



Planet
Geology

GATE 2024

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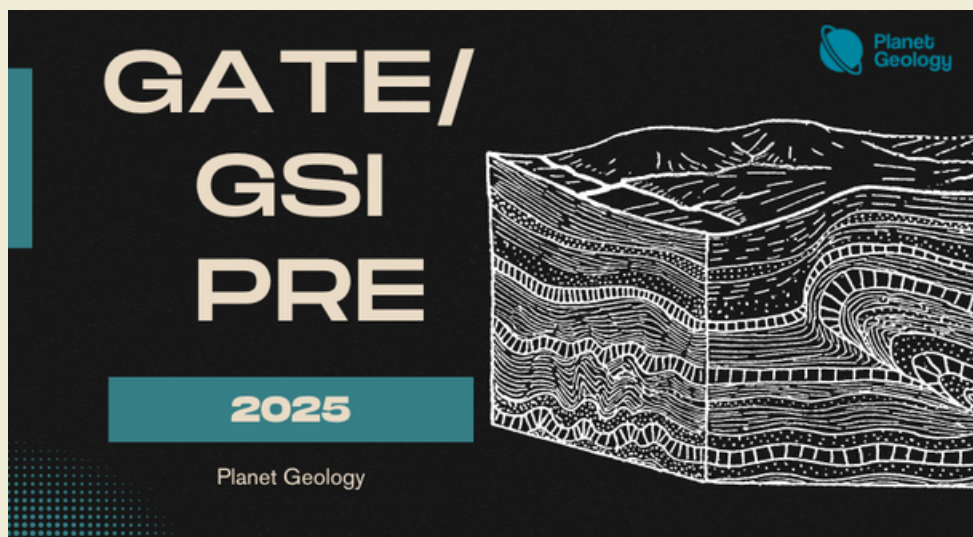
Geology Paper

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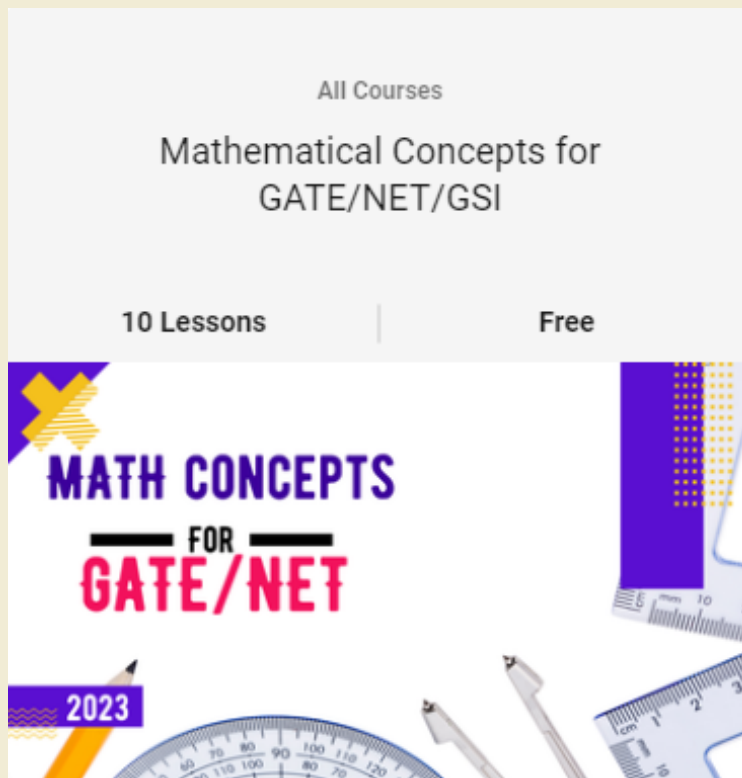


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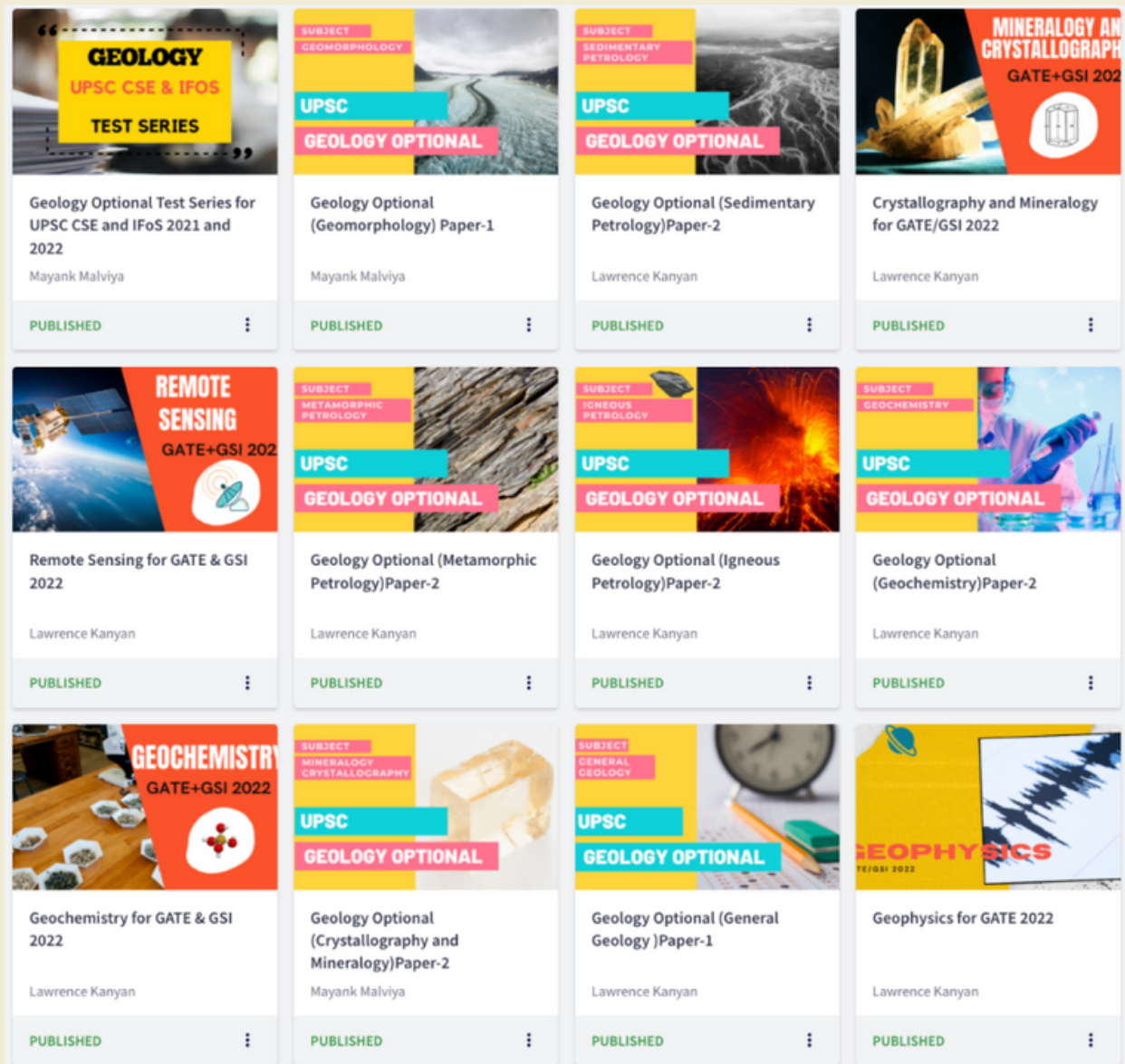


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GATE 4th Feb 2024 S1

Candidate ID	
Candidate Name	
Test Center Name	
Test Date	04/02/2024
Test Time	9:30 AM - 12:30 PM
Subject	GG Geology and Geophysics (Geology)

Section : **General Aptitude****Q.1**

During a half-moon phase, the Earth-Moon-Sun form a right triangle. If the Moon-Earth-Sun angle at this half-moon phase is measured to be 89.85° , the ratio of the Earth-Sun and Earth-Moon distances is closest to

Options

A. 328

B. 283

C. 382

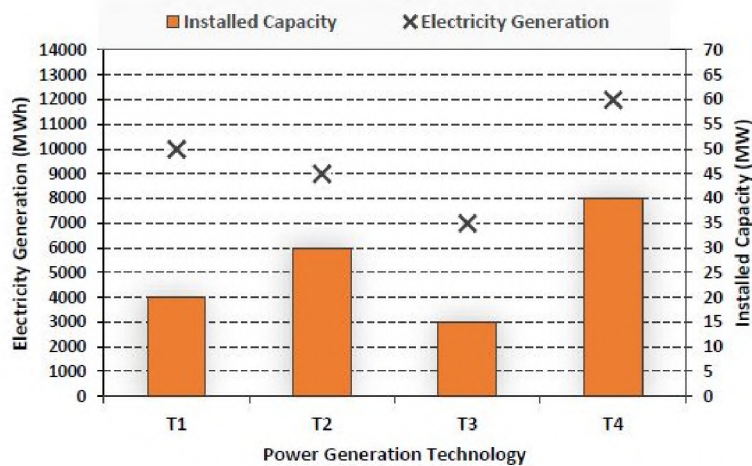
D. 238



Planet Geology

Q.2

The chart given below compares the Installed Capacity (MW) of four power generation technologies. T1, T2, T3, and T4, and their Electricity Generation (MWh) in a time of 1000 hours (h).



The Capacity Factor of a power generation technology is:

$$\text{Capacity Factor} = \frac{\text{Electricity Generation (MWh)}}{\text{Installed Capacity (MW)} \times 1000 \text{ (h)}}$$

Which one of the given technologies has the highest Capacity Factor?

Options

A. T2

B. T3

C. T1

D. T4



Q.3

In the given text, the blanks are numbered (i)–(iv). Select the best match for all the blanks.

From the ancient Athenian arena to the modern Olympic stadiums, athletics ⁽ⁱ⁾ the potential for a spectacle. The crowd ⁽ⁱⁱ⁾ with bated breath as the Olympian artist twists his body, stretching the javelin behind him. Twelve strides in, he begins to cross-step. Six cross-steps ⁽ⁱⁱⁱ⁾ in an abrupt stop on his left foot. As his body ^(iv) like a door turning on a hinge, the javelin is launched skyward at a precise angle.

Options A.

(i) holds (ii) wait (iii) culminates (iv) pivot

B.

(i) hold (ii) waits (iii) culminates (iv) pivot

C.

(i) holds (ii) waits (iii) culminate (iv) pivots

D.

(i) hold (ii) wait (iii) culminate (iv) pivots

Question Type : MCQ

Question ID : 6420085507

Status : Answered

Chosen Option : C

Q.4

Which one of the given options is a possible value of x in the following sequence?

3, 7, 15, x , 63, 127, 255

Options

A. 45

B. 40

C. 31

D. 35

Question Type : MCQ

Question ID : 6420085505

Status : Answered

Chosen Option : C

Q.5

On a given day, how many times will the second-hand and the minute-hand of a clock cross each other during the clock time 12:05:00 hours to 12:55:00 hours?

Options

A. 50

B. 55

C. 51

D. 49

Question Type : MCQ

Question ID : 6420085506

Status : Answered

Chosen Option : A

Q.6

For positive integers p and q , with $\frac{p}{q} \neq 1$, $\left(\frac{p}{q}\right)^{\frac{p}{q}} = p^{\left(\frac{p}{q}-1\right)}$. Then,

Options

A. $q^p = p^q$ B. $\sqrt[p]{q} = \sqrt[q]{p}$ C. $\sqrt{q} = \sqrt{p}$ D. $q^p = p^{2q}$ 

Question Type : MCQ

Question ID : 6420085504

Status : Not Answered

Chosen Option : --

Q.7

If denotes increasing order of intensity, then the meaning of the words

[simmer — seethe — smolder] is analogous to [break —* raze —] _____ .

Which one of the given options is appropriate to fill the blank?

Options

A. obliterate

B. fissure

C. fracture

D. obfuscate

Q.8

Three distinct sets of indistinguishable twins are to be seated at a circular table that has 8 identical chairs. Unique seating arrangements are defined by the relative positions of the people.

How many unique seating arrangements are possible such that each person is sitting next to their twin?

Options

A. 28

B. 12

C. 14

D. 10



Q.9

hi a locality, the houses are numbered in the following way:

The house-numbers on one side of a road are consecutive odd integers starting from 301. while the house-numbers on the other side of the road are consecutive even numbers starting from 302. The total number of houses is the same on both sides of the road.

If the difference of the sum of the house-numbers between the two sides of the road is 27, then the number of houses on each side of the road is

Options

A. 54

B. 26

C. 27

D. 52

Q.10

hi the 4x4 array shown below, each cell of the first three columns has either a cross (X) or a number, as per the given rule.

1	1	2	
2	X	3	
2	X	4	
1	2	X	

Rule: The number in a cell represents the count of crosses around its immediate neighboring cells (left, right, top, bottom, diagonals).

As per this rule, the maximum number of crosses possible in the empty column is

Options

A. 3

B. 1

C. 2

D. 0

Q.1

A cylindrical sample of granite (diameter = 54.7 mm; length = 137 mm) shows a linear relationship between axial stress and axial strain under uniaxial compression up to the peak stress level at which the specimen fails. If the uniaxial compressive strength of this sample is 200 MPa and the axial strain corresponding to this peak stress is 0.005, the Young's modulus of the sample in GPa is (in integer).

Possible that
GATE provides
85 as ans.

Given 40

Answer :

Q.2

Which of the following hydrocarbon fields is/are located in the western offshore of India?

Options

A. Ravva

B. Panna

C. Lakwa

D. Tapti

Q.3

Gold is being produced from which one of the following mines in India?

Options

A. Dariba

B. Baula

C. Hutti

D. Jaduguda



Q.4 The Earth's magnetic field originates from convection in which one of the following layers?

- Options
- A. Asthenosphere
 - B. Lithosphere
 - C. Inner core
 - D. Outer core

Q.5 Which one of the following logging tools is used to measure the diameter of a borehole?

- Options
- A. Neutron
 - B. Sonic
 - C. Caliper
 - D. Density

Question Type : **MCQ**
Question ID : **6420085513**
Status : **Answered**
Chosen Option : **C**

Q.6 The given figure depicts an array used in DC resistivity surveys, where the current electrodes are denoted by C1 and C2, and potential electrodes by P1 and P2. If all the electrodes are equally spaced, then the given array corresponds to which one of the following configurations?



- Options
- A. Dipole–Dipole
 - B. Schlumberger
 - C. Pole–Pole
 - D. Wenner

Question Type : **MCQ**
Question ID : **6420085514**
Status : **Not Answered**
Chosen Option : **--**

Q.7 Which one of the following is an ultramafic rock?

- Options
- A. Granite
 - B. Basalt
 - C. Gabbro
 - D. Dunite

Q.8 Which one or more of the following minerals shows O:Si ratio of 4:1 in its silicate structure?

- Options
- A. Diopside
 - B. Quartz
 - C. Olivine
 - D. Albite

Q.9 The number of planes of symmetry in a tetrahedron is

- Options
- A. 4
 - B. 3
 - C. 6
 - D. 9

Q.10 A current of 2 A passes through a cylindrical rod with uniform cross-sectional area of 4 m^2 and resistivity of $100 \text{ } \Omega\text{-m}$. The magnitude of the electric field (E) measured along the length of the rod in V/m is (in integer) 50

Given 50
Answer :

Q.11 Match the geophysical methods in Group-I with then associated physical properties in Group-II. .

Group—I

P. Magnetic

Q. Gravity

R. Magnetotelluric

S. Induced Polarization

Group—II

1. Chargeability

2. Electrical conductivity

3. Susceptibility

4. Density

Options

A. P-3, Q-4, R-1, S-2

B. P-4, Q-3, R-2, S-1

C. P-3, Q-4, R-2, S-1

D. P-2, Q-1, R-4, S-3

Q.12

A confined aquifer with a uniform saturated thickness of 10 m has hydraulic conductivity of 10^{-2} cm/s. Considering a steady flow, the transmissivity of the aquifer in m^2/day is (rounded off to one decimal place). **86.4**

Given **86.4**

Answer :

Q.13

Which of the following Epochs belong(s) to the Quaternary Period?

Options

A. Miocene

B. Holocene

C. Pleistocene

D. Pliocene

: MSQ

Question ID : 6420085522

Status : Answered

Chosen Option :

Q.14

Assume heat producing elements are uniformly distributed within a 16 km thick layer in the crust in a heat flow province. Given that the surface heat flow and reduced heat flow are 54 mW/m^2 and 22 mW/m^2 , respectively, the radiogenic heat production in the given crustal layer in $\mu\text{W/m}^3$ is 2 (in integer).

Given 2000

Answer :

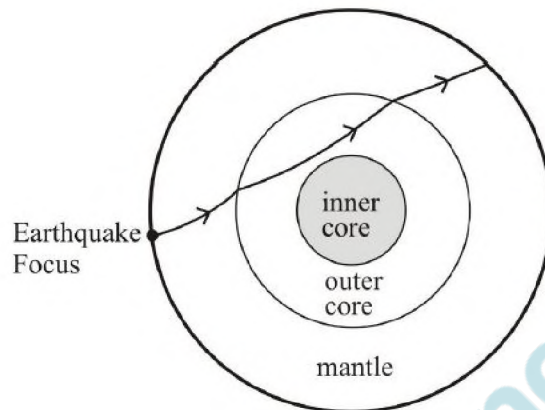
Question Type : NAT

Question ID : 6420085525

Status : Answered

Q.15

The given figure shows the ray path of a P-wave propagating through the Earth. Choose the CORRECT P-phase corresponding to the ray path.



Options

- A. PKP
- B. PcP
- C. PmP
- D. PPP



Question Type : MCQ

Question ID : 6420085519

Status : Not Answered

Chosen Option : --

Q.16

Which of the following rock structures is/are fold(s)?

Options

- A. Horst
- B. Syncline
- C. Synform
- D. Antiform

Question Type : MSQ

Question ID : 6420085524

Status : Answered

Chosen Option :

Q.1 Match the minerals in Group-I with the corresponding cleavage types in Group-II.

Group-I

P. Diopside

Q. Galena

R. Calcite

S. Fluorite

Group-II

1. Cubic

2. Octahedral

3. Prismatic

4. Rhombohedral

Options

A. P-3, Q-1, R-4, S-2

B. P-4, Q-3, R-1, S-2

C. P-3, Q-2, R-4, S-1

D. P-4, Q-1, R-2, S-3

Question Type : **MCQ**

Question ID : **6420085529**

Status : **Not Answered**

Chosen Option : --

Q.2 Which one of the following sequences of index minerals correctly represents the order of increasing metamorphic grade during regional metamorphism of siliceous dolomitic limestones?

Options

A. Talc → Forsterite → Tremolite

B. Talc → Tremolite → Diopside

C. Tremolite → Diopside → Talc

D. Diopside → Tremolite → Forsterite

Question Type : **MCQ**

Question ID : **6420085533**

Status : **Not Answered**

Chosen Option : --

Q.3 Which one of the following textures is called the chalcopyrite disease?

Options

A. Chalcopyrite lamellae in bornite

B. Chalcopyrite blebs in sphalerite

C. Sphalerite stars in chalcopyrite

D. Bornite lamellae in chalcopyrite

Q.4 Which of the following structures is/are associated with duplexes hi fold-thrust belts?

Options

- A. Imbricate fan
- B. Roof thrust
- C. Floor thrust
- D. Horses

Q.5 Consider the solubility product of barite (BaSO_4) at 25°C and 1 bar to be 10^{-10} . If the activities of Ba^{2+} and SO_4^{2-} ions are 0.5×10^{-5} and 10^{-6} , respectively, then the absolute value of 'X' is (rounded off to one decimal place). 4.7

Given 4.6
Answer :

Q.6 The areas of drainage basins A and B are 25 km^2 and 50 km^2 , respectively. The total length of drainages of all orders in basin A is 20 km. If both the basins have the same drainage density, the total length of drainages of all orders in basin B in km is (in integer). 40

Given 40
Answer :

Q.7 The measured plate velocity is maximum (hi International Terrestrial Reference Frame) at which one of the following locations on the Indian Plate?

Options

- A. Bengaluru
- B. Maldives
- C. Delhi
- D. Leh

Q.8 Which of the following types of deposits is/are formed by fractional crystallization of magma?

Options

- A. Komatiite hosted Ni-Cu
- B. Peridotite hosted Cr
- C. Anorthosite hosted Ti-Fe
- D. Leucogranite hosted U

Question Type : **MSQ**

Question ID : **6420085538**

Status : **Answered**

Chosen Option :

Q.9 Which one among the following is the least abundant sedimentary rock in the stratigraphic record?

Options

- A. Limestone
- B. Sandstone
- C. Conglomerate
- D. Shale

Question Type : **MCQ**

Question ID : **6420085532**

Status : **Not Answered**

Chosen Option : --

Q.10 The support pressure of 20 kPa is required to stabilize the loose blocks of the Excavation Disturbed Zone (EDZ) at the crown of a circular tunnel with horizontal axis. The EDZ is to be stabilized by inserting rock bolts vertically into the roof. If the working capacity of a bolt is 160 kN, the area of the roof supported by a single bolt in m^2 is (in integer).

8

Given 8
Answer :

Question Type : **NAT**

Question ID : **6420085544**

Status : **Answered**

Q.11

Which of the following statements is/are CORRECT ?

Options

- A. Ventifacts are formed by glaciers
- B. Oxbow lakes are formed in fluvial environments
- C. Karst topography is formed in limestone terrains
- D. Fjords are formed by aeolian activities

Question Type : MSQ

Question ID : 6420085542

Status : Answered

Chosen Option :

Q.12

The composition of which one of the following reservoirs closely matches with that of iron meteorites?

Options

- A. Primitive Mantle
- B. Bulk Silicate Earth
- C. Earth's Core
- D. Depleted Mantle

Q.13

Which of the following bivalves is/are swimmers?

Options

- A. *Lima*
- B. *Pecten*
- C. *Aspergillum*
- D. *Tellina*

Q.14 Which one of the following lineations can be observed on a foliation with an attitude $210^\circ, 40^\circ \text{ NW}$?

Options

A. $40^\circ \rightarrow 300^\circ$

B. $40^\circ \rightarrow 040^\circ$

C. $40^\circ, -220^\circ$

D. $40^\circ > 350^\circ$

Q.15 Match the microstructures in Group—I with then characteristics in Group—II.

Group—I

Group-II

P. Core-mantle

1. Radiating fibrous aggregate of K-feldspar with or without quartz

Q. Decussate

2. Large strained mineral grains surrounded by fine-grained, recrystallized grains

R. Spherulite

3. Inclusion trails in a {porphyroblast curves into the matrix foliation by developing concave outward pattern

S. Millipede

4. Randomly oriented mineral grains dominated by crystal faces, such as in sheet silicates

Options

A. P-2, Q-3, R-4, S-1

B. P-2, Q-4, R-1, S-3

C. P-4, Q-2, R-3, S-1

D. P-3, Q-4, R-1, S-2

Q.16 Which of the following sedimentary basins is/are producing hydrocarbon commercially?

Options

- A. Krishna—Godavari
- B. Cauvery
- C. Ganga
- D. Kerala-Konkan

Question Type : **MSQ**

Question ID : **6420085539**

Status : **Answered**

Chosen Option :

Q.17 Which one among the following is the oldest horse genus?

Options

- A. *Mesohippus*
- B. *Menchippus*
- C. *Orohippus*
- D. *Pliohippus*

Q.18 Which one of the following is the correct arrangement of volcanics from the oldest to the youngest?

Options

- A. Bijli - Rajmahal - Malani —> Deccan
- B. Malani - Bijli - Deccan —» Rajmahal
- C. Malani - Rajmahal —> Bijli - Deccan
- D. Bijli —> Malani —> Rajmahal -> Deccan

Q.19 The fraction of the incident electromagnetic energy reflected from a material is known as

Options

- A. albedo
- B. acuity
- C. artifact
- D. spectral hue

Question Type : **MCQ**
Question ID : **6420085556**
Status : **Answered**
Chosen Option : **A**

Q.20 Which of the following statements regarding ore deposits is/are CORRECT ?

Options

- A. Rampura- Agucha Pb—Zn deposit is a Mississippi Valley Type deposit
- B. Both replacement and exhalative ores are possible in SEDEX type deposits
- C. Orogenic gold deposit is an epigenetic type deposit
- D. Fluid boiling in the early stage of magmatic crystallization is responsible for Cu—(Mo) deposits

Question Type : **MSQ**
Question ID : **6420085557**
Status : **Answered**
Chosen Option : **A,D**

Q.21 Which one of the following events represents the termination of the Wilson Cycle in Plate Tectonics?

Options

- A. Continent—continent collision
- B. Continental rifting
- C. Ocean-continent subduction
- D. Seafloor spreading

Question Type : **MCQ**
Question ID : **6420085555**
Status : **Answered**
Chosen Option : **C**

Q.22 Which of the following statements is/are CORRECT for the M-plane of any fault?

Options A.

M-plane pole of a fault is parallel to the slickenline on the fault plane

B. M-plane pole of a fault is located on the fault plane

C.

M-plane pole of a fault is perpendicular to the pole to the fault plane

D.

M-plane pole of a fault is perpendicular to the slickenline on the fault plane

Q.23 Match the following copper deposits in Group-I with their host rocks in Group-II.

Group-I

Group-II

P. Khetri

1. Chlorite-biotite schist and soda-granite

Q. Mosabani

2. Garnetiferous chlorite schist

R. Malanjkhand

3. Metachert

S. Kalyadi

4. Tonalite-granodiorite-granite

Options

A. P-2, Q-3, R-4, S-1

B. P-3, Q-4, R-1, S-2

C. P-2, Q-1, R-4, S-3

D. P-4, Q-1, R-2, S-3

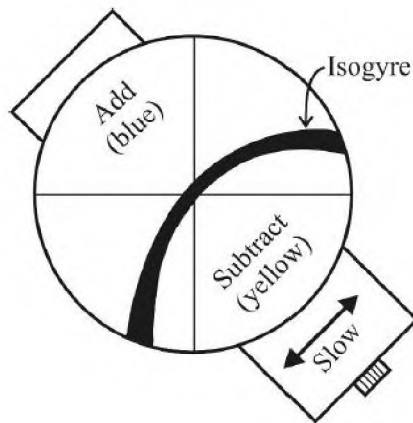
Question Type : **MCQ**

Question ID : **6420085554**

Status : **Not Attempted and
Marked For Review**

Chosen Option : --

Q.24 Which one of the following optic signs is CORRECT for a mineral with the given centered optic axis figure?



Options

- A. Biaxial positive
- B. Uniaxial negative
- C. Biaxial negative
- D. Uniaxial positive

Question Type : MCQ

Question ID : 6420085548

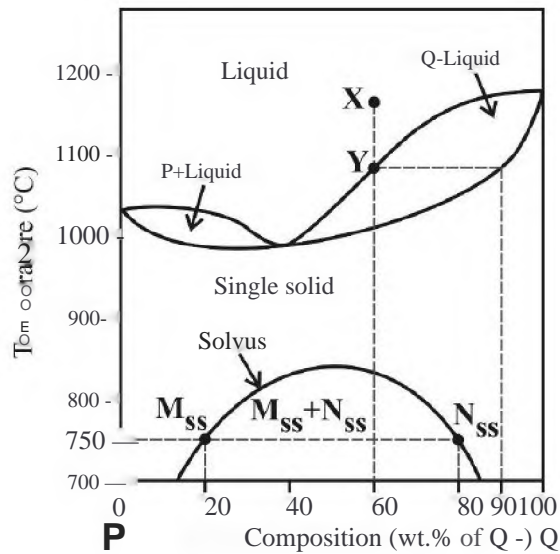
Status : Not Answered

Chosen Option : --



Q.25

The diagram given below shows phase relations between components P and Q at 1 bar pressure. If 'X' represents the initial liquid composition, which of the following statements is/are CORRECT during equilibrium crystallization?



Options A.

Initial liquid composition is 60 wt.% of P and 40 wt.% of Q

B.

The proportion (on the basis of wt.%) of two phases, M_{ss} : N_{ss} is 1 : 2 at 750 °C

C.

The composition of the solid in equilibrium with the liquid at 'Y' is 10 wt.% of P and 90 wt.% of Q

D.

The bulk composition of the final solid product is 40 wt.% of P and 60 wt.% of Q

Question Type : MSQ

Question ID : 6420085561

Status : Answered

Chosen Option : B,C,D

Q.26

Which of the following sedimentary structures is/are found in intertidal deposits?

Options

A. Double mud drape

B. Rain print ?

C. Mud-crack

D. Ladder-back ripple

Question Type : MSQ

Question ID : 6420085558

Status : Answered

Chosen Option : A,D

Q.27 Which of the following schist belts occur(s) to the east of the Closepet Granite in southern India?

Options

A. Shimoga

B. Bababudan

C. Kolar

D. Hutti

Question Type : **MSQ**

Question ID : **6420085560**

Status : **Answered**

Chosen Option : **A,B,C**

Q.28 Match the following invertebrates in Group-I with their morphological features in Group-II.

Group-I

P. Trilobite

Q. Brachiopod

R. Bivalve

S. Echinoid

Group-II

1. Periproct

2. Hypostome

3. Deltidial plate

4. Lunule

Options

A. P-3, Q-2, R-4, S-1

B. P-4, Q-3, R-1, S-2

C. P-2, Q-3, R-4, S-1

D. P-2, Q-4, R-1, S-3

Question Type : **MCQ**

Question ID : **6420085549**

Status : **Answered**

Chosen Option : **A**

Q.29 Which of the following materials is/are used for estimation of hydrocarbon source rock maturation based on color?

Options

- A. Spore
- B. Conodont
- C. Zircon
- D. Illite

Question Type : **MSQ**
Question ID : **6420085559**
Status : **Answered**
Chosen Option : **A**

Q.30 Which one of the following openings is a type of decline in underground mines?

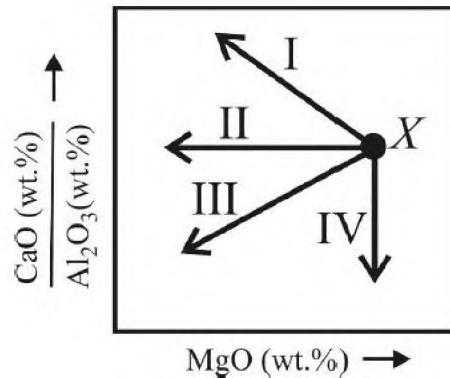
Options

- A. Drift
- B. Winze
- C. Crosscut
- D. Spiral tunnel

Question Type : **MCQ**
Question ID : **6420085547**
Status : **Not Answered**
Chosen Option : **--**



- Q.31** If 'X' represents the initial composition of a melt, which one of the trends indicated by arrows in the schematic diagram corresponds to the evolution of the residual melt composition during crystallization of diopside?

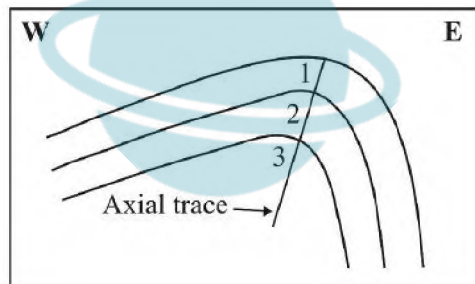


Options

- A. I
- B. II
- C. III
- D. IV

Question Type : MCQ
 Question ID : 6420085553
 Status : Not Answered
 Chosen Option : --

- Q.32** In the fold profile section shown in the figure, 1 and 3 are the oldest and the youngest stratigraphic units, respectively. Which one of the following fold descriptions CORRECTLY matches the asymmetric fold shown in the given figure?



- Options
- A. Antiform facing west
 - B. Antiform facing east
 - C. Synform facing west
 - D. Synform facing east

Question Type : MCQ
 Question ID : 6420085552
 Status : Answered
 Chosen Option : C

Q.33 Which one of the following represents deviatoric stress in a 2D stress Mohr Circle?

Options

- A. Radius
- B. Pole
- C. Diameter
- D. Center

Question Type : MCQ

Question ID : 6420085551

Status : Answered

Chosen Option : A

Q.34 Match the stratigraphic units in Group—I with the sedimentary basins in Group—II.

Group-I

- P. Ramgundam Sandstone
- Q. Raipur Formation
- R. Bagalkot Group
- S. Sonia Sandstone

Group-II

- 1. Chhattisgarh
- 2. Kaladgi
- 3. Marwar
- 4. Godavari

Options

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

Question Type : MCQ

Question ID : 6420085546

Status : Answered

Chosen Option : D

Q.35 The *in situ* stress at a point in a dry sandstone terrain is as follows: $\sigma_1 = 12$ MPa and $\sigma_3 = 4$ MPa. The pore water pressure (p_w) increases by the construction of a reservoir. The failure criterion of the sandstone is given by $\sigma_1 = 3.48 \text{ MPa} + 3\sigma_3$, where σ_1 and σ_3 are the effective maximum and minimum principal stresses, respectively. Assuming that the failure occurs at peak stress, the minimum value of p_w (in MPa) that will cause the sandstone to fail *in situ* is (rounded off to two decimal places). 1.74

Given --
Answer :

Question Type : NAT

Question ID : 6420085564

Status : Not Answered

Q.36 During high-temperature metamorphism of pelites, which one of the following mineral reactions represents the second sillimanite isograd?

Options A.

Staurolite + Muscovite + Quartz = Garnet + Biotite + Sillimanite + H₂O

B.

Muscovite + Quartz = Sillimanite + K-feldspar + H₂O

c. Kyanite = Sillimanite

d. Staurolite + Quartz = Garnet + Sillimanite + H₂O

Question Type : MCQ

Question ID : 6420085550

Status : Not Answered

Chosen Option : --

Q.37

Which of the following microfossils is/are foraminifera?

Options

A. Miliammina

B. Cibicides

C. Guembelitra

D. Triceratium

Question Type : MSQ

Question ID : 6420085563

Status : Not Answered

Chosen Option : --

Q.38

A soil mass comprises two horizontal layers (of equal thickness and equal width) stacked one above the other. The hydraulic conductivities of the two layers are 5×10^{-2} cm/s and 3×10^{-2} cm/s. Considering Darcian flow of water and same hydraulic gradient for both the layers, the effective hydraulic conductivity of the soil mass in cm/s is (rounded off to two decimal places).

Given 0.04
Answer :

0.04

Question Type : NAT

Question ID : 6420085566

Status : Answered

Q.39

If the Rb-Sr isochron formed by a suite of gabbro samples has a slope of 0.0265, then the calculated age of the gabbro in million years is (in integer).

[Use $A(^{87}\text{Rb}) = 1.42 \times 10^{-11} \text{ year}^{-1}$]

Given 1293
Answer :

1842 or 1866
slope = $e^{\lambda t} - 1$ slope = λt (approx.)

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