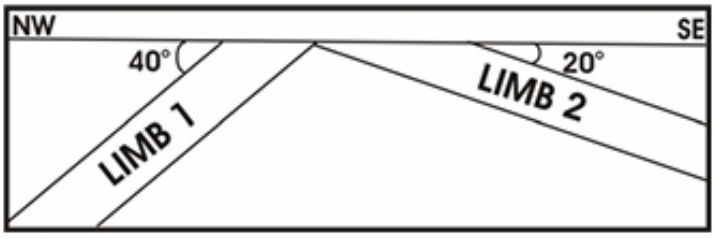
49. Attitudes of the two limbs of a non-plunging kink fold shown below are 045°, 20°SE and 045°, 40°NW. The dip amount (in degrees) of the axial plane of the kink fold is ..... (answer in one decimal place).



50. In the garnet formula $(Fe_3)Mg_3Ca_xAl_2Si_3O_{12}$, x represents the number of atoms of Ca. The mole % of grossular in the garnet is ..... (answer in one decimal place).

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51. Assuming the Earth to be an ideal sphere, the volume % of the core relative to the total volume of the Earth is ..... (answer in one decimal place).

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52. Based on 8 oxygen atoms, the number of silicon atoms in a plagioclase of composition $Ab_2An_2O_8$ is ..... (answer in one decimal place).

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53. 600 tons of low grade iron ore (40% Fe) are blended with 400 tons of high grade iron ore (65% Fe). The grade of the blended ore is ..... % Fe (answer in one decimal place).

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54. The mass of a fully dried rock sample of volume 100 cm^3 is 300 g. The mass of the sample, when fully saturated with water of density 1.00 g/cm^3, is 325 g. Assuming no volume change, the computed porosity of the rock is ..... % (answer in one decimal place).

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55. When a dunite comprising pure forsterite undergoes melting, the weight % of MgO in the melt is ..... (answer in one decimal place). Given molecular weights of $SiO_2 = 60.08$, $MgO = 40.30$.

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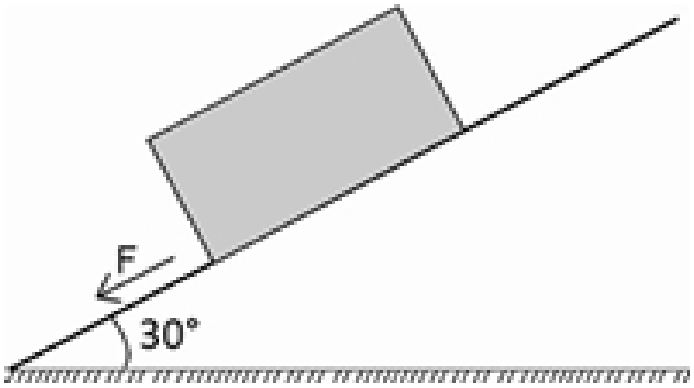
56. A block of rock with a mass of 72 kg slides on a surface inclined at an angle of 30° as shown in the figure. Assuming no cohesion and friction, the force F is ..... Newton (answer in one decimal place; acceleration due to gravity = 9.8 m/s^2).



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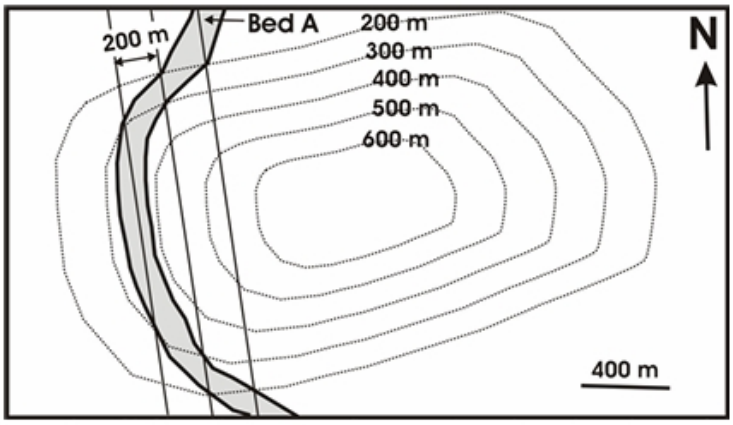
57. The true thickness of Bed A in the map given below is ..... m (answer in one decimal place).



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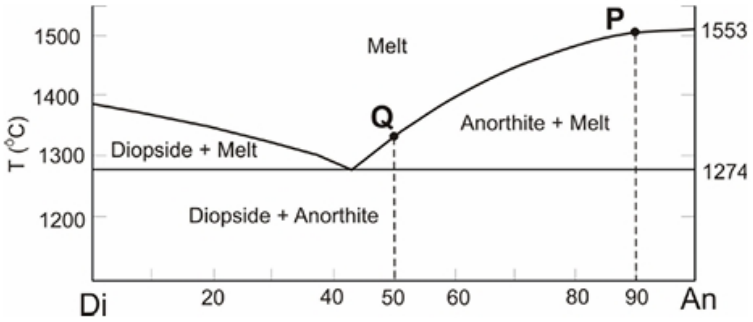
58. A melt containing 900 moles of anorthite and 100 moles of diopside undergoes crystallization. The number of moles of anorthite that crystallize as the melt composition moves from P to Q is .....



59. A confined sandstone aquifer with a uniform cross-sectional area of 7 m^2 and a hydraulic conductivity of 2 m/s, transmits water across a hydraulic gradient of 3.2. Assuming steady state Darcian flow, the volumetric flow rate through the aquifer is ..... m^3/s (answer in one decimal place).

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60. A diamondiferous lamproite is ultrapotassic and has a molar K_2O/Na_2O ratio of 11. If the Na_2O content of the rock is 0.62 wt%, the K_2O content is ..... wt% (answer in one decimal place; molecular weight of $Na_2O = 61.98$, and $K_2O = 94.20$).
