GATE Geology and Geophysics – Geology

Sample Paper – 8

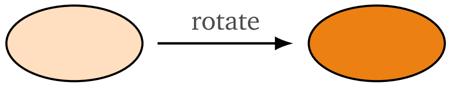
Duration: 128 Minutes **Maximum Marks: 72**

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. Under plane-polarised light a coloured anisotropic mineral such as biotite or tourmaline changes its absorption colour as the microscope stage is rotated, because light vibrating in different crystallographic directions is absorbed to different degrees, as sketched. This optical property is called: **[1 mark]**



pale (light vibrates || E–W) deep (stage rotated 90°)

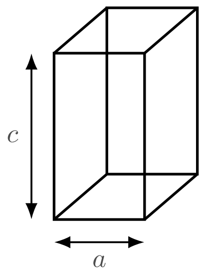
(A) Birefringence

(B) Extinction

(C) Twinning

(D) Pleochroism

Q2. The crystal drawn has two equal horizontal axes at right angles and a vertical axis of a different length ($a = b \neq c$, with $\alpha = \beta = \gamma = 90°$). It belongs to which crystal system? **[1 mark]**



(A) Tetragonal

(B) Isometric (cubic)

(C) Orthorhombic

(D) Monoclinic

Q3. In a thin section a mineral grain stands out in strong (high) relief against the surrounding Canada balsam mounting medium (refractive index $n \approx 1.54$). This relief is controlled chiefly by the difference between the grain and the balsam in their: **[1 mark]**

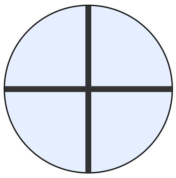
(A) Refractive index

(B) Density

(C) Hardness

(D) Cleavage

Q4. Viewed conoscopically (with the Bertrand lens in), a mineral grain gives a centred interference figure consisting of a single black cross of isogyres that remains fixed and does not break up into separate hyperbolae as the stage is rotated, as shown. Optically the mineral is: **[1 mark]**



fixed black cross

(A) Biaxial

(B) Isotropic

(C) Uniaxial

(D) Amorphous

Q5. Plagioclase feldspar is most reliably identified in thin section by a distinctive set of fine, parallel, repeated (lamellar) twin lamellae that show alternating light and dark bands under crossed polarisers. This twinning is called: **[1 mark]**

(A) Carlsbad twinning

(B) Simple contact twinning

(C) Albite (polysynthetic) twinning

(D) Baveno twinning

Q6. In a standard $30\ \mu$m thin section a mineral has refractive indices $n_{\text{slow}} = 1.700$ for the slow ray and $n_{\text{fast}} = 1.560$ for the fast ray. Its birefringence $\delta = n_{\text{slow}} - n_{\text{fast}}$ is: **[1 mark]**

(A) 0.070

(B) 0.140

(C) 1.630

(D) 0.260

Igneous and Metamorphic Petrology

Q7. Beneath a mid-ocean ridge, hot mantle rises and its confining pressure drops while its temperature stays almost constant, so it crosses its solidus and begins to melt. This mechanism of magma generation is: **[1 mark]**

(A) Flux (water-induced) melting

(B) Heating by radioactive decay

(C) Melting by meteorite impact

(D) Decompression (adiabatic) melting

Q8. At a subduction zone, melting of the hot mantle wedge above the descending oceanic slab is triggered mainly by lowering the mantle's melting point through the addition of: **[1 mark]**

(A) Extra carbon dioxide only

(B) Water (volatiles) released from the slab

(C) Additional confining pressure

(D) Extra silica from the crust

Q9. The volcanic rock erupted in by far the greatest volume along oceanic spreading ridges, forming the bulk of newly created oceanic crust, is: **[1 mark]**

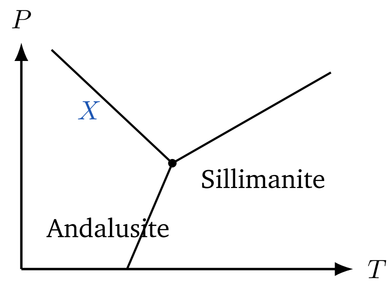
(A) Rhyolite

(B) Basalt

(C) Andesite

(D) Granite

Q10. The three aluminosilicate polymorphs of Al_2SiO_5 share the phase diagram shown, meeting at a triple point. The polymorph stable in the high-pressure field (the field marked X) and used as an indicator of high-pressure metamorphism is: **[1 mark]**



(A) Sillimanite

(B) Andalusite

(C) Kyanite

(D) Quartz

Q11. Contact metamorphism of a pure limestone by the heat of an adjacent hot igneous intrusion recrystallises the calcite to produce which non-foliated metamorphic rock? **[1 mark]**

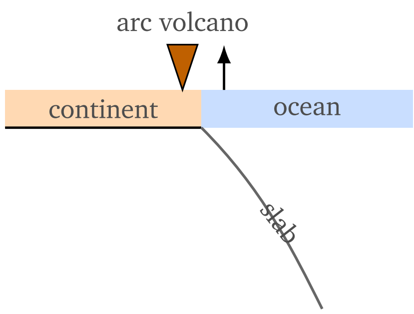
(A) Slate

(B) Marble

(C) Gneiss

(D) Schist

Q12. Explosive composite (strato-) volcanoes that erupt andesitic to rhyolitic magma, such as those of the Andes, are most characteristic of which plate-tectonic setting, shown in section? **[1 mark]**



(A) Convergent (subduction) margin

(B) Mid-ocean ridge

(C) Continental rift

(D) Transform fault

Sedimentology and Stratigraphy

Q13. In sequence stratigraphy, the fundamental stratal unit is a relatively conformable succession of genetically related strata bounded above and below by unconformities or their correlative conformities. This unit is a: **[1 mark]**

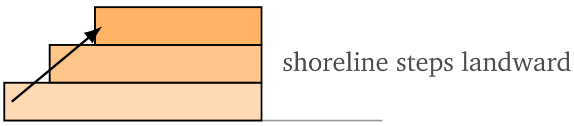
(A) Parasequence

(B) Systems tract

(C) Depositional sequence

(D) Single bedset

Q14. Within a depositional sequence, the systems tract deposited during a relative rise of sea level shows a retrogradational (back-stepping) stacking pattern, as sketched. It is the: **[1 mark]**



(A) Lowstand systems tract

(B) Transgressive systems tract

(C) Highstand systems tract

(D) Falling-stage systems tract

Q15. The maximum flooding surface, which records the deepest, most landward position of the shoreline, separates the transgressive systems tract below from which systems tract above? **[1 mark]**

(A) Lowstand systems tract

(B) Falling-stage systems tract

(C) Transgressive systems tract

(D) Highstand systems tract

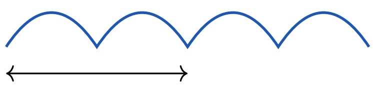
Q16. The smallest-scale, relatively conformable package of genetically related beds, bounded above and below by marine-flooding surfaces, that stacks to build systems tracts, is a: **[1 mark]**

(A) Depositional sequence
(B) Systems tract
(C) Parasequence
(D) Formation

Q17. A single graded bed that fines upward from sand at the base to mud at the top, deposited rapidly from one waning, sediment-laden density current in deep water, is a: **[1 mark]**

(A) Varve
(B) Turbidite
(C) Evaporite bed
(D) Tillite

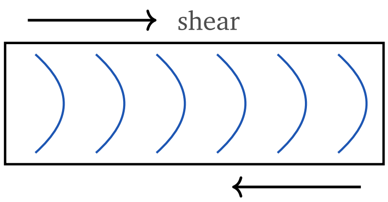
Q18. The ripple marks preserved on the bedding plane shown have symmetrical profiles with sharp, straight crests and rounded troughs of equal size on both sides. Such symmetrical ripples indicate deposition by: **[1 mark]**



(A) A steady unidirectional wind
(B) Flowing glacial ice
(C) A single turbidity current
(D) Oscillatory (to-and-fro) wave action

Structural Geology and Geotectonics

Q19. Deep in a ductile shear zone, rocks are deformed by intense crystal-plastic flow that reduces grain size and produces a strongly foliated, fine-grained fault rock with sigmoidal fabrics, as shown. This fault rock is a: **[1 mark]**



(A) Cataclasite

(B) Mylonite

(C) Fault breccia

(D) Fault gouge

Q20. Asymmetric porphyroclasts wrapped by foliation, such as σ-type and δ-type clasts, are widely used in a mylonite mainly to determine the: **[1 mark]**

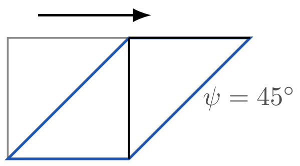
(A) Sense (direction) of shear

(B) Absolute radiometric age

(C) Metamorphic temperature only

(D) Original detrital grain size

Q21. A ductile shear zone deforms an initially square marker by simple shear, as sketched. The shear strain is $\gamma = \tan\psi$, where ψ is the angular shear. For an angular shear of $\psi = 45^\circ$, the shear strain γ is: **[2 marks]**



(A) 1.0

(B) 0.5

(C) 0.707

(D) 1.414

Q22. A thrust fault dips at 20° and the net slip measured along the fault plane is 500 m. The vertical throw equals slip $\times \sin(\text{dip})$. Taking $\sin 20^\circ \approx 0.342$, the throw is closest to: **[2 marks]**

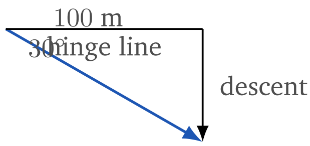
(A) 342 m

(B) 171 m

(C) 500 m

(D) 470 m

Q23. A fold hinge line plunges at 30° toward the north, as shown. Following the hinge horizontally for 100 m in the plunge direction, the vertical descent equals horizontal distance $\times \tan$(plunge). Taking $\tan 30^\circ \approx 0.577$, the hinge descends by about: **[2 marks]**



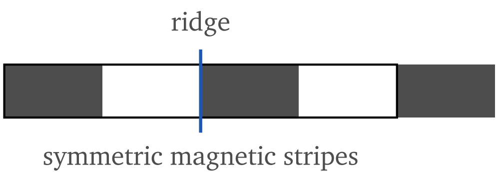
(A) 57.7 m

(B) 50 m

(C) 100 m

(D) 30 m

Q24. The symmetrical pattern of normally and reversely magnetised stripes of oceanic crust running parallel to, and mirror-imaged across, a mid-ocean ridge (shown below) provided the key direct evidence for: **[2 marks]**



(A) Continental collision

(B) Subduction alone

(C) Sea-floor spreading

(D) Isostatic rebound

Palaeontology and Historical Geology

Q25. Identical Permian *Glossopteris* plant fossils and *Mesosaurus* reptile remains occur across South America, Africa, India, Antarctica and Australia. This matching biogeographic distribution is classic evidence for the former southern supercontinent: **[2 marks]**

(A) Gondwana

(B) Laurasia

(C) Laurentia

(D) Baltica

Q26. Widespread late-Palaeozoic (Permo-Carboniferous) tillites, striated pavements and dropstones preserved across the Gondwana continents are evidence of a major episode of: **[2 marks]**

(A) Continental glaciation

(B) Marine transgression

(C) Explosive volcanism

(D) Desert (aeolian) expansion

Q27. The coal seams of the Gondwana Supergroup of Peninsular India, which supply most of the country's coal, accumulated dominantly in which depositional setting? **[2 marks]**

(A) Deep-marine turbidite fans

(B) Aeolian dune fields

(C) Glacio-marine shelves

(D) Fluvio-lacustrine swamps

Q28. A limestone succession rich in ooids, stromatolites and coral-algal reef framework is a reliable palaeoclimate indicator of deposition in a: **[2 marks]**

(A) Warm, shallow, tropical sea

(B) Cold, deep ocean floor

(C) Freshwater glacial lake

(D) Hot, dry inland desert

Q29. The calcareous-shelled microfossils that are widely used in the biostratigraphy of marine successions and whose oxygen-isotope ratios in deep-sea cores record past ocean temperature and ice volume are the: [2 marks]

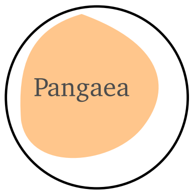
(A) Trilobites

(B) Graptolites

(C) Foraminifera

(D) Ammonites

Q30. On the palaeogeographic reconstruction sketched, the fragments of continental crust have coalesced into the single supercontinent Pangaea. This maximum assembly of Pangaea was reached during which geological period? [2 marks]



single landmass

(A) Cambrian

(B) Jurassic

(C) Permian

(D) Neogene

Economic Geology and Mineral Resources

Q31. Bauxite, the principal ore of aluminium, is not a single mineral but an aggregate dominated by hydrated aluminium-oxide minerals. The chief among these is: [2 marks]

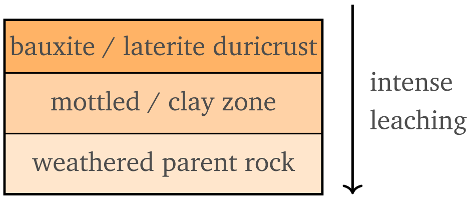
(A) Gibbsite

(B) Hematite

(C) Galena

(D) Chromite

Q32. The lateritic profile shown, in which prolonged leaching has removed silica and concentrated aluminium and iron oxides to form a bauxite duricrust, develops best under which climatic conditions? [2 marks]



(A) Cold, arid polar climate

(B) Temperate, dry climate

(C) Permanently frozen climate

(D) Hot, humid tropical climate

Q33. Chromite, the only economically important ore mineral of chromium, is a member of the spinel group with the chemical formula: [2 marks]

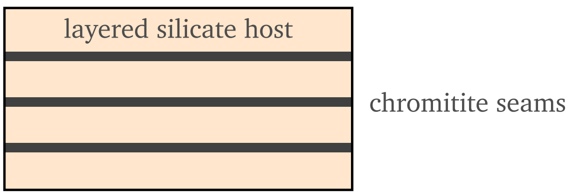
(A) Cr_2O_3

(B) $FeCrO_3$

(C) $FeCr_2O_4$

(D) $CrFeS_2$

Q34. Stratiform chromitite seams and platinum-group-element reefs of the Bushveld type, shown as dark layers in the section, occur as laterally persistent layers within which kind of host body? [2 marks]



(A) A granite pegmatite

(B) A layered mafic–ultramafic intrusion

(C) A porous sandstone aquifer

(D) A shallow-marine limestone reef

Q35. Heavy, chemically resistant minerals such as ilmenite, rutile, monazite, garnet and zircon, winnowed and concentrated by wave and current action along a shoreline, form which type of ore deposit? **[2 marks]**

(A) A beach placer deposit

(B) A hydrothermal vein deposit

(C) A contact skarn deposit

(D) A marine evaporite deposit

Q36. An ore body is estimated to contain 2 million tonnes of rock at an average grade of 1.5% copper. The tonnage of contained copper metal is: **[2 marks]**

(A) $3{,}000$ tonnes

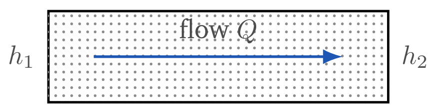
(B) $300{,}000$ tonnes

(C) $30{,}000$ tonnes

(D) $15{,}000$ tonnes

Hydrogeology and Engineering Geology

Q37. Groundwater flows horizontally through the aquifer shown. Using Darcy's law $Q = K\,i\,A$ with hydraulic conductivity $K = 15$ m/day, hydraulic gradient $i = 0.01$ and cross-sectional area $A = 200$ m^2, the discharge Q is: **[2 marks]**



$K = 15$ m/day, $i = 0.01$, $A = 200$ m^2

(A) $30\ \text{m}^3/\text{day}$

(B) $300\ \text{m}^3/\text{day}$

(C) $3\ \text{m}^3/\text{day}$

(D) $15\ \text{m}^3/\text{day}$

Q38. A confined aquifer has a storativity (storage coefficient) of $S = 0.0005$ and extends over an area of $10\ \text{km}^2$. The volume of water it releases from storage for a uniform 1 m decline of head, given by $V = S \times A \times \Delta h$, is: **[2 marks]**

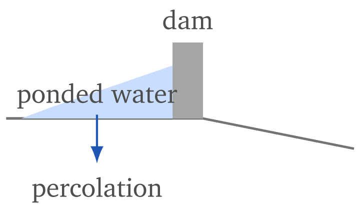
(A) $500\ \text{m}^3$

(B) $50{,}000\ \text{m}^3$

(C) $5 \times 10^6\ \text{m}^3$

(D) $5{,}000\ \text{m}^3$

Q39. In a semi-arid hard-rock terrain with poor natural infiltration, the most effective structural measure to enhance artificial recharge of groundwater by detaining surface runoff and letting it percolate is the construction of: **[2 marks]**



(A) Additional deep tube wells

(B) Concrete-lined supply canals

(C) Paved storm-water drains

(D) Check dams and percolation tanks

Q40. For an unconfined aquifer, the specific yield S_y is best defined as the: **[2 marks]**

(A) Total porosity of the aquifer material

(B) Water retained by capillarity per unit volume

(C) Volume of water released by gravity drainage per unit volume of aquifer

(D) Hydraulic conductivity of the aquifer

Q41. A confined aquifer has a hydraulic conductivity $K = 20$ m/day and a saturated thickness $b = 25$ m. Its transmissivity $T = K \times b$ is: **[2 marks]**

(A) 45 m^2/day

(B) 0.8 m^2/day

(C) 250 m^2/day

(D) 500 m^2/day

Geochemistry, Geomorphology and Remote Sensing

Q42. On satellite imagery, the straight or gently curved topographic and tonal alignments that mark the surface traces of faults, fractures and joint zones, and which are mapped as guides to structure and groundwater, are called: **[2 marks]**

(A) Spectral signatures

(B) Lineaments

(C) Pixels

(D) Ground-control points

Q43. The Normalized Difference Vegetation Index is defined as $\mathrm{NDVI} = \dfrac{\mathrm{NIR} - \mathrm{Red}}{\mathrm{NIR} + \mathrm{Red}}$. For a healthy crop with near-infrared reflectance $\mathrm{NIR} = 0.50$ and red reflectance $\mathrm{Red} = 0.10$, the NDVI is: **[2 marks]**

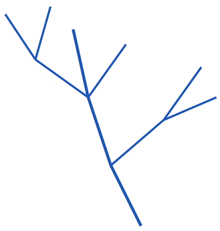
(A) 0.40

(B) 0.67

(C) 0.20

(D) 0.83

Q44. The tree-like, randomly branching drainage pattern shown, in which tributaries join the main stream at acute angles with no preferred orientation, develops characteristically on: [2 marks]



(A) Strongly folded, alternating strata

(B) The flanks of a radial volcanic cone

(C) A grid of faults and joints

(D) Flat-lying, uniformly resistant (homogeneous) rocks

Q45. A rectangular or trellis drainage pattern, in which the main streams and their tributaries characteristically meet one another at nearly right angles, is developed chiefly under: [2 marks]

(A) Perfectly uniform, structureless lithology

(B) The outer slopes of a young volcano

(C) Intense glacial scouring

(D) Strong structural control by joints, faults or bedding

Q46. In a digital multispectral satellite image, the spatial resolution of the sensor refers to the: [2 marks]

(A) Number of spectral bands recorded

(B) Ground area represented by a single pixel

(C) Number of grey (brightness) levels stored

(D) Time interval between two successive overpasses

Detailed Solutions

Q1.

Solution

Concept – selective absorption of light in coloured crystals: Some anisotropic minerals absorb light more strongly along one vibration direction than another.

Step 1 – read the observation: The absorption colour changes as the stage is turned, so the amount of light absorbed depends on the vibration direction of the plane-polarised light.

Step 2 – name the property: This direction-dependent change of colour (and intensity) is called pleochroism.

Step 3 – link to examples: Biotite, tourmaline and hornblende are strongly pleochroic and this is a routine diagnostic aid.

Why the other options are wrong:

- A, birefringence: is the difference of refractive indices; it governs interference colours under crossed nicols, not colour change in plane light.
- B, extinction: is the dark position under crossed nicols, not a colour change.
- C, twinning: is an intergrowth of crystal domains, unrelated to selective absorption.

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

Answer: (D) Go Back to Q1

Q2.

Solution

Concept – crystal systems from axial lengths and angles: The seven crystal systems are told 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: Two axes are equal and the third is different ($a = b \neq c$).

Step 3 – match to the table: Two equal axes and one unequal axis, all at right angles, define the tetragonal system.

Why the other options are wrong:

- B, cubic: requires all three axes equal, $a = b = c$.
- C, orthorhombic: requires three unequal axes, $a \neq b \neq c$, at $90°$.
- D, monoclinic: has two of its inter-axial angles at $90°$ and one that is not.

Final Answer: Tetragonal system $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q2

Q3.

Solution

Concept – relief in thin section: Relief is how sharply a grain's outline and surface stand out against the mounting medium.

Step 1 – identify what controls relief: Relief arises from the contrast in the speed of light (bending of rays) at the grain–balsam boundary.

Step 2 – link speed to a measurable property: The speed of light in a material is set by its refractive index; a large index contrast bends and scatters light strongly at the boundary.

Step 3 – apply to the balsam value: Balsam has $n \approx 1.54$; a grain with an index far from 1.54 (higher or lower) shows strong relief.

Why the other options are wrong:

- B, density: does not by itself control how light bends at the boundary.
- C, hardness: affects polishing, not the optical relief.
- D, cleavage: produces cracks but is not the cause of relief.

Final Answer: Difference in refractive index $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept – conoscopic interference figures: A centred interference figure reveals whether a mineral is optically uniaxial or biaxial.

Step 1 – read the figure: A single black cross (isogyres) that stays whole and does not split on rotation.

Step 2 – recall the rule: In a uniaxial mineral the isogyres form a cross that remains joined as the stage turns; in a biaxial mineral the cross breaks into two separate hyperbolae (isogyres) on rotation.

Step 3 – conclude: Because the cross stays fixed and unbroken, the mineral is optically uniaxial.

Why the other options are wrong:

- A, biaxial: its isogyres would split into two hyperbolae on rotation.
- B, isotropic: gives no interference figure at all (stays dark).
- D, amorphous: is isotropic and gives no figure.

Final Answer: Uniaxial mineral $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q4

Q5.

Solution

Concept – diagnostic twinning of feldspars: Different feldspars show characteristic twin patterns that help identify them.

Step 1 – read the clue: Fine, parallel, repeated lamellae giving alternating light-and-dark bands under crossed polarisers.

Step 2 – name the twin law: This repeated (multiple) lamellar twinning is albite (polysynthetic) twinning.

Step 3 – link to the mineral: Albite twinning is essentially confined to the plagioclase series, so its presence identifies plagioclase.

Why the other options are wrong:

- A, Carlsbad twinning: is a single (simple) twin, common in orthoclase, not a fine repeated set.
- B, simple contact twinning: gives only two halves, not many lamellae.
- D, Baveno twinning: is another simple twin type of alkali feldspar.

Final Answer: Albite (polysynthetic) twinning $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q5

Q6.

Solution

Concept – birefringence: Birefringence is the numerical difference between the highest and lowest refractive indices of an anisotropic mineral.

Step 1 – write the definition: $\delta = n_{\text{slow}} - n_{\text{fast}}$.

Step 2 – substitute the values: $\delta = 1.700 - 1.560$.

Step 3 – subtract: $\delta = 0.140$.

Step 4 – sanity check: A value of 0.140 is a high birefringence, consistent with the bright interference colours such minerals show.

Why the other options are wrong:

- A, 0.070: this is half the true difference.
- C, 1.630: this is the mean index, not the difference.
- D, 0.260: too large; not equal to $1.700 - 1.560$.

Final Answer: $\delta = 0.140 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept – mechanisms of mantle melting: The mantle melts by raising its temperature, lowering its pressure, or lowering its melting point with volatiles.

Step 1 – read the setting: Hot mantle rises beneath a ridge; pressure falls while temperature stays nearly constant.

Step 2 – relate to the solidus: The mantle solidus rises steeply with pressure, so reducing pressure at nearly constant temperature makes the rock cross its solidus and melt.

Step 3 – name the process: Melting caused purely by pressure release along a near-adiabatic path is decompression (adiabatic) melting.

Why the other options are wrong:

- A, flux melting: adds water and is the subduction-zone mechanism, not the ridge one.
- B, radioactive heating: is far too slow and diffuse to drive ridge magmatism.
- C, impact melting: is a rare surface event, not ridge-forming.

Final Answer: Decompression (adiabatic) melting $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept – flux melting at subduction zones: Adding volatiles lowers the melting temperature of mantle rock.

Step 1 – read the setting: The mantle wedge sits above a descending oceanic slab.

Step 2 – identify the agent: As the slab heats up, hydrous minerals break down and release water, which rises into the overlying wedge.

Step 3 – apply the effect: The added water lowers the mantle solidus, so the wedge melts (flux melting) to feed the volcanic arc.

Why the other options are wrong:

- A, carbon dioxide only: CO_2 plays a minor role; water is the dominant flux.
- C, added pressure: higher pressure raises the solidus and hinders melting.
- D, extra silica: adding silica does not lower the mantle solidus.

Final Answer: Water released from the slab $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – composition of new oceanic crust: Oceanic crust generated at spreading ridges is dominated by one rock type.

Step 1 – recall ridge magmatism: Decompression melting of the upper mantle yields large volumes of low-silica (mafic) magma.

Step 2 – name the erupted rock: This mafic magma erupts and quenches as basalt (with gabbro at depth), building the new oceanic crust.

Step 3 – confirm the volume argument: Basalt is by far the most voluminous volcanic rock on Earth because ridges encircle the globe.

Why the other options are wrong:

- A, rhyolite: is silica-rich and typical of continental settings.

- C, andesite: is characteristic of subduction-zone arcs, not ridges.
- D, granite: is an intrusive felsic rock of continental crust.

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

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – the Al_2SiO_5 polymorphs: Kyanite, andalusite and sillimanite have the same composition but are stable in different pressure–temperature fields.

Step 1 – read the diagram: The field marked X is the high-pressure region (upper part of the P axis).

Step 2 – assign the polymorphs: Kyanite is the dense, high-pressure polymorph; andalusite is the low-pressure, low-temperature one; sillimanite is the high-temperature one.

Step 3 – select for the high-P field: The high-pressure field X is occupied by kyanite.

Why the other options are wrong:

- A, sillimanite: is stable at high temperature, not the high-pressure corner.
- B, andalusite: is the low-pressure polymorph.
- D, quartz: is a different mineral (SiO_2), not a polymorph of Al_2SiO_5.

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

Answer: (C) Go Back to Q10

Q11.

Solution

Concept – contact metamorphism of carbonates: Heat from an intrusion recrystallises the host rock without producing regional foliation.

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

Step 2 – apply contact heating: Baking by the intrusion enlarges and interlocks the calcite crystals.

Step 3 – name the product: Recrystallised limestone is marble, a non-foliated (granoblastic) metamorphic rock.

Why the other options are wrong:

- A, slate: forms from shale at low grade, not from limestone.
- C, gneiss: is a high-grade, banded, foliated rock, usually from felsic protoliths.
- D, schist: is strongly foliated, unlike the granoblastic marble.

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

Answer: (B) **Go Back to Q11**

Q12.

Solution

Concept – volcanism and plate settings: The magma type and eruptive style of a volcano reflect its tectonic setting.

Step 1 – read the clues: Andesitic to rhyolitic (silica-rich) magma and explosive strato-volcanoes.

Step 2 – link to a setting: Silica-rich, water-bearing, viscous magmas that erupt explosively are generated by flux melting above a descending slab.

Step 3 – name the boundary: This is a convergent (subduction) margin, as the section shows the slab sinking beneath the arc.

Why the other options are wrong:

- B, mid-ocean ridge: erupts fluid basalt, not explosive andesite/rhyolite.
- C, continental rift: produces mainly basaltic to bimodal magmatism.
- D, transform fault: is dominated by strike-slip motion with little volcanism.

Final Answer: Convergent (subduction) margin $\Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q12**

Q13.

Solution

Concept – the sequence in sequence stratigraphy: Sequence stratigraphy divides the record into packages bounded by unconformity-related surfaces.

Step 1 – read the definition given: Relatively conformable strata bounded above and below by unconformities or their correlative conformities.

Step 2 – match the term: That defined package is the depositional sequence, the fundamental building block of the method.

Step 3 – place the smaller units: Within a sequence, systems tracts and parasequences are the smaller subdivisions.

Why the other options are wrong:

- A, parasequence: is a much smaller unit bounded by flooding surfaces.
- B, systems tract: is a subdivision within a sequence, not the whole sequence.
- D, single bedset: is a small sedimentological unit, far below sequence scale.

Final Answer: Depositional sequence $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q13

Q14.

Solution

Concept – systems tracts and stacking patterns: Each systems tract has a diagnostic stacking pattern set by the balance of accommodation and sediment supply.

Step 1 – read the clue: Deposition during a relative rise of sea level with a backstepping (retrogradational) pattern.

Step 2 – match the tract: When rise outpaces supply the shoreline steps landward, which defines the transgressive systems tract.

Step 3 – note its bounding surfaces: It lies between the transgressive surface below and the maximum flooding surface above.

Why the other options are wrong:

- A, lowstand: progrades and aggrades during early slow rise after a fall.
- C, highstand: progrades during late slow rise, stepping basinward.
- D, falling-stage: forms during relative sea-level fall (forced regression).

Final Answer: Transgressive systems tract $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – the maximum flooding surface (MFS): The MFS marks the turnaround from transgression to renewed progradation.

Step 1 – locate the surface: The MFS records the deepest, most landward shoreline position.

Step 2 – identify what lies above: After maximum flooding, sediment supply again exceeds accommodation and the shoreline progrades: this is the highstand systems tract.

Step 3 – confirm the order: So the MFS separates the transgressive systems tract below from the highstand systems tract above.

Why the other options are wrong:

- A, lowstand: sits below the transgressive tract, not above the MFS.
- B, falling-stage: forms during sea-level fall, well after the highstand.
- C, transgressive: is the tract below the MFS, not above it.

Final Answer: Highstand systems tract $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept – the parasequence: Parasequences are the smallest mappable stratal cycles in sequence stratigraphy.

Step 1 – read the definition: A small, relatively conformable set of genetically related beds bounded by marine-flooding surfaces.

Step 2 – match the term: That unit is the parasequence, typically a shallowing-upward package.

Step 3 – place it in the hierarchy: Parasequences stack to form systems tracts, which stack to form sequences.

Why the other options are wrong:

- A, depositional sequence: is the largest unit, bounded by unconformities.
- B, systems tract: is an intermediate unit made of parasequences.
- D, formation: is a lithostratigraphic unit, defined by rock type, not flooding surfaces.

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

Answer: (C) Go Back to Q16

Q17.

Solution

Concept – deposits of sediment gravity flows: A turbidity current deposits a single graded bed as it wanes.

Step 1 – read the clues: One bed, graded, fining upward from sand to mud, deposited rapidly in deep water.

Step 2 – name the deposit: Such a bed laid down by a waning density current is a turbidite, often showing the Bouma sequence.

Step 3 – link to setting: Turbidites build submarine fans on continental slopes and basin floors.

Why the other options are wrong:

- A, varve: is a thin annual lake couplet, not a single graded gravity-flow bed.
- C, evaporite bed: forms by chemical precipitation, not by a density current.
- D, tillite: is lithified unsorted glacial till, not a graded bed.

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

Answer: (B) Go Back to Q17

Q18.

Solution

Concept – ripple symmetry records the flow type: The cross-sectional shape of ripples tells whether the current was one-way or oscillating.

Step 1 – read the profile: The ripples are symmetrical, with equal limbs on both sides and sharp crests.

Step 2 – interpret the symmetry: Symmetrical ripples require the water (and sediment) to move back and forth equally in both directions.

Step 3 – name the process: That back-and-forth motion is the oscillatory action of surface waves, so these are wave (oscillation) ripples.

Why the other options are wrong:

- A, unidirectional wind: makes asymmetrical (current) ripples with a steep lee side.

- B, glacial ice: does not make ripple marks at all.
- C, turbidity current: is unidirectional and makes asymmetrical ripples.

Final Answer: Oscillatory (wave) action $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q18

Q19.

Solution

Concept – fault rocks of ductile shear zones: Fault rocks are classified by whether they formed by brittle or ductile (crystal-plastic) processes.

Step 1 – read the clues: Deformation is ductile, grain size is reduced, and the rock is strongly foliated with sigmoidal fabrics.

Step 2 – match the fault rock: A cohesive, foliated, fine-grained fault rock formed by crystal-plastic flow is a mylonite.

Step 3 – link to depth: Mylonites form at mid-crustal depths, below the brittle–ductile transition.

Why the other options are wrong:

- A, cataclasite: forms by brittle grain crushing, usually non-foliated.
- C, fault breccia: is a brittle rock of angular fragments.
- D, fault gouge: is incohesive brittle rock flour.

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

Answer: (B) Go Back to Q19

Q20.

Solution

Concept – shear-sense indicators: Asymmetric fabrics in a mylonite record the direction in which one wall moved past the other.

Step 1 – identify the feature: σ- and δ-type porphyroclasts have tails that are wrapped asymmetrically by the foliation.

Step 2 – read what the asymmetry gives: The sense of that asymmetry points to whether the shear was top-to-the-left or top-to-the-right.

Step 3 – conclude the use: Therefore these clasts are used chiefly to determine the sense (direction) of shear.

Why the other options are wrong:

- B, absolute age: needs radiometric dating, not fabric geometry.
- C, temperature only: is estimated from mineral assemblages, not clast asymmetry.
- D, original grain size: is destroyed during mylonitisation.

Final Answer: Sense of shear $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q20

Q21.

Solution

Concept – shear strain in simple shear: Shear strain measures the amount of angular distortion produced by simple shear.

Step 1 – write the relation: $\gamma = \tan\psi$, where ψ is the angular shear.

Step 2 – substitute the angle: $\gamma = \tan 45°$.

Step 3 – evaluate: $\tan 45° = 1$, so $\gamma = 1.0$.

Step 4 – interpret: A shear strain of 1.0 means a line originally perpendicular to the shear plane is displaced sideways by a distance equal to its own height.

Why the other options are wrong:

- B, 0.5: would need $\psi \approx 26.6°$, not $45°$.
- C, 0.707: is $\sin 45°$ or $\cos 45°$, not $\tan 45°$.
- D, 1.414: is $\sqrt{2}$, not $\tan 45°$.

Final Answer: $\gamma = 1.0 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept – throw from net slip on a fault: Throw is the vertical component of the slip on a fault plane.

Step 1 – write the relation: $\text{throw} = \text{slip} \times \sin(\text{dip})$.

Step 2 – substitute the values: $\text{throw} = 500 \times \sin 20°$.

Step 3 – use the given sine: $\sin 20° \approx 0.342$, so throw $= 500 \times 0.342$.

Step 4 – multiply: throw $= 171$ m.

Why the other options are wrong:

- A, 342 m: this is $1000 \times \sin 20°$, using twice the slip.
- C, 500 m: this is the full slip, not its vertical part.
- D, 470 m: this is $500 \times \cos 20°$ (the heave), not the throw.

Final Answer: ≈ 171 m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept – plunge of a fold hinge: The plunge is the vertical angle of the hinge line below the horizontal.

Step 1 – write the relation: vertical descent $=$ horizontal distance $\times \tan(\text{plunge})$.

Step 2 – substitute the values: descent $= 100 \times \tan 30°$.

Step 3 – use the given tangent: $\tan 30° \approx 0.577$, so descent $= 100 \times 0.577$.

Step 4 – multiply: descent $= 57.7$ m.

Why the other options are wrong:

- B, 50 m: this would be $100 \times \sin 30°$ measured along the plunge, not the horizontal-based descent.
- C, 100 m: this is the horizontal distance itself.
- D, 30 m: this simply repeats the plunge angle, which is not a length.

Final Answer: ≈ 57.7 m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q23

Q24.

Solution

Concept – magnetic stripes and the spreading hypothesis: Oceanic crust records Earth's magnetic-field reversals as it forms.

Step 1 – read the pattern: Alternating normal and reversed magnetic stripes are symmetrical about the ridge axis.

Step 2 – interpret the symmetry: New crust forms at the ridge and splits equally to both sides, so it records the same reversal sequence in mirror image on each flank.

Step 3 – name the confirmed idea: This is direct evidence for sea-floor spreading (the Vine–Matthews–Morley hypothesis).

Why the other options are wrong:

- A, continental collision: builds mountains and does not create symmetric ocean stripes.
- B, subduction alone: consumes crust; it does not generate the ridge-symmetric pattern.
- D, isostatic rebound: is vertical crustal adjustment, unrelated to magnetic stripes.

Final Answer: Sea-floor spreading $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q24

Q25.

Solution

Concept – fossil evidence for former supercontinents: Matching land fossils on now-separated continents show they were once joined.

Step 1 – read the fossils and their spread: *Glossopteris* flora and *Mesosaurus* occur across South America, Africa, India, Antarctica and Australia.

Step 2 – identify the landmass: These are exactly the southern continents that fitted together as Gondwana.

Step 3 – conclude: The shared biota is classic evidence for the former supercontinent Gondwana.

Why the other options are wrong:

- B, Laurasia: is the northern supercontinent (North America, Europe, Asia).
- C, Laurentia: is the ancient core of North America only.
- D, Baltica: is the ancient core of northern Europe only.

Final Answer: Gondwana $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept – glacial deposits as palaeoclimate evidence: Certain sedimentary features form only beneath or near ice sheets.

Step 1 – read the evidence: Tillites (lithified till), striated pavements and dropstones across the Gondwana continents.

Step 2 – interpret each feature: Till and striations record grinding by moving ice; dropstones record debris rafted by icebergs.

Step 3 – conclude the climate: Together they demonstrate a major episode of continental glaciation in the late Palaeozoic.

Why the other options are wrong:

- B, marine transgression: leaves marine onlap, not striated pavements and till.
- C, volcanism: leaves lava and ash, not glacial striations.
- D, desert expansion: leaves dune sands, not tillites.

Final Answer: Continental glaciation $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q26

Q27.

Solution

Concept – depositional setting of Gondwana coals: The setting of coal accumulation controls its associated rocks and geometry.

Step 1 – recall the Gondwana coal measures: Indian Gondwana coals occur with sandstones, shales and plant beds in intracratonic rift basins.

Step 2 – identify the environment: Thick peat accumulated in vegetated swamps on river floodplains and around lakes.

Step 3 – name the setting: This is a fluvio-lacustrine (river-and-lake) swamp environment on land.

Why the other options are wrong:

- A, deep-marine turbidite fans: are far too deep and oxygen-poor of the wrong kind for peat swamps.
- B, aeolian dunes: are dry deserts, hostile to peat formation.
- C, glacio-marine shelves: are cold and ice-dominated, not lush swamps.

Final Answer: Fluvio-lacustrine swamps ⇒ $\boxed{\text{D}}$

Answer: (D) Go Back to Q27

Q28.

Solution

Concept – carbonate facies as palaeoclimate indicators: Certain carbonate grains and reefs form only under specific climatic conditions.

Step 1 – read the features: Ooids, stromatolites and coral-algal reef framework.

Step 2 – interpret them: Ooids form in warm, agitated shallow water; coral-algal reefs and stromatolites thrive in warm, clear, sunlit shallow seas.

Step 3 – conclude the environment: Together they indicate deposition in a warm, shallow, tropical sea.

Why the other options are wrong:

- B, cold deep ocean: is dark and cold, unsuitable for reefs and ooids.
- C, glacial lake: is cold freshwater with clastic, not carbonate, deposits.
- D, inland desert: lacks the marine setting these carbonates require.

Final Answer: Warm, shallow, tropical sea ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – microfossils in biostratigraphy and palaeoclimate: Small, abundant, fast-evolving shelled organisms are ideal correlation and climate tools.

Step 1 – read the clues: Calcareous-shelled microfossils, abundant in marine strata, whose oxygen isotopes track ocean temperature and ice volume.

Step 2 – identify the group: These are the foraminifera, whose calcite tests are routinely used for both zonation and δ^{18}O palaeoclimate curves.

Step 3 – confirm: Deep-sea foraminiferal records underpin the Cenozoic ice-volume history.

Why the other options are wrong:

- A, trilobites: are macrofossils, extinct by the end of the Palaeozoic.
- B, graptolites: are Palaeozoic colonial macrofossils, not isotope archives.

- D, ammonites: are useful Mesozoic index macrofossils but not the deep-sea isotope proxy.

Final Answer: Foraminifera ⇒ $\boxed{\text{C}}$

Answer: (C) Go Back to Q29

Q30.

Solution

Concept – the assembly of Pangaea: Pangaea formed by the collision of Gondwana and Laurasia during the late Palaeozoic.

Step 1 – read the sketch: All continental fragments have merged into a single landmass.

Step 2 – recall the timing: The continents amalgamated through the Carboniferous and reached maximum assembly in the Permian.

Step 3 – select the period: Therefore Pangaea's maximum assembly was reached during the Permian.

Why the other options are wrong:

- A, Cambrian: is far too early; the fragments were still dispersed.
- B, Jurassic: is when Pangaea was already breaking apart.
- D, Neogene: is very recent, long after Pangaea had rifted into today's continents.

Final Answer: Permian ⇒ $\boxed{\text{C}}$

Answer: (C) Go Back to Q30

Q31.

Solution

Concept – what bauxite is made of: Bauxite is a residual rock, not a mineral, and its aluminium is held in hydroxide minerals.

Step 1 – recall the bauxite minerals: Bauxite consists mainly of gibbsite $Al(OH)_3$, with boehmite and diaspore $AlO(OH)$.

Step 2 – pick the chief one: Among the listed options the aluminium-hydroxide mineral is gibbsite.

Step 3 – confirm the role: Gibbsite is the principal aluminium-bearing mineral processed for the metal.

Why the other options are wrong:

- B, hematite: is an iron oxide, a common bauxite impurity, not the aluminium mineral.
- C, galena: is a lead sulphide, unrelated to bauxite.
- D, chromite: is a chromium-iron oxide, unrelated to aluminium ore.

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

Answer: (A) Go Back to Q31

Q32.

Solution

Concept – climatic control of laterite and bauxite: Bauxite is a residual weathering product that needs intense chemical leaching.

Step 1 – read the process: Silica is leached away and aluminium (and iron) oxides are concentrated to form a duricrust.

Step 2 – identify the climate needed: Strong leaching requires abundant rainfall and high temperatures to drive rapid chemical weathering.

Step 3 – name the climate: These are hot, humid tropical conditions, where lateritic bauxites form best.

Why the other options are wrong:

- A, cold arid polar: too cold and dry for deep chemical weathering.
- B, temperate dry: insufficient rainfall to leach silica thoroughly.
- C, permanently frozen: chemical weathering is negligible in permafrost.

Final Answer: Hot, humid tropical climate $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept – the composition of chromite: Chromite is a spinel-group oxide and the sole ore of chromium.

Step 1 – recall the spinel formula: Spinels have the general form AB_2O_4.

Step 2 – insert the cations: With $A = Fe^{2+}$ and $B = Cr^{3+}$, the formula is $FeCr_2O_4$.

Step 3 – check the charge balance: $Fe^{2+}(+2) + 2\,Cr^{3+}(+6) = +8$, balanced by $4\,O^{2-}(-8)$; the formula is neutral.

Why the other options are wrong:

- A, Cr_2O_3: is the mineral eskolaite, not chromite.
- B, $FeCrO_3$: does not balance as a spinel and is not chromite.
- D, $CrFeS_2$: is a sulphide formula, whereas chromite is an oxide.

Final Answer: $FeCr_2O_4 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q33

Q34.

Solution

Concept – stratiform chromite and PGE reefs: Some ore layers form by magmatic crystal settling in slowly cooled intrusions.

Step 1 – read the geometry: Laterally persistent, layer-parallel chromitite seams and PGE reefs, as in the Bushveld Complex.

Step 2 – identify the host: Such stratiform layers form by early crystallisation and settling within a large, slowly cooled layered mafic–ultramafic intrusion.

Step 3 – confirm: The Bushveld Complex is the type example of such a layered intrusion.

Why the other options are wrong:

- A, granite pegmatite: is felsic and hosts different (e.g. Li, Be) minerals, not stratiform chromitite.
- C, sandstone aquifer: is sedimentary and unrelated to magmatic layering.
- D, limestone reef: is a biogenic carbonate, not a magmatic host.

Final Answer: Layered mafic–ultramafic intrusion $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept – placer concentration of heavy minerals: Dense, durable minerals are concentrated by moving water that carries away the lighter grains.

Step 1 – read the minerals: Ilmenite, rutile, monazite, garnet and zircon are all dense and chemically resistant.

Step 2 – read the process: Wave and current winnowing along a shoreline removes light quartz and leaves the heavy grains behind.

Step 3 – name the deposit: This mechanical concentration on a beach forms a beach placer deposit.

Why the other options are wrong:

- B, hydrothermal vein: forms by precipitation from hot fluids, not mechanical sorting.
- C, skarn: forms by metasomatism at an intrusion–carbonate contact.
- D, evaporite: forms by evaporation of brine, not by density sorting of grains.

Final Answer: Beach placer deposit $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q35

Q36.

Solution

Concept – contained metal from tonnage and grade: Contained metal equals the ore tonnage multiplied by the fractional grade.

Step 1 – write the relation: metal = tonnage $\times$ grade.

Step 2 – convert the grade to a fraction: $1.5\% = 0.015$.

Step 3 – substitute: metal $= 2{,}000{,}000 \times 0.015$.

Step 4 – multiply: metal $= 30{,}000$ tonnes of copper.

Why the other options are wrong:

- A, $3{,}000$ t: uses a grade of 0.15%, ten times too low.
- B, $300{,}000$ t: uses a grade of 15%, ten times too high.
- D, $15{,}000$ t: uses half the tonnage or half the grade.

Final Answer: $30{,}000$ tonnes $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q36

Q37.

Solution

Concept – Darcy's law for groundwater flow: The volumetric discharge through a porous medium is the product of conductivity, gradient and area.

Step 1 – write the law: $Q = K\,i\,A$.

Step 2 – substitute the values: $Q = 15 \times 0.01 \times 200$.

Step 3 – multiply the first two: $15 \times 0.01 = 0.15$.

Step 4 – multiply by area: $Q = 0.15 \times 200 = 30\ \text{m}^3/\text{day}$.

Why the other options are wrong:

- B, $300\ \text{m}^3/\text{day}$: uses $i = 0.1$ instead of 0.01.
- C, $3\ \text{m}^3/\text{day}$: uses $A = 20\ \text{m}^2$ instead of $200\ \text{m}^2$.
- D, $15\ \text{m}^3/\text{day}$: forgets to multiply by the area properly.

Final Answer: $Q = 30\ \text{m}^3/\text{day} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept – storativity and released volume: Storativity gives the water released per unit area per unit head decline.

Step 1 – write the relation: $V = S \times A \times \Delta h$.

Step 2 – convert the area to m^2: $10\ \text{km}^2 = 10 \times 10^6\ \text{m}^2 = 1 \times 10^7\ \text{m}^2$.

Step 3 – substitute: $V = 0.0005 \times 1 \times 10^7 \times 1$.

Step 4 – multiply: $V = 5 \times 10^{-4} \times 1 \times 10^7 = 5{,}000\ \text{m}^3$.

Why the other options are wrong:

- A, $500\ \text{m}^3$: uses an area of $1\ \text{km}^2$.
- B, $50{,}000\ \text{m}^3$: uses $S = 0.005$, ten times too large.
- C, $5 \times 10^6\ \text{m}^3$: ignores the small storativity ($S = 1$).

Final Answer: $V = 5{,}000\ \text{m}^3 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q38

Q39.

Solution

Concept – artificial recharge in hard-rock terrain: Recharge is boosted by detaining surface runoff so it can infiltrate.

Step 1 – read the problem: Semi-arid hard rock with poor natural infiltration and flashy runoff.

Step 2 – identify the remedy: Small barriers that pond the runoff give it time to soak into fractures and soil.

Step 3 – name the structures: Check dams and percolation tanks do exactly this and are standard recharge structures.

Why the other options are wrong:

- A, more tube wells: only extract water; they do not recharge the aquifer.
- B, concrete-lined canals: are designed to prevent seepage, so they reduce recharge.
- C, paved storm drains: speed runoff away, lowering recharge.

Final Answer: Check dams and percolation tanks $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q39

Q40.

Solution

Concept – specific yield of an aquifer: Specific yield measures the water an aquifer will actually give up by gravity.

Step 1 – recall the split of porosity: Total porosity divides into water that drains freely and water held by capillary and surface forces.

Step 2 – define specific yield: Specific yield is the freely drainable part: the volume of water released by gravity per unit bulk volume of aquifer.

Step 3 – relate to retention: The retained part is the specific retention, so porosity $=$ specific yield $+$ specific retention.

Why the other options are wrong:

- A, total porosity: includes the undrainable water, so it overestimates the yield.
- B, water held by capillarity: is the specific retention, the opposite quantity.
- D, hydraulic conductivity: measures ease of flow, not the drainable volume.

Final Answer: Water released by gravity drainage per unit volume $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept – transmissivity of an aquifer: Transmissivity is the rate at which water moves through the full saturated thickness of an aquifer.

Step 1 – write the relation: $T = K \times b$.

Step 2 – substitute the values: $T = 20 \times 25$.

Step 3 – multiply: $T = 500$ m^2/day.

Step 4 – check the units: (m/day) $\times$ (m) $=$ m^2/day, the correct unit for transmissivity.

Why the other options are wrong:

- A, 45 m^2/day: adds K and b instead of multiplying.
- B, 0.8 m^2/day: divides K by b.
- C, 250 m^2/day: uses half the thickness.

Final Answer: $T = 500$ m^2/day $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept – lineaments in remote sensing: Structural features often show up as straight alignments on satellite images.

Step 1 – read the description: Straight or gently curved topographic and tonal alignments marking faults, fractures and joints.

Step 2 – name the feature: Such mappable linear traces of subsurface structure are called lineaments.

Step 3 – note their use: Lineament maps guide the search for fracture-controlled groundwater and mineralisation.

Why the other options are wrong:

- A, spectral signatures: describe how a material reflects across wavelengths, not linear structures.

- C, pixels: are the picture elements of the image, not geological features.
- D, ground-control points: are survey reference points used for geometric correction.

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

Answer: (B) Go Back to Q42

Q43.

Solution

Concept – the NDVI formula: NDVI normalises the contrast between near-infrared and red reflectance.

Step 1 – write the formula: $\text{NDVI} = \dfrac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$.

Step 2 – substitute the values: $\text{NDVI} = \dfrac{0.50 - 0.10}{0.50 + 0.10}$.

Step 3 – evaluate numerator and denominator: Numerator $= 0.40$; denominator $= 0.60$.

Step 4 – divide: $\text{NDVI} = \dfrac{0.40}{0.60} = 0.67$.

Why the other options are wrong:

- A, 0.40: is only the numerator, not divided by the sum.
- C, 0.20: would need Red $= 0.30$.
- D, 0.83: would need a larger NIR/Red contrast.

Final Answer: $\text{NDVI} \approx 0.67 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q43

Q44.

Solution

Concept – drainage patterns and underlying geology: The plan-view pattern of a river network reflects the rocks and structures beneath it.

Step 1 – read the pattern: A tree-like, randomly branching network with tributaries joining at acute angles and no preferred direction.

Step 2 – interpret it: Randomly oriented branching implies no structural or lithological control, so the substrate is uniform in all directions.

Step 3 – name the setting: Dendritic drainage develops on flat-lying, uniformly resistant (homogeneous) rocks.

Why the other options are wrong:

- A, folded strata: give trellis, not dendritic, patterns.
- B, radial volcanic cone: gives a radial pattern spreading from a summit.
- C, grid of faults and joints: gives an angular or rectangular pattern.

Final Answer: Flat-lying, uniformly resistant rocks $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q44

Q45.

Solution

Concept – structurally controlled drainage: Right-angled stream junctions reveal control by linear structures.

Step 1 – read the pattern: A rectangular or trellis pattern with streams meeting at nearly right angles.

Step 2 – interpret the right angles: Streams exploit two intersecting sets of weaknesses that meet at about $90°$, such as joints, faults or alternating resistant and weak beds.

Step 3 – name the control: This is strong structural control by joints, faults or bedding.

Why the other options are wrong:

- A, uniform structureless lithology: yields dendritic, not rectangular, drainage.
- B, young volcano: yields radial drainage.
- C, glacial scouring: yields deranged or parallel patterns, not right-angled grids.

Final Answer: Structural control by joints, faults or bedding $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept – types of resolution in remote sensing: Spatial, spectral, radiometric and temporal resolution describe different capabilities of a sensor.

Step 1 – focus on spatial resolution: Spatial resolution concerns the size of the smallest feature that can be distinguished on the ground.

Step 2 – express it in pixel terms: It is the ground area represented by a single pixel (the ground sampling distance).

Step 3 – conclude: Therefore spatial resolution is the ground area represented by one pixel; a smaller pixel means finer resolution.

Why the other options are wrong:

- A, number of spectral bands: is the spectral resolution.
- C, number of grey levels: is the radiometric resolution.
- D, time between overpasses: is the temporal resolution.

Final Answer: Ground area represented by a single pixel $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q46

Answer Key

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