GATE Geology and Geophysics – Geology

Sample Paper – 2

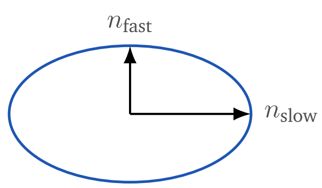
Duration: 128 Minutes **Maximum Marks: 72**

Instructions

- This paper contains **46 questions** covering the core **Geology** stream of the GATE Geology and Geophysics paper conducted by the IITs and IISc (General Aptitude and the common section are provided as separate papers).
- **Q1–Q20 carry 1 mark each** and **Q21–Q46 carry 2 marks each**, for a total of **72 marks**.
- Each question carries **negative marking of one-third of its allotted marks**: a wrong 1-mark question costs **0.33** and a wrong 2-mark question costs **0.67**. Unattempted questions carry no penalty.
- Every question here is a single-correct **MCQ**. The real GATE paper also has Multiple Select (MSQ) and Numerical Answer Type (NAT) questions, and **those carry no negative marking**.
- Attempt this paper in one timed sitting of about **128 minutes**, the share this core subject earns at GATE's overall pace of 180 minutes for 65 questions. Unless stated otherwise, take the acceleration due to gravity as $g = 9.81$ m/s^2 and the unit weight of water as 9.81 kN/m^3.

Mineralogy and Crystallography

Q1. The birefringence of an anisotropic mineral, which governs the intensity of the interference colours it shows between crossed polarisers, is defined as: **[1 mark]**



indicatrix section

(A) The numerical difference between its greatest and least refractive indices

(B) The sum of its two principal refractive indices

(C) The ratio of its density to that of water

(D) The angle measured between its two optic axes

Q2. A clear, transparent variety of calcite that so strongly splits a light ray into two that a single line viewed through it appears doubled (strong double refraction) is known as: **[1 mark]**

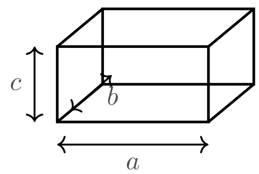
(A) Selenite

(B) Halite

(C) Fluorite

(D) Iceland spar

Q3. A crystal referred to three mutually perpendicular crystallographic axes that are all of different lengths ($a \neq b \neq c$, $\alpha = \beta = \gamma = 90°$), as sketched, belongs to which crystal system? **[1 mark]**



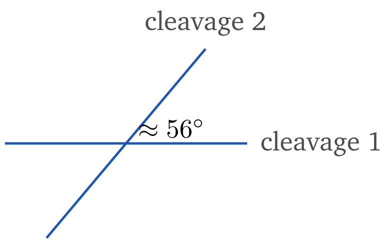
(A) Isometric (cubic)

(B) Tetragonal

(C) Orthorhombic

(D) Hexagonal

Q4. The mineral group whose two directions of prismatic cleavage intersect at characteristic angles of about $56°$ and $124°$, as shown, is the: **[1 mark]**



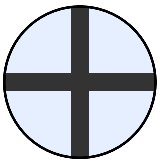
(A) Pyroxene

(B) Amphibole

(C) Mica

(D) Feldspar

Q5. Viewed in convergent polarised light, a mineral grain yields an interference figure that is a black cross (isogyres) which stays fixed and does not break up as the stage is rotated, as sketched. Optically, this mineral is: **[1 mark]**



fixed black cross

(A) Isotropic

(B) Uniaxial

(C) Biaxial

(D) Amorphous

Q6. Among the following minerals, the one that is strongly magnetic, being attracted by an ordinary hand magnet, is: **[1 mark]**

(A) Magnetite

(B) Hematite

(C) Pyrite

(D) Quartz

Igneous and Metamorphic Petrology

Q7. On the continuous (plagioclase) branch of Bowen's reaction series shown below, the first plagioclase to crystallise, at the highest temperature, is the calcium-rich end member: **[1 mark]**

high T Ca-plagioclase (anorthite)

Ca-Na plagioclase

Na-Ca plagioclase

low T Na-plagioclase (albite)

(A) Albite

(B) Anorthite

(C) Orthoclase

(D) Quartz

Q8. An igneous rock consisting of large, well-formed crystals (phenocrysts) set in a distinctly finer-grained groundmass, recording two separate stages of cooling, has a texture described as: **[1 mark]**

(A) Aphanitic

(B) Phaneritic

(C) Porphyritic

(D) Glassy

Q9. A dark-coloured, fine-grained volcanic rock containing about $48–52\%$ silica, which is the extrusive (fine-grained) equivalent of gabbro, is: **[1 mark]**

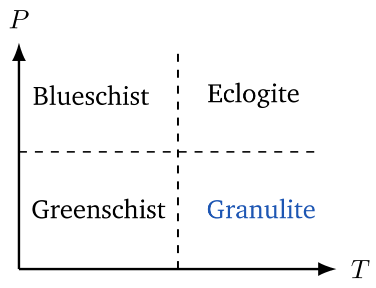
(A) Rhyolite

(B) Basalt

(C) Andesite

(D) Obsidian

Q10. On the pressure–temperature grid of metamorphic facies shown, the field of high temperature and moderate-to-high pressure, in which hydrous minerals break down to anhydrous pyroxene-bearing assemblages in the deep continental crust, corresponds to the: **[1 mark]**



(A) Blueschist facies

(B) Greenschist facies

(C) Eclogite facies

(D) Granulite facies

Q11. Contact metamorphism of a pure limestone by the heat of an adjacent intrusion produces a non-foliated rock made of interlocking, recrystallised calcite grains. This rock is: **[1 mark]**

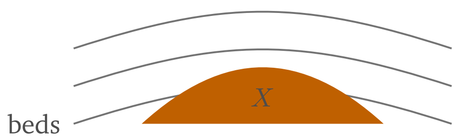
(A) Marble

(B) Slate

(C) Schist

(D) Hornfels

Q12. The concordant igneous body labelled X in the section below has a flat floor but a domed roof that arches the overlying strata upward into a blister-like form. This intrusion is a: **[1 mark]**



(A) Sill

(B) Dyke

(C) Laccolith

(D) Batholith

Sedimentology and Stratigraphy

Q13. A fossiliferous limestone built almost entirely of the calcareous skeletal debris of corals, molluscs and foraminifera most strongly indicates deposition in a: **[1 mark]**

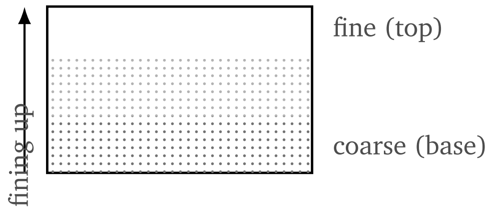
(A) Deep abyssal plain far from land

(B) Sand-dune field in a hot desert

(C) Glaciated mountain valley

(D) Warm, clear, shallow marine shelf

Q14. The sandstone bed shown fines upward from coarse sand at its base to fine silt at its top within a single layer, a structure deposited by a waning (decelerating) turbidity current. This structure is: **[1 mark]**



(A) Cross bedding

(B) Graded bedding

(C) Symmetrical ripple marks

(D) Desiccation cracks

Q15. According to Walther's Law of facies, a conformable vertical succession of sedimentary facies represents environments that were originally: **[1 mark]**

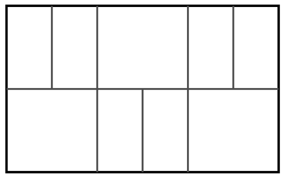
(A) Laterally adjacent to one another

(B) Separated by a major unconformity

(C) All deep-marine in character

(D) Deposited everywhere at the same instant

Q16. The polygonal network of cracks shown in plan view forms in fine-grained mud that is exposed to the air and dries out, and is therefore a reliable indicator of subaerial exposure. This structure is: **[1 mark]**



polygonal cracks

(A) Current ripple marks

(B) Flute casts

(C) Mud (desiccation) cracks

(D) Load casts

Q17. A sandstone composed almost entirely of well-rounded, well-sorted quartz grains with very little clay matrix, reflecting long and vigorous reworking, is described as texturally and mineralogically: **[1 mark]**

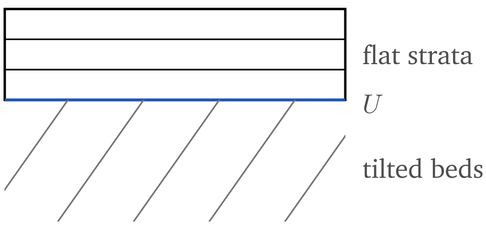
(A) Mature

(B) Immature

(C) Submature

(D) Metamorphosed

Q18. In the section shown, the surface U separates tilted and eroded older strata below from flat-lying younger strata above. This type of unconformity is a: **[1 mark]**



(A) Nonconformity

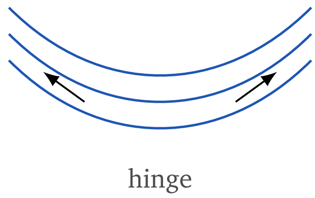
(B) Angular unconformity

(C) Disconformity

(D) Paraconformity

Structural Geology and Geotectonics

Q19. In the fold profile shown, the strata sag downward, the two limbs dip inward toward the hinge, and the youngest beds occupy the core. This structure is a: **[1 mark]**



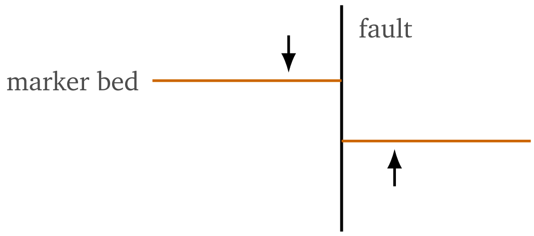
(A) Anticline

(B) Monocline

(C) Dome

(D) Syncline

Q20. Along the fault shown in map view, a marker bed is offset horizontally with essentially no vertical movement, the displacement being parallel to the strike of the fault. This fault is a: **[1 mark]**



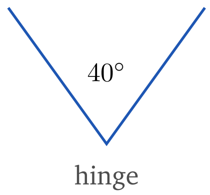
(A) Normal fault

(B) Reverse fault

(C) Thrust fault

(D) Strike-slip fault

Q21. Folds may be classified by their interlimb angle. A fold whose two limbs meet at an interlimb angle of $40°$, as marked, falls into which class? **[2 marks]**



(A) Gentle fold

(B) Close fold

(C) Isoclinal fold

(D) Open fold

Q22. The type of plate boundary at which two thick continental plates collide and neither is subducted, so the crust thickens and buckles into a great mountain belt such as the Himalaya, is a: **[2 marks]**

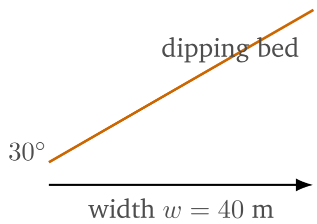
(A) Divergent (spreading) boundary

(B) Transform (conservative) boundary

(C) Oceanic mid-ocean ridge

(D) Continent–continent convergent boundary

Q23. A planar bed dips at $30°$. Its outcrop, measured horizontally across the strike, has a width of 40 m, as shown. The true thickness perpendicular to bedding is $t = w \sin(\text{dip})$. Its value is: **[2 marks]**



(A) 40 m

(B) 34.6 m

(C) 20 m

(D) 80 m

Q24. At a mid-ocean ridge the seafloor spreads at a half-rate of 3 cm per year on one flank. Assuming a constant rate, the width of new oceanic crust added on that one side in 10 million years is: **[2 marks]**

(A) 30 km

(B) 300 km

(C) 3000 km

(D) 150 km

Palaeontology and Historical Geology

Q25. Because of their rapid evolution, wide geographic spread and abundance, the fossil group most widely used as zone (index) fossils for correlating Mesozoic marine strata is the: **[2 marks]**

(A) Reef-building corals

(B) Freshwater gastropods

(C) Long-ranging bivalves

(D) Ammonites

Q26. The era of geological time popularly called the "Age of Mammals," spanning from about 66 million years ago to the present, is the: **[2 marks]**

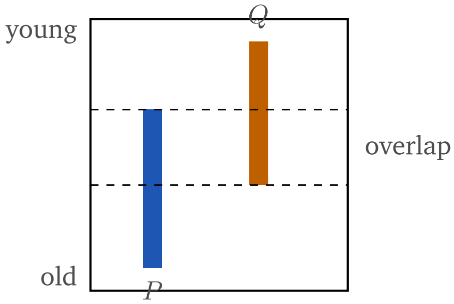
(A) Mesozoic Era

(B) Cenozoic Era

(C) Paleozoic Era

(D) Proterozoic Era

Q27. On the biostratigraphic range chart shown, two index species P and Q have overlapping ranges; the short interval where both occur together is used to define which kind of biozone? **[2 marks]**



(A) Assemblage zone

(B) Acme zone

(C) Interval zone

(D) Concurrent-range zone

Q28. The greatest mass extinction in the entire fossil record, which wiped out an estimated 90% of marine species (including the trilobites), took place at the end of which period? [2 marks]

(A) End of the Permian

(B) End of the Cretaceous

(C) End of the Ordovician

(D) End of the Triassic

Q29. The mode of fossil preservation in which the original organic tissue, such as buried wood, is replaced molecule by molecule with silica while the fine cellular structure is faithfully retained, is called: [2 marks]

(A) Carbonization

(B) Mummification

(C) Petrifaction (permineralization)

(D) Impression

Q30. In the stratigraphic succession of Peninsular India, the thick coal-bearing continental sequences of Permo-Carboniferous to Jurassic age, laid down in fault-bounded basins over a glacial base, belong to the: [2 marks]

(A) Vindhyan Supergroup

(B) Gondwana Supergroup

(C) Cuddapah Supergroup

(D) Deccan Trap Group

Economic Geology and Mineral Resources

Q31. The most important primary ore mineral of copper, a brass-yellow sulphide with the chemical formula $CuFeS_2$, is: **[2 marks]**

(A) Malachite

(B) Bornite

(C) Chalcocite

(D) Chalcopyrite

Q32. Ore deposits formed by the precipitation of metallic minerals from hot aqueous fluids that circulate through fractures and deposit ore as vein fillings are classified as: **[2 marks]**

(A) Hydrothermal vein deposits

(B) Placer deposits

(C) Residual (laterite) deposits

(D) Evaporite deposits

Q33. Natural diamonds are carried up from deep in the mantle within narrow, pipe-like intrusions of a volatile-rich ultrabasic rock. These diamond-bearing pipes are made of: **[2 marks]**

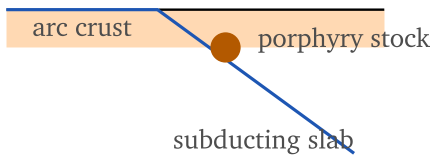
(A) Basaltic dykes

(B) Granite plutons

(C) Kimberlite

(D) Rhyolitic flows

Q34. A porphyry copper deposit, characterised by large-tonnage, low-grade disseminated ore around a shallow felsic intrusion as sketched, forms most typically in which tectonic setting? **[2 marks]**



(A) Above a subduction zone (magmatic arc)

(B) At the crest of a mid-ocean ridge

(C) In an intraplate desert basin

(D) On the deep abyssal plain

Q35. Banded Iron Formations (BIFs), which hold the world's largest reserves of iron ore, are chemically precipitated sedimentary rocks that formed overwhelmingly during which interval of Earth history? **[2 marks]**

(A) Precambrian (Archaean to Palaeoproterozoic)

(B) Jurassic

(C) Cenozoic

(D) Devonian

Q36. Thick, laterally extensive beds of rock salt (halite), gypsum and anhydrite are formed chiefly by the: **[2 marks]**

(A) Gravitational settling of crystals in a magma

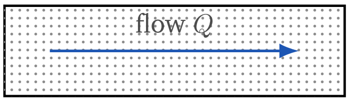
(B) Precipitation of ore from hot vein fluids

(C) Evaporation of a restricted body of saline water

(D) Contact metamorphism of limestone

Hydrogeology and Engineering Geology

Q37. Groundwater flows through the sand-filled tube shown. Using Darcy's law $Q = K\,i\,A$, with hydraulic conductivity $K = 15$ m/day, hydraulic gradient $i = 0.04$ and cross-sectional area $A = 25$ m^2, the discharge Q is: **[2 marks]**



$K = 15$ m/day, $i = 0.04$, $A = 25$ m^2

(A) 1.5 m^3/day

(B) 60 m^3/day

(C) 15 m^3/day

(D) 150 m^3/day

Q38. The Darcy (specific-discharge) velocity of groundwater is $v = K\,i$. For a sand aquifer with hydraulic conductivity $K = 20$ m/day and hydraulic gradient $i = 0.05$, this velocity is: **[2 marks]**

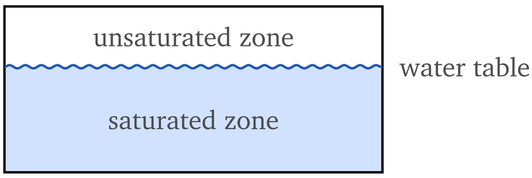
(A) 0.4 m/day

(B) 1 m/day

(C) 4 m/day

(D) 100 m/day

Q39. The aquifer shown has its upper surface marked by a free water table that stands at atmospheric pressure and is recharged directly by rain infiltrating from above. Such an aquifer is: **[2 marks]**



(A) A confined aquifer

(B) A perched aquifer

(C) An unconfined (water-table) aquifer

(D) An aquiclude

Q40. In engineering geology, the Rock Quality Designation (RQD), obtained from drill core, is a numerical index that expresses: **[2 marks]**

(A) The degree of jointing or fracturing of a rock mass

(B) The porosity of a loose soil

(C) The chemical purity of an ore mineral

(D) The salinity of the groundwater

Q41. A saturated soil sample has a void ratio $e = 0.5$. Its porosity is given by $n = \frac{e}{1+e}$. Expressed as a percentage, the porosity is: **[2 marks]**

(A) 50%

(B) 20%

(C) 25%

(D) 33.3%

Geochemistry, Geomorphology and Remote Sensing

Q42. In rock and mineral geochemistry, chemical elements that are present at very low concentrations, generally below about 0.1% (that is, below 1000 ppm), and substitute into the lattice of major minerals, are termed: **[2 marks]**

(A) Trace elements

(B) Major elements

(C) Minor elements

(D) Volatile elements

Q43. A trace element that strongly partitions into the silicate melt rather than the crystallising minerals, having a mineral/melt partition coefficient $D \ll 1$, is described as: **[2 marks]**

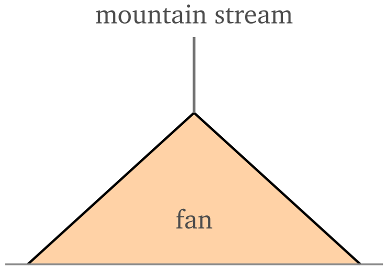
(A) Compatible

(B) Siderophile

(C) Incompatible

(D) Refractory

Q44. The fan-shaped body of sediment shown in profile, deposited where a steep, sediment-laden mountain stream suddenly loses velocity as it emerges onto a flat plain (common in arid regions), is a(n): **[2 marks]**



(A) River delta

(B) Alluvial fan

(C) Oxbow lake

(D) Glacial esker

Q45. A landscape marked by sinkholes, caves, disappearing streams and underground drainage, produced by the chemical dissolution of soluble carbonate bedrock such as limestone, is described as: **[2 marks]**

(A) Aeolian topography

(B) Glacial topography

(C) Fluvial topography

(D) Karst topography

Q46. Active remote-sensing systems such as imaging RADAR differ fundamentally from passive optical systems because their source of energy is: **[2 marks]**

(A) Microwave energy generated and transmitted by the sensor itself

(B) Reflected sunlight only

(C) Thermal radiation emitted by the Sun

(D) Visible light reflected from the Moon

Detailed Solutions

Q1.

Solution

Concept – birefringence in optical mineralogy: An anisotropic mineral splits transmitted light into two rays that travel at different speeds and therefore "see" two different refractive indices.

Step 1 – identify the two indices: For each grain orientation there is a faster ray with a lower index (n_{fast}) and a slower ray with a higher index (n_{slow}).

Step 2 – define birefringence: Birefringence is the numerical difference between the greatest and least of these refractive indices, $\delta = n_{\text{slow}} - n_{\text{fast}}$.

Step 3 – link to interference colours: The larger this difference, the greater the retardation between the two rays, and the higher the order and intensity of the interference colours seen under crossed polarisers.

Why the other options are wrong:

- B: the sum of the indices is not a defined optical quantity.
- C: the density-to-water ratio is the specific gravity, not an optical property.
- D: the angle between optic axes is the $2V$ angle, a separate biaxial parameter.

Final Answer: Difference between greatest and least refractive indices $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – double refraction in calcite: Calcite is a strongly anisotropic (uniaxial) carbonate with an exceptionally large birefringence.

Step 1 – interpret the observation: A line viewed through the crystal appears doubled because the crystal splits the light into two separated rays (the ordinary and extraordinary rays).

Step 2 – name the clear variety: The optically clear, transparent variety of calcite that shows this striking double image is called Iceland spar.

Step 3 – confirm: Iceland spar was historically used to make polarising prisms precisely because of this strong double refraction.

Why the other options are wrong:

- A, selenite: a clear variety of gypsum, not calcite.
- B, halite: rock salt (NaCl), isotropic, shows no double refraction.
- C, fluorite: CaF_2, isometric and optically isotropic.

Final Answer: Iceland spar $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q2

Q3.

Solution

Concept – crystal systems from axes and angles: The seven crystal systems are set apart by the relative lengths of the crystallographic axes and the angles between them.

Step 1 – read the angle condition: All three axes are mutually perpendicular, $\alpha = \beta = \gamma = 90°$.

Step 2 – read the length condition: All three axes have different lengths, $a \neq b \neq c$.

Step 3 – match to the system: Three unequal axes meeting at right angles define the orthorhombic system.

Why the other options are wrong:

- A, isometric: requires three equal axes ($a = b = c$).
- B, tetragonal: requires two equal and one different ($a = b \neq c$).
- D, hexagonal: has four axes with $120°$ inter-axial angles.

Final Answer: Orthorhombic system $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – diagnostic cleavage angles of the chain silicates: Pyroxenes and amphiboles both have two prismatic cleavages, but at markedly different intersection angles, which is a key optical/hand-specimen distinction.

Step 1 – recall the amphibole value: Amphiboles (double-chain silicates) cleave along two directions intersecting at about $56°$ and $124°$.

Step 2 – contrast with pyroxene: Pyroxenes (single-chain silicates) cleave at nearly 90° (about 87° and 93°).

Step 3 – match the figure: The sketched cleavages meet at roughly 56°, which is diagnostic of amphibole.

Why the other options are wrong:

- A, pyroxene: two cleavages at about 90°, not 56°.
- C, mica: a single perfect basal cleavage.
- D, feldspar: two cleavages at about 90°.

Final Answer: Amphibole $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept – interference figures in convergent light: Placing a mineral grain in convergent polarised light (conoscopy) produces an interference figure whose shape reveals the optical class.

Step 1 – read the figure described: A single black cross (two isogyres) that remains fixed and does not split as the stage is rotated.

Step 2 – match to the optical class: A stationary, unbroken black cross centred in the field is the hallmark of a uniaxial mineral viewed down its optic axis.

Step 3 – contrast biaxial behaviour: A biaxial mineral instead shows a cross that breaks into two curved isogyres that separate and rotate as the stage turns.

Why the other options are wrong:

- A and D, isotropic / amorphous: give no interference figure at all (they stay dark).
- C, biaxial: the isogyres split into hyperbolae on rotation, so the cross does not stay fixed.

Final Answer: Uniaxial mineral $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – magnetism as a diagnostic property: A very small number of common minerals are strongly ferrimagnetic and are pulled by an ordinary magnet.

Step 1 – recall the strongly magnetic mineral: Magnetite (Fe_3O_4) is strongly magnetic and is attracted by a hand magnet.

Step 2 – test the others: Hematite is only weakly (para)magnetic, while pyrite and quartz are effectively non-magnetic.

Step 3 – conclude: Therefore the strongly magnetic mineral of the four is magnetite.

Why the other options are wrong:

- B, hematite: Fe_2O_3, only feebly magnetic.
- C, pyrite: FeS_2, not magnetic.
- D, quartz: SiO_2, non-magnetic.

Final Answer: Magnetite $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – the continuous branch of Bowen's series: Bowen's continuous branch describes the plagioclase feldspars, which change composition smoothly as the magma cools.

Step 1 – identify the high-temperature end: The plagioclase that crystallises first, at the highest temperature, is the calcium-rich end member, anorthite.

Step 2 – trace the trend: As temperature falls, the plagioclase becomes progressively more sodium-rich, ending at albite.

Step 3 – read the figure: The chart lists Ca-plagioclase (anorthite) at the top (high T) and Na-plagioclase (albite) at the bottom (low T), confirming anorthite crystallises first.

Why the other options are wrong:

- A, albite: the sodium-rich, lowest-temperature end of the branch.
- C, orthoclase: a K-feldspar that forms late, off the plagioclase branch.
- D, quartz: the very last mineral to crystallise.

Final Answer: Anorthite (Ca-plagioclase) $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept – textures recording two cooling stages: An igneous texture with two distinct crystal sizes records cooling in two stages, one slow and one fast.

Step 1 – read the description: Large phenocrysts sit in a much finer groundmass.

Step 2 – interpret the two sizes: The large crystals grew slowly at depth; the fine groundmass froze quickly after the magma rose and erupted.

Step 3 – name the texture: A texture of large crystals set in a finer matrix is called porphyritic.

Why the other options are wrong:

- A, aphanitic: uniformly fine-grained, no visible phenocrysts.
- B, phaneritic: uniformly coarse-grained.
- D, glassy: no crystals at all (very rapid quench).

Final Answer: Porphyritic texture $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept – volcanic equivalents of plutonic rocks: Every coarse-grained plutonic rock has a fine-grained volcanic equivalent of the same composition.

Step 1 – read the clues: Dark, fine-grained, about $48–52\%$ silica, extrusive.

Step 2 – identify the composition: A silica content around $48–52\%$ is basic (mafic).

Step 3 – name the rock: The fine-grained mafic volcanic rock, the extrusive equivalent of gabbro, is basalt.

Why the other options are wrong:

- A, rhyolite: felsic (about $> 69\%$ silica), the volcanic equivalent of granite.
- C, andesite: intermediate (about $57–63\%$ silica).
- D, obsidian: a volcanic glass, defined by texture rather than this composition.

Final Answer: Basalt $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – metamorphic facies on a P–T grid: Each metamorphic facies occupies a characteristic pressure–temperature field.

Step 1 – read the field requested: High temperature with moderate-to-high pressure, deep in the continental crust.

Step 2 – read the mineral clue: Hydrous minerals break down to anhydrous, pyroxene-bearing assemblages at high grade.

Step 3 – name the facies: High-T dehydration to pyroxene-bearing rocks defines the granulite facies.

Why the other options are wrong:

- A, blueschist: high pressure but low temperature (subduction zones).
- B, greenschist: low pressure and low temperature.
- C, eclogite: very high pressure, producing garnet + omphacite, not the setting described.

Final Answer: Granulite facies $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept – contact metamorphism of carbonate rocks: Contact (thermal) metamorphism recrystallises a rock by heat alone, with little directed pressure, so the product is typically non-foliated.

Step 1 – read the protolith: The starting rock is a pure limestone (calcium carbonate).

Step 2 – apply the heat: The heat of the intrusion recrystallises the calcite into a mosaic of interlocking grains.

Step 3 – name the product: Recrystallised limestone with interlocking calcite is marble.

Why the other options are wrong:

- B, slate: forms by low-grade regional metamorphism of shale.
- C, schist: a foliated rock from medium-grade regional metamorphism of pelites.
- D, hornfels: a contact rock, but it forms from clay-rich (not carbonate) rocks.

Final Answer: Marble $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q11

Q12.

Solution

Concept – shapes of concordant intrusions: Concordant intrusions lie parallel to bedding; their shape distinguishes sills from laccoliths.

Step 1 – read the geometry: Body X has a flat floor but a domed roof that bows the overlying strata upward into a blister.

Step 2 – match the domed concordant body: A concordant intrusion with a flat base and an arched, dome-shaped roof is a laccolith.

Step 3 – contrast with a sill: A sill is a thin, flat sheet that does not appreciably dome the overlying beds, so X is not a sill.

Why the other options are wrong:

- A, sill: tabular and flat, does not arch the roof.
- B, dyke: discordant, cutting across bedding.
- D, batholith: a very large, deep, discordant plutonic mass.

Final Answer: Laccolith $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q12

Q13.

Solution

Concept – depositional environment from rock type: The composition of a sedimentary rock records the environment in which it formed.

Step 1 – read the composition: The limestone is built of the skeletal remains of corals, molluscs and foraminifera.

Step 2 – interpret the fauna: These carbonate-secreting organisms thrive in warm, clear, sunlit, shallow seawater.

Step 3 – conclude: Therefore the rock indicates a warm, clear, shallow marine shelf.

Why the other options are wrong:

- A, deep abyssal plain: too dark and cold for this shelly carbonate fauna.
- B, desert dune field: a continental, non-marine setting.
- C, glaciated valley: cold and clastic, not carbonate-producing.

Final Answer: Warm, clear, shallow marine shelf $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q13

Q14.

Solution

Concept – graded bedding and turbidity currents: A turbidity current is a dense, sediment-laden underflow that slows down and drops its load progressively.

Step 1 – read the vertical grain-size change: The bed passes upward from coarse sand at the base to fine silt at the top within one layer.

Step 2 – link to the process: As the current decelerates, the coarsest grains settle first and finer grains later, producing an upward-fining (graded) bed.

Step 3 – name the structure: This single fining-upward layer is graded bedding, a classic feature of turbidite (Bouma) sequences.

Why the other options are wrong:

- A, cross bedding: inclined foresets from migrating ripples/dunes, not a fining-upward layer.
- C, ripple marks: small bedforms on a surface, not a vertical grading.
- D, desiccation cracks: subaerial drying features, unrelated to grading.

Final Answer: Graded bedding $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – Walther's Law of facies: Walther's Law connects the lateral arrangement of depositional environments to the vertical succession they leave behind.

Step 1 – state the law: Only those facies and environments that occur side by side in nature can be found superimposed in a conformable vertical sequence.

Step 2 – interpret it: As shorelines and environments migrate over time, laterally neighbouring environments become stacked one on top of another.

Step 3 – conclude: Therefore a conformable vertical succession of facies represents environments that were originally laterally adjacent.

Why the other options are wrong:

- B: the law applies only where there is no break (unconformity) in deposition.
- C: the facies need not be deep-marine; the law is general.
- D: the beds are deposited at different times as environments migrate, not simultaneously.

Final Answer: Laterally adjacent environments $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ Go Back to Q15

Q16.

Solution

Concept – desiccation (mud) cracks: Some sedimentary structures directly record exposure of the sediment surface to the air.

Step 1 – read the pattern: A polygonal network of cracks develops in fine mud.

Step 2 – link to the process: When wet mud is exposed and dries, it shrinks and cracks into polygons.

Step 3 – name and interpret the structure: These are mud (desiccation) cracks, and they are a reliable indicator of subaerial exposure and drying.

Why the other options are wrong:

- A, ripple marks: formed by moving water or wind, not by drying.
- B, flute casts: erosional scours on a bed base, formed by currents.
- D, load casts: bulges formed by dense sand sinking into soft mud.

Final Answer: Mud (desiccation) cracks $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q16

Q17.

Solution

Concept – textural and mineralogical maturity: Maturity measures how far transport and reworking have driven a sediment toward well-rounded, well-sorted, quartz-rich composition.

Step 1 – read the texture: The grains are well-rounded and well-sorted with little matrix, so the sediment is texturally advanced.

Step 2 – read the mineralogy: It is composed almost entirely of durable quartz, so unstable minerals have been removed.

Step 3 – combine: A well-rounded, well-sorted, quartz-dominated sandstone is described as mature.

Why the other options are wrong:

- B, immature: poorly sorted, angular, matrix-rich, with many unstable grains.
- C, submature: an intermediate stage, still moderately sorted with some matrix.
- D, metamorphosed: maturity is a sedimentary concept and does not imply metamorphism.

Final Answer: Mature $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept – classifying unconformities: The type of unconformity depends on the relationship between the rocks below and above the buried erosion surface.

Step 1 – read what lies below the surface: Below U are older sedimentary strata that were tilted and then truncated by erosion.

Step 2 – read what lies above: Above U lie flat-lying younger strata deposited on the eroded surface.

Step 3 – match to the definition: Flat beds resting on the eroded edges of tilted older beds define an angular unconformity.

Why the other options are wrong:

- A, nonconformity: sedimentary strata rest on eroded igneous or metamorphic rock, not tilted strata.
- C, disconformity: separates two parallel (non-tilted) sedimentary sequences.
- D, paraconformity: a subtle break between parallel beds with no visible erosion or tilting.

Final Answer: Angular unconformity $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept – synclines versus anticlines: Folds are classified by the direction the limbs dip and by the age pattern of the beds in the core.

Step 1 – read the fold shape: The strata sag downward and both limbs dip inward toward the central hinge.

Step 2 – read the age pattern: The youngest beds occupy the core of the fold.

Step 3 – match to the fold type: Limbs dipping toward the hinge with the youngest beds in the core define a syncline.

Why the other options are wrong:

- A, anticline: limbs dip away from the hinge and the oldest beds are in the core.
- B, monocline: a single one-limbed step-like flexure.
- C, dome: a circular upwarp with beds dipping outward in all directions.

Final Answer: Syncline $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept – strike-slip faults: Faults are classified by the direction of relative movement of the two blocks.

Step 1 – read the movement: The marker bed is offset horizontally, with the displacement parallel to the strike of the fault.

Step 2 – read the vertical component: There is essentially no vertical (up-or-down) movement of one block relative to the other.

Step 3 – name the fault: Dominantly horizontal, strike-parallel displacement defines a strike-slip fault.

Why the other options are wrong:

- A, normal fault: hanging wall moves down (dip-slip, vertical component).
- B, reverse fault: hanging wall moves up (dip-slip under compression).
- C, thrust fault: a low-angle reverse fault, still dip-slip.

Final Answer: Strike-slip fault $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – classifying folds by interlimb angle: The interlimb angle is the angle between the two limbs of a fold, measured across the hinge, and is used to grade the tightness of folding.

Step 1 – recall the standard classes: Gentle $120°$–$180°$; open $70°$–$120°$; close $30°$–$70°$; tight $0°$–$30°$; isoclinal $\approx 0°$.

Step 2 – read the given angle: The interlimb angle in the figure is $40°$.

Step 3 – place it in a class: $40°$ lies between $30°$ and $70°$.

Step 4 – name the class: An interlimb angle of $40°$ therefore corresponds to a close fold.

Why the other options are wrong:

- A, gentle: interlimb angle $120°$–$180°$, far more open than $40°$.
- C, isoclinal: limbs essentially parallel, interlimb angle near $0°$.
- D, open: interlimb angle $70°$–$120°$, larger than $40°$.

Final Answer: Close fold $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q21

Q22.

Solution

Concept – continent–continent collision: Convergent boundaries take different forms depending on the kinds of plate that meet.

Step 1 – read the plates involved: Two thick, buoyant continental plates collide.

Step 2 – read the subduction behaviour: Neither continental plate is dense enough to subduct fully.

Step 3 – read the outcome: The crust thickens, buckles and is thrust up into a great mountain belt (the Himalaya).

Step 4 – name the boundary: Colliding continents with no subduction form a continent–continent convergent boundary.

Why the other options are wrong:

- A, divergent: plates move apart and new crust is created, not a collision.
- B, transform: plates slide past horizontally with no mountain building of this kind.
- C, mid-ocean ridge: a specific divergent oceanic setting, not a collision.

Final Answer: Continent–continent convergent boundary $\Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ Go Back to Q22

Q23.

Solution

Concept – true thickness from outcrop width: For a bed dipping at angle δ, a horizontal traverse of width w across strike corresponds to a true (perpendicular) thickness $t = w \sin \delta$.

Step 1 – list the data: Dip $\delta = 30^\circ$, outcrop width $w = 40$ m.

Step 2 – write the relation: $t = w \sin \delta$

Step 3 – evaluate the sine: $\sin 30^\circ = 0.5$

Step 4 – substitute: $t = 40 \times 0.5$

Step 5 – compute: $t = 20$ m

Step 6 – sanity check: The true thickness (20 m) must be smaller than the horizontal outcrop width (40 m) for a dipping bed, which it is.

Final Answer: True thickness $= 20$ m $\Rightarrow \boxed{\text{C}}$

$\boxed{\text{Answer: (C)}}$ Go Back to Q23

Q24.

Solution

Concept – distance from a constant spreading rate: The width of new crust equals the spreading half-rate multiplied by the elapsed time, $d = v \times t$.

Step 1 – list the data: Half-rate $v = 3$ cm/year, time $t = 10 \times 10^6$ years.

Step 2 – multiply rate by time: $d = 3 \times (10 \times 10^6)$

Step 3 – evaluate in centimetres: $d = 30 \times 10^6 = 3 \times 10^7$ cm

Step 4 – convert to metres (1 m = 100 cm): $d = \dfrac{3 \times 10^7}{100} = 3 \times 10^5$ m

Step 5 – convert to kilometres (1 km = 1000 m): $d = \dfrac{3 \times 10^5}{1000} = 300$ km

Final Answer: $d = 300 \text{ km} \Rightarrow \boxed{\text{B}}$

$\boxed{\text{Answer: (B)}}$ Go Back to Q24

Q25.

Solution

Concept – zone fossils of the Mesozoic: The best zone fossils evolve fast, spread widely and are abundant, giving fine time resolution.

Step 1 – recall the ideal properties: Rapid evolution (short-lived species), wide geographic distribution and abundance.

Step 2 – match to the Mesozoic group: Ammonites (coiled cephalopods) evolved rapidly, floated and swam widely across the Mesozoic seas, and are very common.

Step 3 – conclude: Therefore ammonites are the classic zone fossils for correlating Mesozoic marine strata.

Why the other options are wrong:

- A, corals: tied to specific reef habitats and evolve relatively slowly.
- B, gastropods: many are long-ranging and facies-controlled.
- C, bivalves: often long-ranging, giving coarse time resolution.

Final Answer: Ammonites $\Rightarrow \boxed{\text{D}}$

$\boxed{\text{Answer: (D)}}$ Go Back to Q25

Q26.

Solution

Concept – eras of the Phanerozoic and their nicknames: The three Phanerozoic eras carry informal names based on their dominant life: Paleozoic (ancient life), Mesozoic ("Age of Reptiles"), Cenozoic ("Age of Mammals").

Step 1 – read the time span: From about 66 million years ago to the present.

Step 2 – match the interval: This interval, following the extinction of the dinosaurs, is the Cenozoic Era.

Step 3 – confirm the nickname: Mammals diversified to dominate the land during this era, hence the "Age of Mammals."

Why the other options are wrong:

- A, Mesozoic: the "Age of Reptiles," ending 66 Ma ago.
- C, Paleozoic: far older, ending about 252 Ma ago.
- D, Proterozoic: a Precambrian eon, long before mammals.

Final Answer: Cenozoic Era $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept – kinds of biozone: Biostratigraphers define several types of zone depending on how fossil ranges are used.

Step 1 – read the situation: Two index species, P and Q, have ranges that partly overlap, and the interval of interest is where both occur together.

Step 2 – identify the defining criterion: A zone defined by the overlap of the ranges of two or more taxa is a concurrent-range (overlap) zone.

Step 3 – read the chart: The dashed lines bracket the interval where the P and Q bars coincide, which is the concurrent-range interval.

Why the other options are wrong:

- A, assemblage zone: defined by a distinctive group of many taxa together, not the overlap of two ranges.
- B, acme zone: defined by the peak abundance of one taxon.
- C, interval zone: the barren interval between two marker events (e.g. between the last of one and the first of another).

Final Answer: Concurrent-range zone $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q27

Q28.

Solution

Concept – the "Great Dying": The end-Permian event is the most severe mass extinction recorded in the fossil history of life.

Step 1 – read the magnitude: About 90% of marine species were wiped out, including the trilobites.

Step 2 – identify the boundary: This catastrophe marks the end of the Permian period (and of the Paleozoic Era).

Step 3 – conclude: Therefore the greatest extinction occurred at the end of the Permian.

Why the other options are wrong:

- B, end-Cretaceous: the K–Pg event that killed the dinosaurs, but smaller than the end-Permian.
- C, end-Ordovician: a major extinction, but less severe.
- D, end-Triassic: another of the "big five," but smaller than the end-Permian.

Final Answer: End of the Permian $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – modes of fossil preservation: Fossils are preserved in several ways, distinguished by what happens to the original material.

Step 1 – read the process: Buried wood has its tissue replaced molecule by molecule with silica while the cell structure is retained.

Step 2 – name the process: Replacement/pore-filling by mineral matter that preserves internal detail is petrifaction (permineralization); petrified wood is the classic example.

Step 3 – conclude: Therefore the mode of preservation described is petrifaction.

Why the other options are wrong:

- A, carbonization: volatiles are driven off, leaving a thin carbon film (e.g. leaf compressions).
- B, mummification: soft tissue is dried and preserved, not replaced by silica.
- D, impression: only a flattened imprint remains, with no cellular detail preserved.

Final Answer: Petrifaction (permineralization) $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q29

Q30.

Solution

Concept – major stratigraphic units of Peninsular India: The Indian shield preserves several great Proterozoic-to-Phanerozoic successions distinguished by age and setting.

Step 1 – read the clues: Thick coal-bearing continental sequences of Permo-Carboniferous to Jurassic age, deposited in fault-bounded basins above a glacial base.

Step 2 – match the succession: These are the deposits of the Gondwana Supergroup, which host India's major Permian (Lower Gondwana) coal seams.

Step 3 – confirm: The glacial Talchir beds at the base and the coal measures above are hallmarks of the Gondwana succession.

Why the other options are wrong:

- A, Vindhyan: a Proterozoic sequence, largely unfossiliferous and much older, with no coal.
- C, Cuddapah: a Proterozoic basin succession, far older than the coal measures.
- D, Deccan Traps: end-Cretaceous flood basalts, not coal-bearing sediments.

Final Answer: Gondwana Supergroup $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept – copper ore minerals: Copper is won from several ore minerals, but one sulphide dominates world production.

Step 1 – read the formula: $CuFeS_2$.

Step 2 – match the mineral: $CuFeS_2$ is chalcopyrite, a brass-yellow copper–iron sulphide.

Step 3 – confirm its importance: Chalcopyrite is the single most important primary ore mineral of copper worldwide.

Why the other options are wrong:

- A, malachite: $Cu_2CO_3(OH)_2$, a green secondary carbonate ore.
- B, bornite: Cu_5FeS_4, a copper ore but less abundant than chalcopyrite.
- C, chalcocite: Cu_2S, an important but secondary (enrichment) ore.

Final Answer: Chalcopyrite ($CuFeS_2$) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q31

Q32.

Solution

Concept – hydrothermal ore-forming processes: Many metallic ores are deposited from hot watery fluids moving through the crust.

Step 1 – read the process: Hot aqueous fluids circulate through fractures and precipitate ore minerals as they cool and react.

Step 2 – read the form: The ore is deposited as vein fillings within the fractures.

Step 3 – name the deposit type: Ore precipitated from hot fluids into fractures forms hydrothermal (epigenetic) vein deposits.

Why the other options are wrong:

- B, placer: mechanical concentration of dense grains by flowing water at the surface.
- C, residual: concentration by intense surface weathering (e.g. laterite/bauxite).
- D, evaporite: precipitation of salts from evaporating water, a sedimentary process.

Final Answer: Hydrothermal vein deposits $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – primary source of diamonds: Diamonds crystallise deep in the mantle and are transported upward by rare, fast, volatile-rich magmas.

Step 1 – read the host: The diamonds arrive in narrow, pipe-like intrusions of a volatile-rich ultrabasic rock.

Step 2 – name the rock: This diamond-bearing ultrabasic pipe rock is kimberlite.

Step 3 – confirm: Kimberlite pipes (and related lamproites) are the world's primary source of natural diamonds.

Why the other options are wrong:

- A, basaltic dykes: mafic but not the deep, diamond-carrying pipe rock.
- B, granite plutons: felsic crustal rocks, not diamond hosts.
- D, rhyolitic flows: felsic volcanic rocks, unrelated to diamonds.

Final Answer: Kimberlite $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q33

Q34.

Solution

Concept – tectonic setting of porphyry copper deposits: Porphyry copper deposits are large, low-grade orebodies genetically tied to a particular magmatic setting.

Step 1 – read the geological association: Disseminated ore surrounds a shallow felsic (porphyritic) intrusion.

Step 2 – link to magma generation: Such calc-alkaline intrusions are generated by melting above a descending oceanic slab.

Step 3 – name the setting: Therefore porphyry copper deposits form above a subduction zone, in the magmatic (volcanic) arc.

Why the other options are wrong:

- B, mid-ocean ridge: produces basaltic crust and volcanogenic massive sulphides, not porphyry copper.

- C, intraplate desert basin: a depositional/evaporite setting, not arc magmatism.
- D, abyssal plain: deep-sea sedimentation, unrelated to arc intrusions.

Final Answer: Above a subduction zone (magmatic arc) $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q34

Q35.

Solution

Concept – age of Banded Iron Formations: BIFs are chemically precipitated iron-rich sediments whose formation is tied to the early chemistry of the oceans and atmosphere.

Step 1 – recall the setting: BIFs precipitated when rising free oxygen combined with dissolved iron in the early oceans.

Step 2 – link to time: This condition prevailed mainly in the Precambrian, especially the Archaean to Palaeoproterozoic (around 2.5 billion years ago).

Step 3 – conclude: Therefore the great BIF iron ores formed overwhelmingly in the Precambrian.

Why the other options are wrong:

- B, Jurassic: far too young; oceans were already oxygenated.
- C, Cenozoic: recent, well after major BIF deposition ceased.
- D, Devonian: Palaeozoic, again long after the main BIF episode.

Final Answer: Precambrian (Archaean–Palaeoproterozoic) $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q35

Q36.

Solution

Concept – evaporite deposits: Some economic mineral beds form directly by precipitation from concentrating natural brines.

Step 1 – read the minerals: Rock salt (halite), gypsum and anhydrite are soluble salts.

Step 2 – link to the process: When a restricted body of saline water evaporates, these salts precipitate in sequence as the brine concentrates.

Step 3 – name the process: The formation of such beds by evaporation of saline water is evaporite precipitation.

Why the other options are wrong:

- A, magmatic settling: an igneous process forming ores like chromite, not salt beds.
- B, hydrothermal deposition: precipitates metallic ores from hot fluids in veins.
- D, contact metamorphism: alters existing rock by heat; it does not deposit salt beds.

Final Answer: Evaporation of a restricted saline water body $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q36

Q37.

Solution

Concept – Darcy's law for groundwater discharge: For laminar flow, the volume discharge is $Q = K\,i\,A$, with K the hydraulic conductivity, i the hydraulic gradient and A the cross-sectional area.

Step 1 – list the data: $K = 15$ m/day, $i = 0.04$, $A = 25$ m^2.

Step 2 – multiply K by i: $K\,i = 15 \times 0.04 = 0.6$ m/day

Step 3 – multiply by the area: $Q = 0.6 \times 25$

Step 4 – compute: $Q = 15$ m^3/day

Step 5 – check the units: (m/day) $\times$ (m^2) $=$ m^3/day, a volume flow rate, as required.

Final Answer: $Q = 15$ m^3/day $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q37

Q38.

Solution

Concept – Darcy (specific-discharge) velocity: The Darcy velocity is the discharge per unit total cross-sectional area, $v = K\,i$.

Step 1 – list the data: $K = 20$ m/day, $i = 0.05$.

Step 2 – write the relation: $v = K\,i$

Step 3 – substitute: $v = 20 \times 0.05$

Step 4 – compute: $v = 1$ m/day

Step 5 – note the caution: This Darcy velocity is an apparent (bulk) velocity; the true seepage velocity through the pores, v/n, would be higher, but the quantity asked for is $v = Ki = 1$ m/day.

Final Answer: $v = 1$ m/day $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept – unconfined (water-table) aquifers: Aquifers are classified by whether their upper surface is a free water table or a confining bed.

Step 1 – read the upper boundary: The aquifer's top is a free water table standing at atmospheric pressure.

Step 2 – read the recharge: It is recharged directly by rain infiltrating from the surface above.

Step 3 – name the aquifer: An aquifer with a free, atmospheric water table open to direct recharge is an unconfined (water-table) aquifer.

Why the other options are wrong:

- A, confined: enclosed above and below by impermeable beds, with water under pressure.
- B, perched: a small local saturated body sitting on an impermeable lens above the main water table.
- D, aquiclude: an impermeable layer that does not transmit useful water at all.

Final Answer: An unconfined (water-table) aquifer $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q39

Q40.

Solution

Concept – Rock Quality Designation (RQD): RQD is a standard index in engineering geology derived from drill-core recovery.

Step 1 – recall the definition: RQD is the summed length of intact core pieces longer than 10 cm, divided by the total length of the core run, expressed as a percentage.

Step 2 – interpret what it measures: A rock mass with many joints and fractures yields short broken pieces and a low RQD; a massive, unbroken rock yields a high RQD.

Step 3 – conclude: Therefore RQD expresses the degree of jointing or fracturing (the quality) of a rock mass.

Why the other options are wrong:

- B, porosity of loose soil: RQD is a rock-mass (core) measure, not a soil porosity.
- C, chemical purity of ore: an assay/grade issue, unrelated to RQD.
- D, salinity of groundwater: a water-chemistry parameter, not a rock-quality index.

Final Answer: The degree of jointing/fracturing of a rock mass $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ Go Back to Q40

Q41.

Solution

Concept – relation between porosity and void ratio: Porosity n (void volume over total volume) and void ratio e (void volume over solid volume) are linked by $n = \dfrac{e}{1+e}$.

Step 1 – list the data: Void ratio $e = 0.5$.

Step 2 – write the relation: $n = \dfrac{e}{1+e}$

Step 3 – substitute: $n = \dfrac{0.5}{1+0.5} = \dfrac{0.5}{1.5}$

Step 4 – simplify: $n = \dfrac{1}{3} = 0.333$

Step 5 – convert to a percentage: $n = 0.333 \times 100\% = 33.3\%$

Final Answer: Porosity $= 33.3\% \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept – major, minor and trace elements: Geochemists group the elements in a rock by their concentration level.

Step 1 – recall the concentration ranges: Major elements exceed about 1%; minor elements lie roughly between 0.1% and 1%; trace elements are below about 0.1% (1000 ppm).

Step 2 – read the given level: The elements described are present below 0.1% (1000 ppm) and substitute into the lattices of major minerals.

Step 3 – match the class: Elements below $\sim 0.1\%$ are, by definition, trace elements.

Why the other options are wrong:

- B, major elements: present at percent levels and form the essential minerals.
- C, minor elements: an intermediate (0.1–1%) group, above the trace level.
- D, volatile elements: classified by their gas-forming behaviour, not by this concentration cut-off.

Final Answer: Trace elements $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q42

Q43.

Solution

Concept – compatible versus incompatible trace elements: The partition (distribution) coefficient D measures how a trace element divides between crystallising minerals and the melt.

Step 1 – read the given condition: The element strongly prefers the melt, with $D \ll 1$.

Step 2 – interpret $D \ll 1$: A partition coefficient much less than 1 means the element is largely excluded from the growing crystals and stays in the liquid.

Step 3 – name the behaviour: An element with $D \ll 1$ that concentrates in the melt is called incompatible.

Why the other options are wrong:

- A, compatible: has $D > 1$ and enters the crystals, the opposite behaviour.
- B, siderophile: a Goldschmidt affinity class (iron-loving), not a melt-partitioning term.
- D, refractory: refers to a high melting/condensation temperature, not to D.

Final Answer: Incompatible $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q43

Q44.

Solution

Concept – fluvial depositional landforms: Where flowing water suddenly loses energy, it drops its sediment load in a characteristic shape.

Step 1 – read the setting: A steep, sediment-laden mountain stream emerges abruptly onto a flat plain.

Step 2 – interpret the deposition: As the channel loses gradient and spreads out, the current decelerates and dumps its load in a fan spreading from the canyon mouth.

Step 3 – name the landform: A fan-shaped deposit at the foot of mountains, common in arid regions, is an alluvial fan.

Why the other options are wrong:

- A, delta: forms where a river enters a standing body of water (sea or lake), not a dry plain.
- C, oxbow lake: a cut-off meander loop, an erosional/abandonment feature.
- D, esker: a sinuous ridge of sediment deposited by a glacial meltwater stream.

Final Answer: Alluvial fan $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q44

Q45.

Solution

Concept – karst landscapes: Certain landscapes are shaped chiefly by chemical dissolution rather than mechanical erosion.

Step 1 – read the features: Sinkholes, caves, disappearing streams and underground drainage.

Step 2 – read the cause: These form by the dissolution of soluble carbonate bedrock such as limestone by slightly acidic water.

Step 3 – name the topography: A landscape dominated by such solution features is called karst topography.

Why the other options are wrong:

- A, aeolian: shaped by wind (dunes, yardangs), not dissolution.
- B, glacial: shaped by moving ice (cirques, moraines).
- C, fluvial: shaped by running water eroding and depositing in channels, not by solution of carbonate.

Final Answer: Karst topography $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept – active versus passive remote sensing: Remote-sensing systems are classed by whether they supply their own illumination.

Step 1 – read the system type: Imaging RADAR is an active system.

Step 2 – identify the energy source: An active sensor generates and transmits its own energy (microwave pulses) toward the target and records the return.

Step 3 – conclude: Therefore the energy source for RADAR is microwave energy generated by the sensor itself, which is why it can operate day or night and see through cloud.

Why the other options are wrong:

- B, reflected sunlight only: describes passive optical sensors, not active RADAR.
- C, thermal radiation from the Sun: this is a passive source; RADAR does not rely on solar heat.
- D, moonlight: far too weak and again a passive, reflected source.

Final Answer: Microwave energy generated by the sensor itself $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q46

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	D	3	C	4	B	5	B
6	A	7	B	8	C	9	B	10	D
11	A	12	C	13	D	14	B	15	A
16	C	17	A	18	B	19	D	20	D
21	B	22	D	23	C	24	B	25	D
26	B	27	D	28	A	29	C	30	B
31	D	32	A	33	C	34	A	35	A
36	C	37	C	38	B	39	C	40	A
41	D	42	A	43	C	44	B	45	D
46	A								