GATE Geology and Geophysics – Geology

Sample Paper – 10

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 gem variety of the mineral beryl that owes its rich green colour to trace amounts of chromium and vanadium is: **[1 mark]**

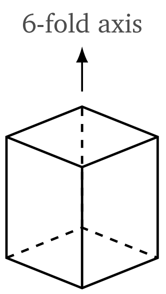
(A) Emerald

(B) Aquamarine

(C) Morganite

(D) Heliodor

Q2. Corundum, whose transparent coloured varieties are the gems ruby and sapphire, crystallises with a single principal axis of six-fold symmetry, as sketched. It belongs to which crystal system? **[1 mark]**



(A) Isometric (cubic)

(B) Trigonal (hexagonal division)

(C) Orthorhombic

(D) Monoclinic

Q3. The optical property responsible for the play of spectral colours, the "fire", seen in a well-cut diamond, arising because white light entering the stone is split into its component wavelengths, is: **[1 mark]**

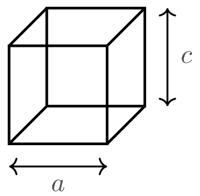
(A) Dispersion

(B) Pleochroism

(C) Cleavage

(D) Luminescence

Q4. A crystal referred to three mutually perpendicular axes of which two are equal and the third differs ($a = b \neq c$, $\alpha = \beta = \gamma = 90°$), as shown by the square-based prism, belongs to which crystal system? **[1 mark]**



(A) Orthorhombic

(B) Tetragonal

(C) Isometric (cubic)

(D) Monoclinic

Q5. A coloured mineral such as biotite or tourmaline that shows a distinct change of absorption colour when the stage is rotated in plane-polarised light (one polariser inserted) is said to be: **[1 mark]**

(A) Pleochroic

(B) Isotropic

(C) Opaque

(D) Isometric

Q6. Among the four minerals below, which one, cut as a cabochon, commonly displays asterism, a six-rayed star, produced by light reflecting from oriented needle-like rutile inclusions? **[1 mark]**

(A) Star sapphire (corundum)

(B) Calcite

(C) Orthoclase feldspar

(D) Fluorite

Igneous and Metamorphic Petrology

Q7. The process by which a pre-existing high-grade rock undergoes partial melting in the deep crust to yield a mixed rock (a migmatite) with an intermingled dark and light part is called: **[1 mark]**

(A) Metasomatism

(B) Diagenesis

(C) Cataclasis

(D) Anatexis

Q8. In a migmatite, the light-coloured, quartzofeldspathic portion that represents the crystallised product of the partial melt is termed the: **[1 mark]**

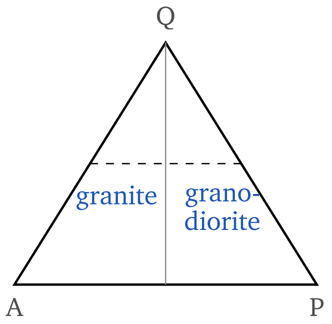
(A) Melanosome

(B) Palaeosome

(C) Leucosome

(D) Restite

Q9. On the QAPF diagram for plutonic rocks shown, a coarse-grained rock with essential quartz in which plagioclase strongly dominates over alkali feldspar plots between granite and tonalite. This rock is a: **[1 mark]**



(A) Syenite

(B) Granodiorite

(C) Gabbro

(D) Dunite

Q10. In the Barrovian sequence of increasing metamorphic grade in pelitic (aluminous) rocks, the appearance of which of the following index minerals marks the highest grade among those listed? **[1 mark]**

(A) Chlorite

(B) Biotite

(C) Sillimanite

(D) Garnet

Q11. The Deccan Traps of peninsular India, one of the world's great flood-basalt provinces erupted near the Cretaceous–Paleogene boundary, are dominantly composed of which volcanic rock? **[1 mark]**

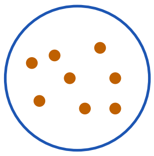
(A) Rhyolite

(B) Andesite

(C) Tholeiitic basalt

(D) Granite

Q12. In the metamorphic texture sketched, a large garnet crystal (a porphyroblast) has grown enclosing many small oriented inclusions of the earlier matrix. Such an inclusion-crowded texture is described as: **[1 mark]**



garnet porphyroblast

(A) Granoblastic

(B) Nematoblastic

(C) Lepidoblastic

(D) Poikiloblastic

Sedimentology and Stratigraphy

Q13. A chemical (non-clastic) sedimentary rock formed by the evaporation of seawater in a restricted basin and composed chiefly of the mineral halite (NaCl) is: **[1 mark]**

(A) Chert

(B) Rock salt

(C) Coal

(D) Limestone

Q14. As seawater in a barred basin is progressively evaporated, its dissolved salts precipitate in order of increasing solubility. Which of the following, being the most soluble, precipitates LAST in the evaporite sequence? **[1 mark]**

(A) Calcite

(B) Gypsum

(C) Halite

(D) Potash salts (sylvite)

Q15. A dark, finely laminated, organic-rich mudrock that acts as the principal source rock for petroleum and can yield liquid hydrocarbons when heated is best described as: **[1 mark]**

(A) Arkose

(B) Bedded chert

(C) Oil (black) shale

(D) Chalk

Q16. The single sandstone bed shown fines upward from coarse sand at the base to silt at the top, the classic record of deposition from a waning turbidity current. This internal arrangement is called: **[1 mark]**

(A) Cross-bedding

(B) Massive bedding

(C) Graded bedding

(D) Flaser bedding

Q17. In Dunham's textural classification of carbonate rocks, a mud-supported limestone that nonetheless contains more than about 10% grains (allochems) floating in the carbonate mud is a: **[1 mark]**

(A) Mudstone

(B) Grainstone

(C) Boundstone

(D) Wackestone

Q18. The stratigraphic principle summarised by the facies belts F_1, F_2, F_3 shown migrating laterally through time is Walther's Law. Which statement expresses this law correctly? **[1 mark]**

(A) Facies seen in a conformable vertical succession are those that were laid down side by side in laterally adjacent environments

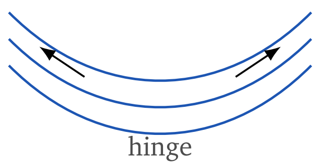
(B) The oldest bed always lies at the top of a succession

(C) Every facies boundary marks a major unconformity

(D) Rock layers are deposited only in horizontal marine settings

Structural Geology and Geotectonics

Q19. In the fold profile shown, the strata are down-warped into a trough, the two limbs dip toward the hinge, and the youngest beds occupy the core. This structure is a: **[1 mark]**



(A) Syncline

(B) Anticline

(C) Monocline

(D) Structural dome

Q20. The major crustal-scale thrust of the Himalaya along which the Lesser Himalaya rides over the Sub-Himalaya (Siwalik) foreland, marking the present southern deformation front, is the: **[1 mark]**

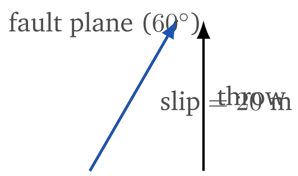
(A) Main Central Thrust (MCT)

(B) South Tibetan Detachment System (STDS)

(C) Indus–Tsangpo Suture Zone

(D) Main Boundary Thrust (MBT)

Q21. A reverse fault dips at 60° and has a net slip of 20 m measured along the dip direction of the fault plane, as sketched. The vertical throw, given by throw $=$ slip $\times \sin(\text{dip})$, is: **[2 marks]**



(A) 17.3 m

(B) 10 m

(C) 20 m

(D) 11.5 m

Q22. The Himalayan mountain belt was raised when the Indian Plate drove into and collided with the Eurasian Plate. In plate-tectonic terms, this convergent boundary between two blocks of low-density continental lithosphere is a: **[2 marks]**

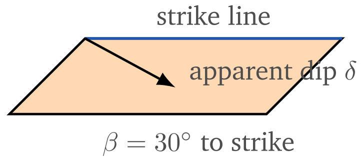
(A) Ocean–ocean subduction zone

(B) Continent–continent collision zone

(C) Divergent (spreading) boundary

(D) Transform (conservative) boundary

Q23. A planar bed has a true dip of 40°. In a vertical cliff whose trend makes an angle $\beta = 30^\circ$ with the strike, the apparent dip δ satisfies $\tan\delta = \tan(40^\circ) \times \sin(30^\circ)$, as sketched. The apparent dip is closest to: **[2 marks]**



(A) $40°$

(B) $20°$

(C) $90°$

(D) $22.7°$

Q24. The Indian and Eurasian plates converge at an average rate of about 4 cm per year. Assuming the rate is constant, the total convergence accumulated across the collision zone over 10 million years is: **[2 marks]**

(A) 40 km

(B) 400 km

(C) 4000 km

(D) 4 km

Palaeontology and Historical Geology

Q25. Large disc-shaped benthic foraminifera of the genus *Nummulites* are index microfossils that flourished in warm shallow seas and gave their name to the "Nummulitic Limestone" used to build the Egyptian pyramids. They chiefly characterise which epoch? **[2 marks]**

(A) Late Cretaceous

(B) Late Jurassic

(C) Eocene

(D) Permian

Q26. Which microfossil group consists of single-celled marine protists that build delicate tests of opaline silica (SiO_2), making them valuable in deep-sea biostratigraphy and palaeoceanography? **[2 marks]**

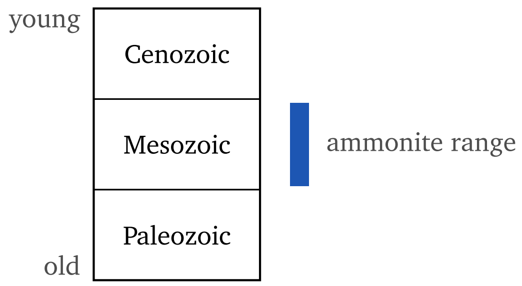
(A) Ostracods

(B) Conodonts

(C) Foraminifera

(D) Radiolaria

Q27. The range chart below shows the stratigraphic span of ammonites, coiled cephalopods that are among the best index fossils for correlation. Ammonites became extinct at the close of which era? **[2 marks]**



(A) Paleozoic

(B) Mesozoic

(C) Cenozoic

(D) Precambrian

Q28. The most severe mass extinction in Earth history, in which roughly 90% of all marine species were wiped out, occurred at the boundary between which two periods? **[2 marks]**

(A) Permian and Triassic

(B) Cretaceous and Paleogene

(C) Ordovician and Silurian

(D) Triassic and Jurassic

Q29. The stratigraphic principle stating that any rock fragment (or fossil) contained within another rock body must be older than the rock that encloses it is the principle of: **[2 marks]**

(A) Superposition

(B) Original horizontality

(C) Inclusions

(D) Cross-cutting relationships

Q30. Planktonic (free-floating) foraminifera are especially prized for correlating deep-marine sediments across ocean basins. The main reason is that they: **[2 marks]**

(A) are bottom-dwelling and restricted to one small area

(B) are dispersed widely through the surface oceans and evolved rapidly, giving short-ranged, wide-spread species

(C) are built of silica and dissolve everywhere below the sea floor

(D) live only in isolated freshwater lakes

Economic Geology and Mineral Resources

Q31. In reflected-light (ore) microscopy of polished sections, the diagnostic property that expresses the percentage of incident light an opaque ore mineral reflects, used as a key identifying character, is its: **[2 marks]**

(A) Birefringence

(B) Reflectance

(C) Transmitted-light pleochroism

(D) Cleavage angle

Q32. The order in which ore and gangue minerals crystallised in a deposit, worked out from cross-cutting, overgrowth and replacement textures seen under the ore microscope, is called the Nderlinehspace1.5cm sequence. **[2 marks]**

(A) Paragenetic

(B) Stratigraphic

(C) Diagenetic

(D) Metamorphic

Q33. The principal ore mineral of copper, a brassy-yellow sulphide with the chemical formula $CuFeS_2$, is: [2 marks]

(A) Sphalerite

(B) Galena

(C) Chalcopyrite

(D) Bornite

Q34. In the polished section of a hydrothermal vein sketched, a later galena grain clearly cuts across and replaces an earlier sphalerite grain. What does this texture establish about the paragenesis? [2 marks]

(A) Galena and sphalerite crystallised at exactly the same instant

(B) Sphalerite is younger than galena

(C) Sphalerite crystallised earlier than galena

(D) No age relation can be inferred from replacement textures

Q35. Stratabound lead–zinc sulphide ore bodies hosted in undeformed platform carbonate rocks, deposited at low temperature from migrating basinal brines and named for a classic mid-continent district of the United States, are known as Nderlinehspace1.5cm deposits. [2 marks]

(A) Porphyry copper

(B) Volcanogenic massive sulphide (VMS)

(C) Skarn

(D) Mississippi Valley-Type (MVT)

Q36. The Kolar and Hutti gold fields of southern India occur as gold-bearing quartz reefs (lodes) within Archaean greenstone belts. Genetically, such vein-hosted gold is an example of a Nderlinehspace1.5cm deposit. [2 marks]

(A) Hydrothermal (orogenic lode)

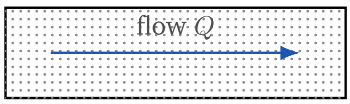
(B) Placer

(C) Evaporite

(D) Residual laterite

Hydrogeology and Engineering Geology

Q37. Groundwater moves horizontally through the sand-filled channel shown. Using Darcy's law $Q = K\,i\,A$ with hydraulic conductivity $K = 20$ m/day, hydraulic gradient $i = 0.03$ and cross-sectional area $A = 50$ m^2, the discharge Q is: [2 marks]



$K = 20$ m/day, $i = 0.03$, $A = 50$ m^2

(A) 300 m^3/day

(B) 3 m^3/day

(C) 60 m^3/day

(D) 30 m^3/day

Q38. The rock-mass classification scheme, widely used in tunnelling and foundation design, that combines the strength of intact rock, RQD, joint spacing, joint condition, groundwater and joint orientation into a single rating from 0 to 100, is the: [2 marks]

(A) Rock Mass Rating (RMR) of Bieniawski

(B) Mohs scale of hardness

(C) Wentworth grain-size scale

(D) Udden phi scale

Q39. The Rock Quality Designation (RQD) of a core run is the summed length of intact core pieces of 10 cm or longer, expressed as a percentage of the total run length. For a core run of 200 cm in which the sound pieces (≥ 10 cm) total 130 cm, the RQD is: **[2 marks]**

(A) 200%

(B) 65%

(C) 35%

(D) 13%

Q40. When a dimension stone or coarse aggregate is judged for durability and soundness, a LOW value of which of the following properties is generally desirable, because it indicates fewer connected voids and greater resistance to weathering? **[2 marks]**

(A) Unconfined compressive strength

(B) Bulk density

(C) Water absorption

(D) Modulus of elasticity

Q41. A cylindrical rock core has a bulk (total) volume of 250 cm^3 and a solid (grain) volume of 200 cm^3. Its porosity, expressed as a percentage, is: **[2 marks]**

(A) 80%

(B) 25%

(C) 50%

(D) 20%

Geochemistry, Geomorphology and Remote Sensing

Q42. In a stream-sediment geochemical survey, a sample site returning a metal concentration markedly above the normal spread of values, and which may point to a concealed ore source upstream, is called a: **[2 marks]**

(A) Geochemical anomaly

(B) Background value

(C) Threshold value

(D) Isotope ratio

Q43. In interpreting geochemical prospecting data, the concentration value chosen to separate the normal background population from the anomalous (potentially ore-related) population is termed the: **[2 marks]**

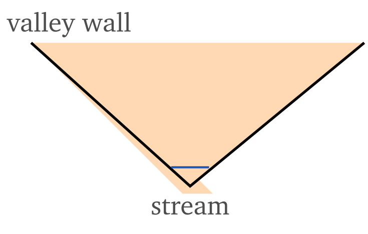
(A) Arithmetic mean

(B) Threshold

(C) Mode

(D) Median

Q44. The river-valley cross-profile shown is a narrow, steep-sided "V" with the stream occupying the full width of the floor, typical of a youthful mountain river. This form indicates that erosion is dominated by: **[2 marks]**



(A) Lateral erosion (sideways cutting)

(B) Glacial scour (producing a U-shape)

(C) Vertical erosion (downcutting)

(D) Wind (aeolian) deflation

Q45. In GIS-based mineral exploration, the analytical step in which several weighted thematic layers, such as lithology, structure and geochemistry, are integrated to generate a single mineral-prospectivity map is: **[2 marks]**

(A) Single-band grey-scale display

(B) Histogram (contrast) stretching of one image

(C) Supervised classification of a single scene

(D) Weighted overlay analysis of multiple layers

Q46. Elements present in a rock in very low concentrations, typically well below 0.1% (for example the rare-earth elements, used to fingerprint petrogenesis), are collectively referred to as: **[2 marks]**

(A) Major elements

(B) Trace elements

(C) Volatile elements

(D) Native elements

Detailed Solutions

Q1.

Solution

Concept – gem varieties of beryl: Beryl, $Be_3Al_2Si_6O_{18}$, is colourless when pure; trace transition metals give it distinct gem colours.

Step 1 – identify the colouring agent named: The question specifies a rich green colour caused by traces of chromium and vanadium.

Step 2 – match colour to variety: Chromium and vanadium in beryl produce the deep green gem called emerald.

Step 3 – fix the answer: Therefore the required variety is emerald.

Why the other options are wrong:

- B, aquamarine: pale blue-green, coloured by iron (Fe^{2+}), not chromium.
- C, morganite: pink to peach, coloured by manganese.
- D, heliodor: golden-yellow beryl, coloured by iron (Fe^{3+}).

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

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – crystal system of corundum: The crystal system is fixed by the symmetry and the axial scheme of the mineral.

Step 1 – recall the symmetry of corundum: Corundum (Al_2O_3) has a single principal axis and grows as barrel-shaped or tapering hexagonal prisms.

Step 2 – assign the system: That single high-order axis with a hexagonal outline places corundum in the trigonal (rhombohedral) division of the hexagonal system.

Step 3 – link to the gems: Ruby (Cr-bearing) and sapphire (Fe–Ti-bearing) are simply coloured corundum, so they share this trigonal symmetry.

Why the other options are wrong:

- A, isometric: has three equal axes at 90° and no unique principal axis.
- C, orthorhombic: has three unequal axes at 90°.
- D, monoclinic: has one oblique inter-axial angle.

Final Answer: Trigonal (hexagonal division) $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

Concept – the "fire" of a diamond: The flashes of spectral colour from a cut diamond come from an optical property, not from its body colour.

Step 1 – describe the phenomenon: White light entering the stone is separated into red, green, blue and the other component wavelengths.

Step 2 – name the property: The splitting of white light into its component colours by a difference of refractive index with wavelength is called dispersion.

Step 3 – confirm: Diamond has an exceptionally high dispersion (0.044), which is why it shows such vivid fire.

Why the other options are wrong:

- B, pleochroism: a colour change with viewing direction, absent in isotropic diamond.
- C, cleavage: a breakage property, unrelated to colour flashes.
- D, luminescence: light emitted after absorbing energy (e.g. UV), not the splitting of white light.

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

Answer: (A) Go Back to Q3

Q4.

Solution

Concept – crystal systems from axial lengths and angles: Each system has a characteristic set of axial lengths and inter-axial angles.

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 differs, $a = b \neq c$.

Step 3 – match the table: Two equal horizontal axes and one unequal vertical axis, all at $90°$, define the tetragonal system.

Why the other options are wrong:

- A, orthorhombic: all three axes unequal ($a \neq b \neq c$).
- C, isometric (cubic): all three axes equal ($a = b = c$).
- D, monoclinic: one inter-axial angle is not 90°.

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

Answer: (B) **Go Back to Q4**

Q5.

Solution

Concept – colour change in plane-polarised light: With a single polariser inserted, some coloured anisotropic minerals absorb light differently along different vibration directions.

Step 1 – interpret the observation: The grain changes absorption colour (for example brown to pale yellow) as the stage rotates.

Step 2 – name the property: Selective absorption that produces a change of colour with vibration direction is called pleochroism.

Step 3 – confirm with examples: Biotite and tourmaline are classic strongly pleochroic minerals.

Why the other options are wrong:

- B, isotropic: shows a single colour that does not change on rotation.
- C, opaque: transmits no light, so no colour is seen in transmitted light.
- D, isometric: describes crystal symmetry, not an optical absorption effect.

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

Answer: (A) **Go Back to Q5**

Q6.

Solution

Concept – asterism in gemstones: Asterism is a star of light seen in a cabochon-cut stone that contains oriented needle-like inclusions.

Step 1 – recall the mechanism: Fine rutile needles arranged along three directions of the host crystal reflect light into intersecting bands.

Step 2 – identify the host mineral: In corundum the rutile needles lie along three directions 120° apart, giving a six-rayed star (star sapphire, star ruby).

Step 3 – conclude: Hence the star effect belongs to star sapphire (corundum).

Why the other options are wrong:

- B, calcite: a transparent carbonate noted for double refraction, not asterism.
- C, orthoclase feldspar: may show adularescence or schiller, not a rutile star.
- D, fluorite: known for fluorescence and octahedral cleavage, not asterism.

Final Answer: Star sapphire (corundum) $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – partial melting in the deep crust: When crustal temperatures rise high enough, the lowest-melting fraction of a rock begins to melt while refractory minerals stay solid.

Step 1 – describe the process: This in-situ partial melting of a solid rock is what generates migmatites.

Step 2 – name it: Partial melting of a pre-existing rock is called anatexis.

Step 3 – link to the product: The melt fraction crystallises as light bands, giving the mixed igneous–metamorphic rock called a migmatite.

Why the other options are wrong:

- A, metasomatism: change of bulk composition by fluid-borne ions, without necessarily melting.
- B, diagenesis: low-temperature changes in sediments, far below melting.
- C, cataclasis: mechanical grinding and fracturing of rock, a brittle process.

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

Answer: (D) Go Back to Q7

Q8.

Solution

Concept – the parts of a migmatite: A migmatite is described by naming its dark and light components.

Step 1 – recall the terms: The dark, mafic-rich part is the melanosome; the unmelted host is the palaeosome (or restite where residual).

Step 2 – identify the light part: The pale quartz–feldspar-rich part represents the crystallised partial melt.

Step 3 – name it: That light quartzofeldspathic band is the leucosome.

Why the other options are wrong:

- A, melanosome: the dark (biotite/hornblende-rich) part.
- B, palaeosome: the original, little-changed parent rock.
- D, restite: the refractory solid residue left after melt extraction.

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

Answer: (C) Go Back to Q8

Q9.

Solution

Concept – the QAPF classification of plutonic rocks: Quartz-bearing plutonic rocks are named from the ratio of alkali feldspar (A) to plagioclase (P).

Step 1 – place the rock: The rock has essential quartz, so it plots in the upper part of the QAPF triangle.

Step 2 – read the feldspar ratio: Plagioclase strongly dominates over alkali feldspar, shifting the plot toward the P corner.

Step 3 – name the field: Quartz-rich rock with plagioclase $>$ alkali feldspar (but still some alkali feldspar) is granodiorite.

Why the other options are wrong:

- A, syenite: alkali-feldspar-rich and quartz-poor.
- C, gabbro: a mafic plagioclase–pyroxene rock with little or no quartz.
- D, dunite: an ultramafic rock made almost wholly of olivine.

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

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – Barrovian index minerals track grade: In pelitic rocks, new index minerals appear one after another as metamorphic grade rises: chlorite $\rightarrow$ biotite $\rightarrow$ garnet $\rightarrow$ staurolite $\rightarrow$ kyanite $\rightarrow$ sillimanite.

Step 1 – order the four options by grade: Chlorite (lowest) $<$ biotite $<$ garnet $<$ sillimanite (highest).

Step 2 – pick the highest: Sillimanite marks the highest grade among the four minerals given.

Step 3 – confirm: Sillimanite forms at the highest temperatures of the Barrovian series, near the onset of anatexis.

Why the other options are wrong:

- A, chlorite: the lowest-grade (greenschist) index mineral.
- B, biotite: appears just above chlorite, still low grade.
- D, garnet: mid-grade, below staurolite, kyanite and sillimanite.

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

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q10

Q11.

Solution

Concept – the Deccan flood basalts: Continental flood-basalt provinces are built of vast piles of low-viscosity lava.

Step 1 – recall the setting: The Deccan Traps formed by voluminous fissure eruptions near the end of the Cretaceous.

Step 2 – identify the rock: Such flood eruptions produce iron- and magnesium-rich, silica-poor lava.

Step 3 – name it: The Deccan Traps are dominantly tholeiitic basalt.

Why the other options are wrong:

- A, rhyolite: silica-rich felsic lava, not typical of the Deccan.
- B, andesite: intermediate lava of subduction settings.
- D, granite: a coarse plutonic rock, not an extrusive flood lava.

Final Answer: Tholeiitic basalt $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q11

Q12.

Solution

Concept – porphyroblast textures: Metamorphic textures are named for the shape and inclusion content of the grains.

Step 1 – read the texture: A large porphyroblast (here garnet) is crowded with many small inclusions of the earlier matrix.

Step 2 – name the inclusion-rich habit: A crystal riddled with inclusions, like a sieve, is described as poikiloblastic.

Step 3 – note the value: The trapped inclusion trails can preserve an earlier fabric (S_i) and record the growth history.

Why the other options are wrong:

- A, granoblastic: equant grains with straight boundaries (e.g. quartzite).
- B, nematoblastic: parallel prismatic/needle grains (e.g. amphibole).
- C, lepidoblastic: parallel platy grains (e.g. micas).

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

Answer: (D) Go Back to Q12

Q13.

Solution

Concept – evaporite rocks: Chemical sediments precipitated from evaporating seawater are named for their dominant mineral.

Step 1 – read the mineral given: The rock is composed chiefly of halite, NaCl.

Step 2 – name the rock: A rock made of halite is rock salt (halite rock).

Step 3 – confirm the setting: Rock salt forms in restricted basins where seawater evaporates strongly, as in sabkhas and barred lagoons.

Why the other options are wrong:

- A, chert: a hard siliceous rock (SiO_2), not a halite evaporite.
- C, coal: an organic sedimentary rock formed from plant matter.
- D, limestone: a carbonate rock of calcite, not sodium chloride.

Final Answer: Rock salt $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – the evaporite precipitation sequence: As seawater evaporates, minerals crystallise in order of decreasing abundance and increasing solubility.

Step 1 – recall the sequence: First carbonates (calcite/dolomite), then sulphates (gypsum/anhydrite), then halite, and finally the highly soluble potassium and magnesium salts.

Step 2 – rank the options by solubility: Calcite (least soluble) $<$ gypsum $<$ halite $<$ potash salts (most soluble).

Step 3 – pick the last to precipitate: The most soluble salts, the potash (sylvite/carnallite) salts, crystallise last, only after the brine is nearly exhausted.

Why the other options are wrong:

- A, calcite: precipitates first, at only slight concentration.
- B, gypsum: precipitates early, when about 80% of the water is gone.
- C, halite: precipitates before the potash salts, at higher solubility than gypsum but lower than sylvite.

Final Answer: Potash salts (sylvite) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q14

Q15.

Solution

Concept – petroleum source rocks: Hydrocarbons are generated from fine-grained sediments rich in preserved organic matter.

Step 1 – read the clues: Dark, finely laminated, organic-rich mudrock that yields oil on heating.

Step 2 – name the rock: A laminated organic-rich mudrock that is the source of petroleum is an oil (black) shale.

Step 3 – confirm the role: On burial and heating, its kerogen matures to oil and gas, making it the classic source rock.

Why the other options are wrong:

- A, arkose: a feldspar-rich sandstone, a potential reservoir, not a source.
- B, bedded chert: a siliceous rock, not organic-rich.
- D, chalk: a fine white limestone, generally organic-poor.

Final Answer: Oil (black) shale $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept – vertical grain-size trends in a bed: A single bed can record how the transporting current changed with time.

Step 1 – read the trend: The bed passes from coarse at the base upward to fine at the top.

Step 2 – name the structure: An upward-fining single bed is called graded bedding (normal grading).

Step 3 – link to process: It forms as a decelerating (waning) turbidity current drops its coarsest load first and its finest load last, the basis of the Bouma sequence.

Why the other options are wrong:

- A, cross-bedding: inclined laminae from migrating ripples/dunes, not a size gradient.
- B, massive bedding: a bed with no internal structure or grading.
- D, flaser bedding: mud drapes in ripple troughs, a tidal structure.

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

Answer: (C) Go Back to Q16

Q17.

Solution

Concept – Dunham's carbonate classification: Dunham names limestones by whether they are grain-supported or mud-supported and by the amount of mud and grains.

Step 1 – read the fabric: The rock is mud-supported (matrix holds it together), so it is not a grainstone.

Step 2 – read the grain content: It contains more than about 10% grains floating in the mud.

Step 3 – name it: Mud-supported with $> 10\%$ grains is a wackestone.

Why the other options are wrong:

- A, mudstone: mud-supported but with fewer than 10% grains.
- B, grainstone: grain-supported and mud-free.
- C, boundstone: components bound together in situ (e.g. a reef framework).

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

Answer: (D) Go Back to Q17

Q18.

Solution

Concept – Walther's Law of the correlation of facies: This law links the vertical stacking of facies to their lateral arrangement.

Step 1 – state the law: In a conformable succession (one with no break), the facies that follow one another vertically are the same facies that lay side by side in adjacent depositional environments.

Step 2 – apply the condition: The rule holds only where the vertical succession is conformable, with no unconformity between the facies.

Step 3 – choose the matching statement: Option A states exactly this relationship, so it is correct.

Why the other options are wrong:

- B: contradicts superposition; the oldest bed lies at the bottom, not the top.
- C: Walther's Law applies to conformable successions, not to unconformity-bounded ones.
- D: original horizontality does not require an exclusively marine setting.

Final Answer: Adjacent lateral facies succeed one another vertically in a conformable sequence $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q18

Q19.

Solution

Concept – classifying folds by form and younging: Folds are named from the way the limbs dip and from where the youngest beds lie.

Step 1 – read the geometry: The beds sag into a trough and the two limbs dip inward toward the hinge.

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

Step 3 – name the fold: A trough-shaped fold with the youngest beds in the core is a syncline.

Why the other options are wrong:

- B, anticline: an up-arch with the oldest beds in the core.
- C, monocline: a one-limbed step-like flexure.
- D, structural dome: a circular up-warp that dips away in all directions.

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

Answer: (A) Go Back to Q19

Q20.

Solution

Concept – the major thrusts of the Himalaya: The Himalaya is stacked by a set of north-dipping thrusts that young southward toward the foreland.

Step 1 – list the thrust order (north to south): Indus–Tsangpo Suture, then MCT, then MBT, then the Main Frontal Thrust.

Step 2 – identify the required boundary: The thrust that carries the Lesser Himalaya over the Sub-Himalayan Siwaliks is the Main Boundary Thrust.

Step 3 – confirm: The MBT marks the boundary between the Lesser Himalaya and the youngest foreland (Siwalik) belt.

Why the other options are wrong:

- A, MCT: separates the High (Greater) Himalaya crystallines from the Lesser Himalaya, farther north.
- B, STDS: a normal-sense detachment at the top of the Greater Himalaya, not a southern thrust.
- C, Indus–Tsangpo Suture: marks the India–Asia join, far to the north.

Final Answer: Main Boundary Thrust (MBT) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – resolving net slip into throw: On a dip-slip fault the vertical component of the slip is the throw.

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

Step 2 – insert the values: throw $= 20 \times \sin(60°)$.

Step 3 – evaluate the sine: $\sin(60°) = 0.866$.

Step 4 – multiply: throw $= 20 \times 0.866 = 17.32$ m.

Step 5 – round: The throw is about 17.3 m.

Why the other options are wrong:

- B, 10 m: would be $20 \times \sin(30°)$, using the wrong angle.
- C, 20 m: assumes the fault is vertical ($\sin 90° = 1$).
- D, 11.5 m: uses $\cos 60°$ (heave), not $\sin 60°$.

Final Answer: 17.3 m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept – types of convergent plate boundary: Convergent boundaries differ according to whether oceanic or continental lithosphere is involved.

Step 1 – identify the plates: Both the leading edge of India and the margin of Asia are buoyant continental lithosphere.

Step 2 – consider the behaviour: Continental lithosphere is too light to subduct fully, so the plates crumple and thicken instead of one sinking.

Step 3 – name the boundary: This is a continent–continent collision zone, which built the Himalaya and the Tibetan Plateau.

Why the other options are wrong:

- A, ocean–ocean subduction: needs two oceanic plates, forming island arcs, not a continental collision belt.
- C, divergent boundary: plates move apart and make new crust, the opposite

of collision.

- D, transform boundary: plates slide past each other with little crustal thickening.

Final Answer: Continent–continent collision zone $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept – apparent dip is always less than true dip: Any section not perpendicular to strike records a shallower (apparent) dip than the true dip.

Step 1 – write the relation: $\tan\delta = \tan(\text{true dip}) \times \sin\beta$, where β is the angle between the section and the strike.

Step 2 – insert the values: $\tan\delta = \tan(40°) \times \sin(30°)$.

Step 3 – evaluate the terms: $\tan(40°) = 0.839$ and $\sin(30°) = 0.5$.

Step 4 – multiply: $\tan\delta = 0.839 \times 0.5 = 0.4195$.

Step 5 – take the inverse tangent: $\delta = \tan^{-1}(0.4195) \approx 22.7°$.

Why the other options are wrong:

- A, $40°$: equals the true dip, which occurs only for a section at right angles to strike.
- B, $20°$: a rough guess, not the computed value.
- C, $90°$: impossible, as apparent dip cannot exceed the true dip of $40°$.

Final Answer: $22.7° \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q23

Q24.

Solution

Concept – distance from a constant plate rate: Total displacement equals rate multiplied by time, with careful unit handling.

Step 1 – state the rate and time: Rate $= 4$ cm/yr; time $= 10$ million years $= 10^7$ yr.

Step 2 – multiply rate by time: Distance $= 4$ cm/yr $\times 10^7$ yr $= 4 \times 10^7$ cm.

Step 3 – convert centimetres to metres: 4×10^7 cm $\div 100 = 4 \times 10^5$ m.

Step 4 – convert metres to kilometres: 4×10^5 m $\div 1000 = 400$ km.

Why the other options are wrong:

- A, 40 km: off by a factor of ten (a unit-conversion slip).
- C, 4000 km: too large by a factor of ten.
- D, 4 km: too small by a factor of one hundred.

Final Answer: 400 km $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q24

Q25.

Solution

Concept – *Nummulites* as index microfossils: Large benthic foraminifera pin down the age of shallow-marine limestones.

Step 1 – recall the range of *Nummulites*: *Nummulites* flourished after the dinosaur extinction, in the early Palaeogene warm seas.

Step 2 – identify the epoch: Their acme is the Eocene, giving the "Nummulitic Limestone".

Step 3 – confirm the cultural note: This Eocene limestone was quarried to build the Egyptian pyramids, consistent with an Eocene age.

Why the other options are wrong:

- A, Late Cretaceous: predates the main *Nummulites* radiation.
- B, Late Jurassic: far too old; *Nummulites* had not yet evolved.
- D, Permian: a Palaeozoic period, long before these foraminifera appeared.

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

Answer: (C) Go Back to Q25

Q26.

Solution

Concept – test mineralogy of microfossil groups: Different microfossil groups build their skeletons of different materials.

Step 1 – recall the compositions: Foraminifera and ostracods use calcite; conodonts use calcium phosphate; radiolaria and diatoms use opaline silica.

Step 2 – match the clue: The group described builds tests of opaline silica (SiO_2).

Step 3 – name it: Single-celled silica-secreting marine protists are the radiolaria.

Why the other options are wrong:

- A, ostracods: bivalved crustaceans with calcite carapaces.
- B, conodonts: tooth-like elements of calcium phosphate.
- C, foraminifera: mostly calcareous (calcite) tests.

Final Answer: Radiolaria $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q26

Q27.

Solution

Concept – reading a fossil range chart: The top of a fossil's range bar marks its extinction level on the time scale.

Step 1 – read the range bar: The ammonite bar spans the Mesozoic and ends at the top of the Mesozoic block.

Step 2 – interpret the top of the bar: The upper end lies at the Mesozoic–Cenozoic boundary, i.e. the end-Cretaceous event.

Step 3 – name the era: Ammonites therefore became extinct at the close of the Mesozoic Era.

Why the other options are wrong:

- A, Paleozoic: the ammonites' close relatives arose here, but true ammonites persisted well beyond it.
- C, Cenozoic: ammonites were already gone before the Cenozoic began.
- D, Precambrian: far too old, before shelled cephalopods existed.

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

Answer: (B) Go Back to Q27

Q28.

Solution

Concept – the great mass extinctions: Earth history records five major extinctions of differing severity.

Step 1 – recall the largest one: The most severe extinction, removing about 90% of marine species, is the "Great Dying".

Step 2 – place it in time: It occurred at the end of the Permian, at the Permian–Triassic boundary.

Step 3 – fix the answer: Hence the boundary is between the Permian and Triassic periods.

Why the other options are wrong:

- B, Cretaceous–Paleogene: severe (dinosaur extinction) but smaller than the end-Permian.
- C, Ordovician–Silurian: a major extinction, but less severe than the end-Permian.
- D, Triassic–Jurassic: an extinction event, but not the largest.

Final Answer: Permian and Triassic $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – the principle of inclusions: Relative-age principles let us order rocks without numerical dates.

Step 1 – state the rule: A fragment enclosed within a host rock must have existed before the host, so the inclusion is older.

Step 2 – name the principle: This is the principle of inclusions.

Step 3 – give an example: Granite clasts within a sandstone show the granite is older than the sandstone that contains them.

Why the other options are wrong:

- A, superposition: says lower beds are older, in undisturbed strata.
- B, original horizontality: says sediments are deposited in near-horizontal layers.
- D, cross-cutting relationships: says a feature that cuts another is younger

than the one it cuts.

Final Answer: Principle of inclusions $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q29

Q30.

Solution

Concept – why planktonic foraminifera are ideal index fossils: A good index fossil is widespread and short-ranged.

Step 1 – consider their habitat: Planktonic foraminifera drift in the surface waters of the open ocean, so they are spread across whole ocean basins.

Step 2 – consider their evolution: They evolved rapidly, so individual species existed for only short intervals.

Step 3 – combine the two properties: Wide geographic spread plus short time range gives species that are both widely correlatable and finely age-diagnostic.

Why the other options are wrong:

- A: they are planktonic and widespread, not benthic and local.
- C: their tests are calcareous, and dissolution below the CCD is a limitation, not the reason they are useful.
- D: they are marine, not freshwater, organisms.

Final Answer: Widely dispersed and rapidly evolving $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept – diagnostic properties in ore microscopy: Opaque ore minerals are studied in reflected light, where transmitted-light properties do not apply.

Step 1 – consider what can be measured: An opaque grain reflects a fraction of the incident light back to the objective.

Step 2 – name the property: The percentage of incident light reflected is the reflectance, a primary identifying character (for example galena is bright, sphalerite dull).

Step 3 – confirm: Reflectance, together with colour and bireflectance, allows opaque minerals to be told apart.

Why the other options are wrong:

- A, birefringence: a transmitted-light property of transparent minerals.
- C, transmitted-light pleochroism: also requires light to pass through the grain, impossible for opaques.
- D, cleavage angle: a physical property, not the main reflected-light identifier.

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

Answer: (B) Go Back to Q31

Q32.

Solution

Concept – ordering of ore minerals: The relative timing of mineral growth is deduced from their mutual textures.

Step 1 – read the evidence used: Cross-cutting, overgrowth and replacement relations under the ore microscope.

Step 2 – name the ordered sequence: The resulting order of crystallisation is the paragenetic sequence (paragenesis).

Step 3 – state its use: It records how the ore fluid evolved and which minerals formed early or late.

Why the other options are wrong:

- B, stratigraphic: refers to the layering of sedimentary rocks, not mineral growth order.
- C, diagenetic: describes post-depositional changes in sediments.
- D, metamorphic: refers to recrystallisation under heat and pressure, a different context.

Final Answer: Paragenetic sequence $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – the chief copper ore mineral: Copper is won mainly from sulphide ores.

Step 1 – read the formula given: $CuFeS_2$, a copper–iron sulphide.

Step 2 – match the mineral: The brassy-yellow sulphide $CuFeS_2$ is chalcopyrite.

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

Why the other options are wrong:

- A, sphalerite: ZnS, the ore of zinc.
- B, galena: PbS, the ore of lead.
- D, bornite: Cu_5FeS_4, a copper ore but with a different formula and purple tarnish.

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

Answer: (C) Go Back to Q33

Q34.

Solution

Concept – reading replacement textures for paragenesis: When one mineral cuts across and replaces another, their relative ages are fixed.

Step 1 – read the texture: Galena cuts across and replaces sphalerite.

Step 2 – apply the cross-cutting rule: The mineral that cuts and replaces is the younger one, so galena is younger.

Step 3 – conclude for the earlier mineral: Therefore sphalerite crystallised earlier than galena.

Why the other options are wrong:

- A: replacement shows a clear age difference, not simultaneous growth.
- B: reverses the relation; the replacing galena is younger, not older.
- D: replacement textures are precisely what let us infer the age order.

Final Answer: Sphalerite crystallised earlier than galena $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q34

Q35.

Solution

Concept – carbonate-hosted Pb–Zn deposits: Certain lead–zinc ores form in flat-lying limestones from cool basinal fluids.

Step 1 – read the setting: Stratabound sulphides in undeformed platform carbonates, deposited at low temperature from basinal brines.

Step 2 – match the deposit type: This description defines Mississippi Valley-Type (MVT) deposits, named for the classic mid-continent US district.

Step 3 – confirm the ore: MVT ores are chiefly galena and sphalerite with fluorite and barite gangue.

Why the other options are wrong:

- A, porphyry copper: large low-grade Cu–Mo bodies around felsic intrusions, high-temperature.
- B, VMS: sulphides formed on the sea floor at volcanic centres.
- C, skarn: high-temperature contact ores at intrusion–carbonate contacts.

Final Answer: Mississippi Valley-Type (MVT) $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q35

Q36.

Solution

Concept – lode (vein) gold in greenstone belts: Gold quartz reefs in ancient greenstone belts are a major class of gold deposit.

Step 1 – read the description: Gold occurs in quartz reefs within Archaean greenstone belts at Kolar and Hutti.

Step 2 – identify the genesis: Such quartz-vein gold precipitated from hot, mineralising fluids during deformation, an orogenic (hydrothermal lode) process.

Step 3 – name the deposit type: These are hydrothermal (orogenic lode) gold deposits.

Why the other options are wrong:

- B, placer: gold concentrated by rivers in loose gravels, not in solid quartz reefs.
- C, evaporite: forms by evaporation of brines, unrelated to gold veins.
- D, residual laterite: forms by tropical weathering, not vein filling.

Final Answer: Hydrothermal (orogenic lode) gold $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q36

Q37.

Solution

Concept – Darcy's law for groundwater flow: The volumetric discharge equals conductivity times gradient times area.

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

Step 2 – list the values: $K = 20$ m/day, $i = 0.03$, $A = 50$ m^2.

Step 3 – multiply K and i: $20 \times 0.03 = 0.6$ m/day.

Step 4 – multiply by the area: $Q = 0.6 \times 50 = 30$ m^3/day.

Why the other options are wrong:

- A, 300 m^3/day: uses $i = 0.3$ instead of 0.03.
- B, 3 m^3/day: drops a factor of ten in the area or gradient.
- C, 60 m^3/day: doubles the correct value by mishandling the gradient.

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

Answer: (D) Go Back to Q37

Q38.

Solution

Concept – rock-mass classification for engineering: Design in rock uses schemes that combine several rock-mass parameters into one rating.

Step 1 – read the parameters listed: Intact-rock strength, RQD, joint spacing, joint condition, groundwater and joint orientation.

Step 2 – match to the scheme: The scheme that sums these six parameters into a rating of 0 to 100 is Bieniawski's Rock Mass Rating (RMR).

Step 3 – confirm the use: RMR guides support design for tunnels, slopes and foundations.

Why the other options are wrong:

- B, Mohs scale: ranks mineral hardness, not rock-mass quality.
- C, Wentworth scale: classifies sediment grain sizes.
- D, Udden phi scale: another grain-size scale, not a rock-mass rating.

Final Answer: Rock Mass Rating (RMR) $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q38

Q39.

Solution

Concept – Rock Quality Designation (RQD): RQD measures core intactness as a percentage.

Step 1 – write the definition: $\text{RQD} = \dfrac{\sum \text{lengths of intact pieces} \geq 10\ \text{cm}}{\text{total core-run length}} \times 100.$

Step 2 – insert the values: $\text{RQD} = \dfrac{130}{200} \times 100.$

Step 3 – divide: $\dfrac{130}{200} = 0.65.$

Step 4 – express as a percentage: $0.65 \times 100 = 65\%.$

Step 5 – interpret: An RQD of 65% classes the rock as "fair" quality.

Why the other options are wrong:

- A, 200%: an RQD can never exceed 100%.
- C, 35%: is the complement $(100 - 65)$, the fraction of poor core.
- D, 13%: mistakenly divides 130 by 1000.

Final Answer: $65\% \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept – durability of dimension stone and aggregate: Connected pore space lets water in, which lowers strength and speeds weathering.

Step 1 – link the property to voids: Water absorption measures the volume of connected pores that fill with water.

Step 2 – decide the desirable direction: A low water absorption means few connected voids, so the stone is denser and more durable.

Step 3 – select the property: Therefore a low value of water absorption is desirable.

Why the other options are wrong:

- A, unconfined compressive strength: here a HIGH value is desirable, not a low one.
- B, bulk density: a higher density generally goes with better quality, not lower.
- D, modulus of elasticity: describes stiffness; a low value is not the durability indicator sought.

Final Answer: Water absorption $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept – porosity from bulk and grain volumes: Porosity is the pore volume expressed as a fraction of the bulk volume.

Step 1 – find the pore volume: Pore volume $=$ bulk volume $-$ grain volume $= 250 - 200 = 50$ cm^3.

Step 2 – write the porosity formula: $n = \dfrac{\text{pore volume}}{\text{bulk volume}} \times 100$.

Step 3 – insert the values: $n = \dfrac{50}{250} \times 100$.

Step 4 – divide: $\dfrac{50}{250} = 0.20$.

Step 5 – express as a percentage: $0.20 \times 100 = 20\%$.

Why the other options are wrong:

- A, 80%: is the solid (grain) fraction, not the porosity.
- B, 25%: wrongly divides the pore volume by the grain volume ($50/200$).
- C, 50%: confuses the pore volume value with a percentage.

Final Answer: $20\% \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept – geochemical anomalies in prospecting: Exploration geochemistry looks for values that stand out from the normal spread.

Step 1 – describe the observation: One sample returns a metal content far above the ordinary range of the survey.

Step 2 – name it: A value that departs markedly from the background population is a geochemical anomaly.

Step 3 – state its significance: An anomaly may signal a hidden ore source, often upstream of the anomalous stream-sediment site.

Why the other options are wrong:

- B, background value: the normal, non-mineralised level, the opposite of an anomaly.
- C, threshold value: the cut-off separating background from anomaly, not the high value itself.
- D, isotope ratio: a measurement of isotopic composition, unrelated to this definition.

Final Answer: Geochemical anomaly $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q42

Q43.

Solution

Concept – separating background from anomaly: Prospecting data are split into a normal population and an anomalous one by a chosen cut-off.

Step 1 – define the cut-off: The value above which readings are treated as anomalous is the dividing line.

Step 2 – name it: This dividing value is the threshold (often set at mean plus two standard deviations of the background).

Step 3 – use it: Values above the threshold are followed up as targets; those below are treated as background.

Why the other options are wrong:

- A, arithmetic mean: a measure of central tendency, not the anomaly cut-off.
- C, mode: the most frequent value, not the separating limit.
- D, median: the middle value, again a central measure, not the threshold.

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

Answer: (B) Go Back to Q43

Q44.

Solution

Concept – valley cross-profiles record the dominant erosion style: The shape of a river valley reflects whether the river cuts down or sideways.

Step 1 – read the profile: A narrow, steep-sided "V" with the stream filling the floor.

Step 2 – link shape to process: A tight V-shape means the river is cutting downward faster than it widens the valley.

Step 3 – name the dominant process: This youthful form is produced by dominant vertical erosion (downcutting).

Why the other options are wrong:

- A, lateral erosion: widens the valley and builds a broad floodplain (a mature stage), giving a wide flat floor, not a V.
- B, glacial scour: produces a broad U-shaped valley, not a V.
- D, wind deflation: an arid-land process, not the sculptor of river valleys.

Final Answer: Vertical erosion (downcutting) $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q44

Q45.

Solution

Concept – GIS integration for mineral prospectivity: GIS combines many map layers to highlight ground favourable for ore.

Step 1 – read the task: Several weighted thematic layers (lithology, structure, geochemistry) are to be merged into one prospectivity map.

Step 2 – name the operation: Assigning weights to each layer and summing them cell by cell is weighted overlay analysis.

Step 3 – state the output: The result is a single map ranking areas by their favourability for mineralisation.

Why the other options are wrong:

- A, single-band display: just shows one image, with no integration.
- B, histogram stretching: an image-enhancement step, not multi-layer integration.
- C, supervised classification: labels pixels of one scene, not a weighted merge

of themes.

Final Answer: Weighted overlay analysis of multiple layers $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept – major versus trace elements: Geochemists group rock-forming elements by their concentration.

Step 1 – recall the threshold: Major elements occur in percent amounts; trace elements occur below about 0.1% (roughly 1000 ppm).

Step 2 – read the clue: The elements described are present far below 0.1% and include the rare-earth elements.

Step 3 – name the group: Such low-abundance elements are the trace elements.

Why the other options are wrong:

- A, major elements: the abundant ones (Si, Al, Fe, Ca, and so on) present in percent amounts.
- C, volatile elements: those readily lost as gas (e.g. H, C, S), a different grouping.
- D, native elements: elements found uncombined in nature (e.g. gold, copper), not a concentration class.

Final Answer: Trace elements $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q46

Answer Key

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