UPSC

Comb. Geo Scientist (Prelims)

Previous Year Paper

(Geology/Hydrogeology)

09 Feb, 2025

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

T.B.C. : ESGC-B-GHD

Combined Geo-Scientist (P) Examination-2025

Test Booklet Series

A

Serial 1004945

TEST BOOKLET

Paper-II

Geology / Hydrogeology

Time Allowed : Two Hours *Maximum Marks : 300*

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET ***DOES NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.

(iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Soil type)	*List-II (Description)*
A. Histosols	1. Soils with a subsurface horizon of clay accumulation, highly leached; commonly found in humid tropical and subtropical climates.
B. Oxisols	2. Soils with a thick upper layer very rich in organic matter (0.25%) and containing relatively little mineral material.
C. Ultisols	3. Very old, highly leached soils with subsurface accumulation of iron and aluminium oxides, commonly found in tropical environments.
D. Vertisols	4. Soils that develop deep, wide cracks when dry (shrink and swell) due to high clay content (0.35%) and are not highly leached.

Code :

	A	B	C	D
(a)	4	3	1	2
(b)	2	1	3	4
(c)	2	3	1	4
(d)	4	1	3	2

2. Consider the following statements regarding seismic waves :

Statement 1 : The seismic waves follow curved paths.

Statemen 2 : The velocity of seismic waves generally increases with depth — the result of increasing pressure that squeezes the rock into a more compact, rigid material.

Which one of the following is correct in respect of above statements ?

(a) Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.

(b) Both statement 1 and statement 2 are true and statement 2 is ***not*** the correct explanation of statement 1.

(c) Statement 1 is true but statement 2 is false.

(d) Statement 1 is false but statement 2 is true.

3. Consider the following statements :

Statement 1 : Residence times of chemicals in the atmosphere are usually longer than those in the oceans.

Statement 2 : In terms of total mass, the atmosphere is a smaller reservoir than the oceans, and fluxes into and out of the atmosphere can be larger.

Which one of the following is correct in respect of above statements ?

(a) Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.

(b) Both statement 1 and statement 2 are true and statement 2 is ***not*** the correct explanation of statement 1.

(c) Statement 1 is true but statement 2 is false.

(d) Statement 1 is false but statement 2 is true.

4. Which one of the following pairs is ***not*** correctly matched ?

(a) Cinder Cones : A bowl-shaped pit found at the summit of most volcanic mountains, surrounding the central vent

(b) Stratovolcanoes : Mount Fuji in Japan is an example

(c) Calderas : Large steep walled, basin-shaped depression much larger than crater

(d) Diatremes : Kimberlite pipes are perhaps most exotic diatremes

5. Considering that there is no erosion and the thickness of the crust is doubled, the change of elevation because of isostasy would be roughly :

(a) 50%

(b) 40%

(c) 20%

(d) 10%

6. Consider the following statements regarding Hot spot :

Statement 1 : A hot spot is an area of volcanism, high heat flow and crustal uplifting.

Statement 2 : Hot spot is the surface manifestation of the mantle plume and partial melting.

Which one of the following is correct in respect of above statements ?

(a) Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.

(b) Both statement 1 and statement 2 are true and statement 2 is ***not*** the correct explanation of statement 1.

(c) Statement 1 is true but statement 2 is false.

(d) Statement 1 is false but statement 2 is true.

7. At any one location, sea-level change during deglaciation reflects :

(a) Eustatic and tectonic components only

(b) Eustatic and isostatic components only

(c) Tectonic and isostatic components only

(d) Eustatic, isostatic and tectonic components

8. Which one of the following processes is responsible for distribution of energy, degree of erosion, sediment transport and deposition along the shore ?

(a) Beach drift

(b) Wave refraction

(c) Longshore current

(d) Rip currents

9. Consider the following statements regarding depositional glacial landforms :

1. Eskers are deposited by subglacial fluvial system.
2. The larger terminal moraines are generated by a fast-retreating glacier.
3. Medial moraines typically display a rounded crest and relatively straight limbs.

Which of the statement(s) given above is/are correct ?

(a) 1 and 2

(b) 1 only

(c) 2 and 3

(d) 1 and 3

10. Consider the following statements regarding drumlins :

1. These are characterized by smooth, elongated, parallel hills.
2. These are deposition features.
3. Its gentler longer slope points towards upstream direction from which the ice advances.
4. Mostly found as an isolated landform.

Which of the statements given above are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 1, 3 and 4

(d) 3 and 4

11. Consider the following statements regarding mechanical weathering :

1. Removal of surface material results in easing of confining pressure on the underlying rocks.
2. Under natural conditions, dilation of a rock takes place at right angles to an erosional surface.
3. The dilation results in cracks running at right angles to the surface.

Which of the statement(s) given above is/are correct ?

(a) 1 and 2
(b) 1 and 3
(c) 2 and 3
(d) 3 only

12. Which one of the following statements is ***not*** correct ?

(a) Incongruent dissolution occurs when all the constituents of an individual molecule are separated and remain in solution.
(b) During incongruent dissolution, some of the released ions recombine to create new compounds and secondary minerals.
(c) In hydrolysis reactions, mineral cations are released into solution and replaced by hydrogen, producing new mineral.
(d) Conversion of anhydrite to gypsum is an example of hydration.

13. If σ_1 represents the maximum principal compressive stress, which one of the following statements is correct for a normal faulting regime ?

(a) σ_1 is horizontal.
(b) σ_1 is vertical.
(c) σ_1 is inclined at 60° from the horizontal.
(d) σ_1 is perpendicular to the fault plane.

14. Which one of the following statements regarding pure shear deformation is correct ?

(a) The orientations of the principal axes of strain ellipsoid continuously change during the deformation.
(b) The principal axes of strain ellipsoid always coincide with the principal axes of strain.
(c) The orientations of the principal axes of strain ellipsoid do not coincide with the orientations of the principal axes of strain.
(d) It is a special type of constant volume deformation having no stretching or shortening of lines.

15. Consider the following statements regarding transected cleavage in a folded rock :

1. Transected cleavage forms parallel to the axial plane of the fold.
2. Transected cleavage forms when folding occurs in a layer-oriented oblique to all the principal axes of strain.
3. Transected cleavage forms concurrently with the associated fold.

Which of the statement(s) given above is/are correct ?

(a) 1, 2 and 3
(b) 2 and 3 only
(c) 1 and 2 only
(d) 1 only

16. A type of lineation found in unmetamorphosed or very low-grade metasedimentary rocks, formed by the intersection of a compaction cleavage and a subsequent tectonic cleavage, is called :

(a) Pencil structure

(b) Augen structure

(c) Slickenside structure

(d) Boudinage structure

17. A highly competent layer embedded in thick incompetent rock layers is subjected to layer-parallel shortening. The type of fold developed in the competent layer will be :

(a) Cuspate-lobate fold

(b) Ptygmatic fold

(c) Shear fold

(d) Drag fold

18. Which one of the following statements is true for a supratenuous fold ?

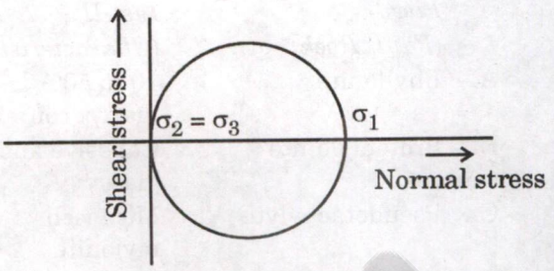
(a) Orthogonal thickness of the layer is maximum at the hinge and minimum at the limbs.

(b) Orthogonal thickness of layer is constant all along the folded layer.

(c) Axial plane parallel thickness of layers is constant all along the folded layer.

(d) Orthogonal thickness of layers is minimum at the hinge and increases towards the limbs.

19. The following Mohr diagram for stress represents :



(a) Hydrostatic state of stress

(b) Uniaxial state of stress

(c) Biaxial state of stress

(d) Triaxial state of stress

20. Consider the following statements regarding brittle shear zones :

1. The brittle shear zones are also known as frictional shear zones.
2. The brittle shear zones are generally confined up to uppermost 10 – 15 km of the Earth's crust.
3. Shear fractures have relative movement perpendicular to the fracture wall.
4. In brittle shear zones, breaking of rock occurs along macroscale fracture planes or zones.

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

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 1, 2 and 4

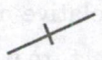
21. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Fault Rock)		*List-II (Characteristic)*
A.	Phyllonite	1. 10 to 50% matrix content
B.	Protomylonite	2. Cohesive and glassy
C.	Pseudotachylyte	3. Mica rich mylonite
D.	Gouge	4. Brittle faulting

Code :

	A	B	C	D
(a)	3	2	1	4
(b)	3	1	2	4
(c)	4	2	1	3
(d)	4	1	2	3

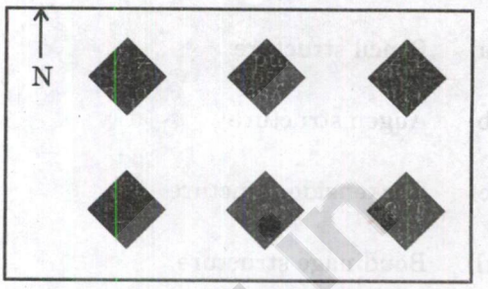
22. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Map symbol)		*List-II (Explanation)*
A.	 60°	1. Strike of vertical cleavage
B.		2. Strike of vertical foliation
C.		3. Strike and dip of vertical bedding plane
D.		4. Strike and dip of overturned bedding plane

Code :

	A	B	C	D
(a)	1	3	2	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	4	2	3	1

23. Consider the following outcrop pattern of a superposed fold structure on the geological map and the corresponding statements :



1. The outcrop pattern may result from two co-axial folding events in the rocks.
2. The outcrop pattern may be a result of two mutually perpendicular upright folding events.
3. The outcrop pattern may be a result of two mutually parallel upright fold superposition.
4. The outcrop pattern may be a result of upright folding followed by inclined folding with the same axial trend.

Which one of the statements given above is correct ?

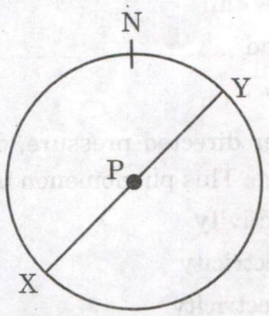
(a) 1 only

(b) 2 only

(c) 3 only

(d) 4 only

24. Consider the following diagram where the X–Y line and point P represent the axial plane and the axis of a fold respectively, on a stereonet overlay :



Which of the statement(s) given below about fold is/are correct ?

1. It represents an antiformal fold.
2. It represents an inclined fold.
3. The fold plunges towards southeast.
4. The fold is a vertical fold.

Select the answer using the code given below :

(a) 1 only
(b) 4 only
(c) 2 and 3
(d) 1, 3 and 4

25. Which one of the following statements is ***not*** correct ?

(a) Triclinic crystals have a lattice with $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90°$.
(b) Monoclinic crystals possess a lattice with $a \neq b \neq c$ and with $c \wedge a (= \beta) \neq 90°$.
(c) Orthorhombic crystals possess a lattice with $a \neq b \neq c$ and with all axial angles 90°.
(d) Hexagonal crystals possess a lattice with $a_1 \neq a_2 \neq a_3 \neq c$ and with $c \wedge a$ greater than 90°.

26. Which of the following is the appropriate symmetry element for a crystal with a point group $^4/_m\ ^2/_m\ ^2/_m$?

(a) $2m, 1A_2$
(b) $i, 1A_2, 1m$
(c) $i, 3A_2, 3m$
(d) $i, 1A_4, 4A_2, 5m$

27. Glaucophane, a mineral formed in low temperature – high pressure metamorphic rocks, has chemical formula :

(a) $Mg_7Si_8O_{22}(OH)_2$
(b) $Ca_2Fe_5Si_8O_{22}(OH)_2$
(c) $Na_2Fe_3^{2+}Fe_2^{3+}Si_8O_{22}(OH)_2$
(d) $Na_2Mg_3Al_2Si_8O_{22}(OH)_2$

28. In a trioctahedral layer silicate :

(a) All the three octahedra within each hexagonal ring of tetrahedra is occupied by ions
(b) Two-thirds of the three octahedra within each hexagonal ring of tetrahedra is occupied by ions
(c) All octahedra within each hexagonal ring of tetrahedra remain vacant
(d) There is no octahedral site in a layer silicate

29. Consider the following statements :

Statement 1 : Illite is essentially fine-grained muscovite, with some of the K^+ leached out and replaced by weakly bound water.

Statement 2 : Vermiculite is a leached biotite with some interlayer water.

Which of the statement(s) given above is/are correct ?

(a) Neither 1 nor 2
(b) Both 1 and 2
(c) 1 only
(d) 2 only

30. An element or compound that can exist in more than one crystallographic structure is known as :

(a) Polymorph
(b) Pseudomorph
(c) Isomorph
(d) Paramorph

31. Consider the following statements :

Statement 1 : Coupled substitutions occur when cations of different valence are interchanged.

Statement 2 : $Al^{3+} + Ca^{2+} = Si^{4+} + Na^{+}$ coupled substitution is common in garnets.

Which of the statement(s) given above is/are correct ?

(a) Both 1 and 2
(b) Neither 1 nor 2
(c) 1 only
(d) 2 only

32. Consider the following statements :

Statement 1 : The free energy change associated with the formation of solid solution is given by the equation $\Delta G_{mix} = \Delta H_{mix} - T\Delta S_{mix}$

Statement 2 : Regular solid solution is when $\Delta H_{mix} = 0$ and ideal solid solution is when $\Delta H_{mix} > 0$.

(*G = Free energy, H = Enthalpy, S = Entropy, T = Temperature*)

Which of the statement(s) given above is/are correct ?

(a) Both 1 and 2
(b) 1 only
(c) 2 only
(d) Neither 1 nor 2

33. In the silicate minerals, Mg^{2+}, Fe^{2+} and Mn^{2+} commonly occur with which coordination ?

(a) Four-fold
(b) Six-fold
(c) Eight-fold
(d) Twelve-fold

34. Gypsum with {100} as twin plane produces which one of the following twin types ?

(a) Manebach
(b) Swallow-tail
(c) Carlsbad
(d) Baveno

35. Quartz, under directed pressure, develops an electric charge. This phenomenon is called :

(a) Radioactivity
(b) Pyroelectricity
(c) Piezoelectricity
(d) Magnetism

36. Crankshaft-like chains that run parallel to a-crystallographic axis is a common feature of which one of the following minerals ?

(a) Feldspar
(b) Olivine
(c) Garnet
(d) Pyroxene

37. Which one of the following statements is ***not*** correct ?

(a) Water reacts with the bridging oxygens to break the silicate network.
(b) Water is more soluble in highly polymerized granitic melts than in less polymerized basaltic melts.
(c) The addition of water to silicate melts decreases temperature of crystallization.
(d) Decreasing water pressure causes melting to occur at progressively lower temperatures.

38. In the Nd-isotope isochron equation $^{143}Nd/^{144}Nd = (^{143}Nd/^{144}Nd)_0 + (^{147}Sm/^{144}Nd)(e^{\lambda t} - 1)$, the slope of the isochron is given by :

(a) $e^{\lambda t} - 1$
(b) $(^{147}Sm/^{144}Nd)(e^{\lambda t} - 1)$
(c) $(^{143}Nd/^{144}Nd)_0 + (^{147}Sm/^{144}Nd)(e^{\lambda t} - 1)$
(d) $(^{143}Nd/^{144}Nd)_0$

39. A plutonic rock with essential minerals quartz (> 20% vol.) and plagioclase (about 60% vol.) is known as :

(a) Anorthosite

(b) Quartz-rich granitoid

(c) Quartz monzonite

(d) Tonalite

40. Gabbro with subequal amounts of clinopyroxene and orthopyroxene is called :

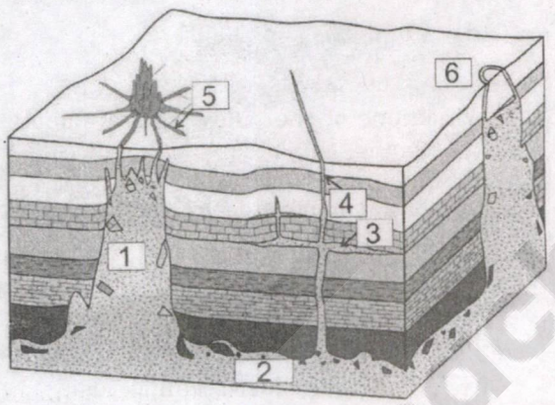
(a) Alkali gabbro

(b) Gabbronorite

(c) Ferrogabbro

(d) Troctolite

41. In the schematic block diagram of some intrusive bodies given below, identify the correctly matched pair :



(a) 1-stock, 2-batholith, 3-sill, 4-dyke, 5-radial dyke, 6-ring dyke

(b) 1-batholith, 2-stock, 3-sill, 4-dyke, 5-ring dyke, 6-radial dyke

(c) 1-lopolith, 2-laccolith, 3-dyke, 4-sill, 5-radial dyke, 6-ring dyke

(d) 1-laccolith, 2-batholith, 3-dyke, 4-sill, 5-ring dyke, 6-radial dyke

42. In some granitic rocks, plagioclase overgrowths are observed on orthoclase megacrysts. The texture is called :

(a) Poikilitic

(b) Variolitic

(c) Rapakivi

(d) Spinifex

43. A low temperature trough (valley) exists in which one of the following ternary phase diagrams ?

(a) Diopside-Albite-Anorthite

(b) Nepheline-Kalsilite-Silica

(c) Anorthite-Forsterite-Silica

(d) Diopside-Nepheline-Silica

44. Low Mg# [Mg/(Mg+Fe)] value is associated with which one of the following ?

(a) Low alkalis in the magma

(b) High extrusion temperature of the magma

(c) Evolved magma

(d) Primitive magma

45. Consider the following statements on the effects of H_2O and CO_2 on the behaviour of melts :

1. H_2O is involved in hydrolysis reaction which reduces the polymerization of melt.
2. H_2O is involved in hydrolysis reaction which increases the polymerization of melt.
3. CO_2 forms carbonate complexes which reduces the polymerization of melt.
4. CO_2 forms carbonate complexes which increases the polymerization of melt.
5. H_2O is more soluble in felsic melt while CO_2 is more soluble in mafic melt.
6. H_2O is less soluble in felsic melt while CO_2 is less soluble in mafic melt.

Which of the statements given above are correct ?

(a) 1, 3 and 6

(b) 1, 4 and 5

(c) 2, 3 and 6

(d) 2, 4 and 5

46. Consider the following statements regarding S-, I-, and A-type granites :

1. S-type granites are peraluminous.
2. I-type granites contain metasedimentary xenoliths.
3. S-type granites contain normative corundum.
4. I-type granites are peraluminous.
5. S-type granites generally contain muscovite and biotite.
6. A-type granites are peraluminous.

Which of the statements given above are correct ?

(a) 1, 3 and 5
(b) 2, 4 and 6
(c) 1, 4 and 6
(d) 2, 3 and 5

47. Komatiite commonly shows :

(a) Ophitic texture
(b) Intergranular texture
(c) Spinifex texture
(d) Poikilitic texture

48. "Room problem" is associated with :

(a) Ophiolite
(b) Deccan basalt
(c) Carbonatite emplacement
(d) Granite

49. Which one of the following is ***not*** formed during cataclastic metamorphism ?

(a) Fault gauge
(b) Pseudotachylite
(c) Hornfels
(d) Fault breccia

50. Match the List-I with List-II and select the correct answer using the code given below the lists :

	List-I (Protolith rock)		*List-II (Metamorphic equivalent)*
A.	Sandstone	1.	Metapelite
B.	Marl	2.	Marble
C.	Limestone	3.	Quartzite
D.	Shale	4.	Calc-silicate

Code :

	A	**B**	**C**	**D**
(a)	3	2	4	1
(b)	3	4	2	1
(c)	1	4	2	3
(d)	1	2	4	3

51. Which one of the following statements is ***not*** correct ?

(a) Heat generated by radioactive decay is higher in oceanic crust than continental crust.
(b) Young oceanic crust has higher heat flow than older oceanic crust.
(c) Continental crust has higher heat flow than old oceanic crust.
(d) At mid-oceanic ridge, heat is brought into the crust by rising bodies of magma.

52. Which one of the following metamorphic rocks exhibits strongly developed foliation ?

(a) Marble
(b) Granofels
(c) Quartzite
(d) Phyllite

53. The close spatial occurrence of coeval high P/T and low P/T metamorphic rocks is called :

(a) Contact metamorphic aureole

(b) Metamorphic core complex

(c) Paired metamorphic belt

(d) Exoskarn and endoskarn

54. Intimate intergrowth of two or more minerals that have nucleated and grown together in a single shell of reaction rim is known as :

(a) Moat

(b) Pseudomorph

(c) Symplectite

(d) Exolution

55. Incomplete replacement of earlier minerals produces :

(a) Coronal texture

(b) Decussate texture

(c) Granoblastic texture

(d) Kink band

56. Which one of the following is ***not*** related to recrystallization process ?

(a) Grain boundary area reduction

(b) Mechanical crushing of grains

(c) Subgrain rotation

(d) Grain boundary migration

57. Which one of the following reactions can be used as a good geobarometer ?

(a) Andalusite = Sillimanite

(b) Hematite = Magnetite + O_2

(c) Annite + Pyrope = Phlogopite + Almandine

(d) Anorthite = Grossularite + Kyanite + Quartz

58. The mineralogical difference between two successive zones, caused by a specific univariant reaction is known as :

(a) Isotherm

(b) Metamorphic Field Gradient

(c) Index Mineral

(d) Facies

59. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Mineral assemblage)	*List-II (Condition of formation)*
A. Andalusite-cordierite-chlorite	1. Low T
B. Sapphirine-quartz	2. High P
C. Garnet-omphacite	3. Ultra-High T
D. Chlorite-Zeolite	4. Low P

Code :

	A	B	C	D
(a)	4	2	3	1
(b)	1	2	3	4
(c)	1	3	2	4
(d)	4	3	2	1

60. Which one of the following is the correct arrangement of mineral zones according to their appearance with increasing metamorphic grade ?

(a) Chlorite zone < Garnet zone < Sillimanite zone

(b) Staurolite zone < Kyanite zone < Biotite zone

(c) Kyanite zone < Biotite zone < Garnet zone

(d) Sillimanite zone < Kyanite zone < Staurolite zone

61. Which of the following statements regarding different sediment gravity flows are correct ?

1. Grain flows occur when cohesive sediment moves downward under gravity.
2. Fluidized flows are concentrated dispersions of grains supported by pore water.
3. Debris flows occur when slurry-like mass moves downhill under gravity.
4. Turbidity currents are gravity flows in which the sediment is supported by upward turbulence in the flow.

Select the answer using the code given below :

(a) 1, 2 and 3
(b) 2, 3 and 4
(c) 1, 3 and 4
(d) 1, 2 and 4

62. Which one of the following parameters for sedimentary grain size distribution analysis is ***not*** correctly matched ?

(a) Standard deviation : Sorting of grains
(b) Mode : Mid-point of a grain size distribution
(c) Skewness : Asymmetricity in grain size distribution
(d) Kurtosis : Peakedness in grain size distribution

63. The chemical weathering process in which hydrogen ions replace mobile ions in minerals and put them in a solution causing dissolution or partial alteration of the mineral, is called :

(a) Hydration
(b) Hydrolysis
(c) Oxidation-reduction
(d) Insolation

64. A waxing-waning grading in a sedimentary bed is defined by grading up from :

(a) Sand to mud
(b) Mud to sand
(c) Sand to mud to sand
(d) Mud to sand to mud

65. The correct arrangement of current ripple crests in order of increasing energy conditions is :

(a) Catenary – Sinuous – Linguoid – Lunate
(b) Sinuous – Catenary – Lunate – Linguoid
(c) Sinuous – Catenary – Linguoid – Lunate
(d) Catenary – Sinuous – Lunate – Linguoid

66. Match the List-I with List-II and select the correct answer using the code given below the lists :

	List-I (Sedimentary structure)		*List-II (Mechanism)*
A.	Convolute bedding	1.	Saltation load transportation of grain
B.	Prod marks	2.	Differential forcing of hydroplastic non-cohesive sediments
C.	Rill marks	3.	Bed load and suspension load sedimentation
D.	Climbing ripples	4.	Thin flow during sinking water level

Code :

	A	B	C	D
(a)	3	4	1	2
(b)	2	4	1	3
(c)	3	1	4	2
(d)	2	1	4	3

67. In sandstone, discontinuous matrix-like material formed by squeezing and flowing of weak detrital grains in adjacent pore spaces is called :

(a) Orthomatrix

(b) Epimatrix

(c) Pseudomatrix

(d) Protomatrix

68. Consider the following statements regarding classification of sandstones on the basis of principal components (Q- Quartz; F- Feldspar; Rx- Rock fragments) :

1. The ratio Q/(F+Rx) is a rough measure of compositional maturity.
2. The ratio Q/(F+Rx) measures the progress towards the ultimate end type – a pure quartz sand.
3. The ratio F/Rx reflects provenance.
4. The ratio F/Rx cannot distinguish between a deep-seated provenance and a supracrustal provenance.

Which of the statements given above are correct ?

(a) 1 and 4 only

(b) 2 and 4 only

(c) 1, 2 and 3 only

(d) 1, 2, 3 and 4

69. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Process)	*List-II (Depositional environment)*
A. Chute cut-off	1. Shelf
B. Geostrophic current	2. Shoreface
C. Contour current	3. Meandering channel
D. Rip current	4. Continental rise

Code :

	A	B	C	D
(a)	3	1	4	2
(b)	2	1	4	3
(c)	3	4	1	2
(d)	2	4	1	3

70. Which of the following pairs are correctly matched ?

1. Bay head delta : Wave-dominated estuary
2. Interdistributary bay : Prolonged delta top
3. Sand ribbons : Tide-dominated shelf
4. Inner ramp : Inner estuary

Select the answer using the code given below :

(a) 1 and 4 only

(b) 2, 3 and 4 only

(c) 1, 2 and 3 only

(d) 1, 2, 3 and 4

71. Consider the following depositional conditions :

1. A microtidal to mesotidal coastline with tidal range less than 3 meters
2. A steady sand supply
3. A stable low-gradient coastal plain

Which of the above condition(s) favoured the formation of a beach-barrier island ?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1 only

72. Which of the following are the general features for the recognition of marine cements in limestone ?

1. These are the first-generation cements
2. These are usually from isopachous fringes around grains or cavity walls
3. The crystals are usually ferroan and luminescent
4. These usually are fibrous in nature

Select the correct answer using the code given below :

(a) 1, 2, 3 and 4
(b) 2, 3 and 4 only
(c) 1, 2 and 4 only
(d) 1 and 3 only

73. Which one of the following events was instrumental in changing composition of the Earth's atmosphere ?

(a) Evolution of Brachiopods
(b) Appearance of Cyanobacteria
(c) Extinction of Trilobites
(d) Extinction of Conodonts

74. A specimen of a species from the same locality, where its holotype or syntypes are recorded is known as :

(a) Paratype
(b) Lectotype
(c) Topotype
(d) Plesiotype

75. Which one of the following Brachiopod order has strophic shell ?

(a) Terebratulida
(b) Rhynchonellida
(c) Athyridida
(d) Spiriferida

76. Which one of the following represents the correct geological range of Trilobites ?

(a) Cambrian to Permian
(b) Cambrian to Devonian
(c) Silurian to Permian
(d) Cambrian to Ordovician

77. Goniatitic sutures in Cephalopods are characterised by :

(a) Broad rounded lobes and saddles
(b) Sharp lobes and rounded saddles
(c) Narrow mid ventral lobes and broad lateral saddles
(d) Frilled lobes and undivided saddles

78. The *Syringothyris* Limestone of Kashmir belongs to which one of the following periods ?

(a) Cambrian
(b) Ordovician
(c) Carboniferous
(d) Silurian

79. Which one of the following statements regarding the genus *Pecten* is correct ?

(a) It is a free-swimming, monomyarian bivalve.
(b) It is an infaunal monomyarian bivalve.
(c) It is a free-swimming monomyarian branchiopoda.
(d) It is an infaunal isomyarian bivalve.

80. Which one among the following is the correct sequence of hominid evolution ?

(a) *Australopithecus – Paranthropus – Homo erectus – Homo habilis*
(b) *Australopithecus – Homo habilis – Paranthropus – Homo erectus*
(c) *Australopithecus – Paranthropus – Homo erectus – Homo sapiens*
(d) *Australopithecus – Homo erectus – Homo floresiensis – Homo sapiens*

81. According to the record of human evolution, when was fire used for the first time ?

(a) 2 – 1·5 Myr ago

(b) 1·5 Myr ago

(c) 35,000 years ago

(d) 10,000 years ago

82. Which one of the following statements regarding Foramen is correct ?

(a) It is an opening that connects the chambers in foraminifera.

(b) It is a monolamellar structure in foraminifera.

(c) It is a bilamellar structure in foraminifera.

(d) It represents growth plans of foraminiferal test.

83. Microfossils live in various environmental conditions and play a crucial role in inferring the past environmental conditions and also help in deducing causes for variation in the environmental conditions. Which one among the following is living in all kinds of aquatic environments ?

(a) Conodont

(b) Foraminifera

(c) Dinoflagellates

(d) Ostracoda

84. Which one of the following group of fossils is used for biostratigraphic subdivision of Mesozoic time ?

(a) Brachiopods

(b) Cephalopods

(c) Foraminifera

(d) Trilobites

85. The correct hierarchy of formal lithostratigraphic units is :

(a) Supergroup → Group → Formation → Member

(b) Supergroup → Subgroup → Group → Member

(c) Supergroup → Group → Member → Formation

(d) Supergroup → Group → Formation → Bed → Member

86. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Geochronostratigraphic unit)	*List-II (Geochronologic unit)*
A. Erathem	1. Age
B. System	2. Epoch
C. Series	3. Period
D. Stage	4. Era

Code :

	A	B	C	D
(a)	4	2	3	1
(b)	4	3	2	1
(c)	1	2	3	4
(d)	1	3	2	4

87. The principle of Uniformitarianism was proposed by :

(a) Charles Darwin

(b) Charles Lyell

(c) Eduard Suess

(d) Jean-Baptiste Lamarck

88. The Palghat-Cauvery Shear Zone separates :

(a) Aravalli Craton from Bastar Craton

(b) Bastar Craton from Singhbhum Craton

(c) Southern Granulite Terrain from Northern Dharwar Craton

(d) Bundelkhand Craton from Singhbhum Craton

89. Most of the continents had grown up to about 75% of the present size with major stabilization of cratons by :

(a) About 3·5 billion years ago in Archaean

(b) About 2·5 billion years ago at the end of Archaean

(c) About the end of Hadean

(d) About the end of Ediacaran

90. Malanjkhand Granite is a calc-alkaline plutonic body, close to :

(a) Palghat-Cauvery Shear Zone

(b) Central Indian Shear Zone

(c) Singhbhum Shear Zone

(d) Main Central Thrust

91. Which one of the following lithostratigraphic unit of Proterozoic represents glacial origin ?

(a) Nagthat Formation

(b) Chandpur Formation

(c) Blaini Formation

(d) Krol Formation

92. Which of the following groups of Vindhyan Supergroup contains very well developed stromatolitic limestones ?

1. Bhander Group
2. Rewah Group
3. Kaimur Group
4. Semri Group

Select the correct answer using the code given below :

(a) 1 only

(b) 1 and 4

(c) 2 and 3

(d) 4 only

93. The Glacial Boulder Bed is present within :

(a) Barakar Formation

(b) Karharbari Formation

(c) Talchir Formation

(d) Kamthi Formation

94. The stratigraphically significant K-T boundary (Cretaceous-Tertiary boundary) representing major mass extinction event occurs between :

(a) Maastrichtian and Danian Stages

(b) Danian and Selandian Stages

(c) Thanetian and Lutetian Stages

(d) Ypresian and Lutetian Stages

95. *Syringothyris* Limestone in the Lidar Valley, Kashmir Basin, belongs to :

(a) Devonian period

(b) Ordovician period

(c) Early Carboniferous period

(d) Late Permian period

96. Which one of the following represents the correct ascending stratigraphic order ?

(a) Kunzam La Formation – Muth Formation – Po Formation

(b) Po Formation – Kunzam La Formation – Muth Formation

(c) Muth Formation – Po Formation – Kunzam La Formation

(d) Po Formation – Muth Formation – Kunzam La Formation

97. Veins filling regularly spaced, short, transverse fractures roughly parallel to each other are called :

(a) Stockwork deposits

(b) Shear Zone deposits

(c) Saddle Reefs

(d) Ladder Veins

98. Which one of the following ores can be found in Komatiitic flows of Archaean greenstone belts ?

(a) Sn–W ore

(b) Nb–Ta ore

(c) Cu–Mo ore

(d) Ni–Cu ore

99. Match the List-I with List-II and select the correct answer using the code given below the lists :

List-I (Rock)	*List-II (Ore)*
A. Lamproite	1. Ilmenite-Hematite
B. Anorthosite	2. Chalcopyrite-Molybdenite
C. Granodiorite	3. Rare Earth Element (REE)
D. Carbonatite	4. Diamond

Code :

	A	B	C	D
(a)	4	2	1	3
(b)	3	1	2	4
(c)	4	1	2	3
(d)	3	2	1	4

100. Consider the following statements regarding PGE mineralization in chromititic layers :

1. The chromititic layers do contain minor sulphide minerals including RuS_2.
2. The assemblage Pt-Pd-Au occasionally occurs as discrete inclusion in chromite.
3. Presence of pyrrhotite with chromitite allows liberation of sulphur.

Which of the statement(s) given above is/are correct ?

(a) 1 and 2

(b) 1 and 3

(c) 1 only

(d) 2 and 3

101. The variety of Banded Iron Formation (BIF) present in Archaean greenstone belts with greywacke-volcanic association is known as :

(a) Superior type

(b) Algoma type

(c) Clinton type

(d) Bog iron type

102. Which one of the following statements regarding Supergene enrichment process is ***not*** correct ?

(a) Pyrite breaks down to produce insoluble Fe-hydroxide and sulphuric acid in oxidation zone.

(b) The soluble metals in the upper part of a sulphide orebody are generally leached down to the water table.

(c) Supergene environment takes place below the water table.

(d) The nature of hypogene mineralization has no bearing on supergene enrichment mineralization.

103. Which one of the following indicates the temperature range (in °C) of the formation of mesothermal deposits as defined by Lindgren ?

(a) 50 – 200
(b) 200 – 300
(c) 300 – 500
(d) 500 – 600

104. Consider the following statements regarding lateritic deposits :

1. Laterite is the product of intense weathering in humid, warm intertropical regions and can be divided into ferruginous and aluminous varieties.
2. The accumulation of an alumina-rich residuum, as opposed to Fe in lateritic profile is a function of higher rainfall and lower average temperatures.

Which of the statement(s) given above is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

105. Consider the following statements regarding gas hydrates :

1. Gas hydrates are crystalline aqueous compounds that form at low temperatures when the ice lattice expands to accommodate a variety of gaseous molecules, the most important of which is methane.
2. Gas hydrates will melt if either the temperature increases or the pressure decreases.

Which of the statement(s) given above is/are correct ?

(a) 1 only
(b) Both 1 and 2
(c) 2 only
(d) Neither 1 nor 2

106. The rank of coal depends upon which one of the following factors ?

(a) Degree of metamorphism
(b) Climatic condition of coal formation
(c) Place of accumulation
(d) Source material

107. Match the List-I with List-II and select the correct answer using the code given below the lists :

	List-I (Metal)		*List-II (Deposit)*
A.	Sn	1.	Gadag
B.	Au	2.	Baula-Nuasahi
C.	Cr	3.	Tosham
D.	Fe	4.	Bababudan Hills

Code :

	A	**B**	**C**	**D**
(a)	3	2	1	4
(b)	3	1	2	4
(c)	4	2	1	3
(d)	4	1	2	3

108. Which one of the following is the main reservoir rock of Mumbai Offshore Basin ?

(a) Sandstone
(b) Granite
(c) Carbonate
(d) Shale

109. Which of the following conditions are required for a flowing well in a confined aquifer ?

1. Overlying impermeable layer
2. Underlying impermeable layer
3. Potentiometric surface above the ground surface
4. Potentiometric surface below the ground surface

Select the correct answer using the code given below :

(a) 2 and 3 only
(b) 1 and 3 only
(c) 1, 2 and 3
(d) 1, 2 and 4

110. In an area of 10,000 m^2, the water table dropped by 4 meters. Assuming the aquifer to be homogeneous and isotropic, if porosity of the aquifer is 30% and the specific retention is 10%, the estimated change in the groundwater storage would be :

(a) 4,000 m^3

(b) 12,000 m^3

(c) 8,000 m^3

(d) 16,000 m^3

111. If a rock has 55% porosity and 30% specific retention, its specific yield will be :

(a) 85%

(b) 25%

(c) 40%

(d) 55%

112. Consider the following statements regarding hydraulic conductivity of an aquifer :

1. It depends on dynamic viscosity of the fluid.
2. It depends on aquifer properties.
3. It does not depend on density of the fluid.

Which of the statement(s) given above is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 1 and 3

(d) 2 and 3

113. Consider the following statements regarding permeability of sediments :

1. Permeability increases with the increase in median grain size.
2. Finer sediments show a greater decrease in permeability with an increase in standard deviation than coarser samples do.
3. Unimodal (one dominant size) samples have a greater permeability than bimodal (two dominant sizes) samples.

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

114. What is the average interstitial velocity of groundwater through a sandstone having 40% effective porosity, if Darcy velocity is 25 m/day ?

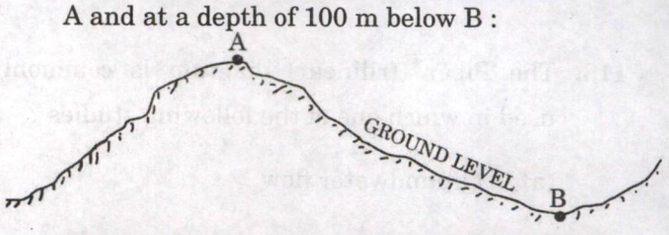
(a) 62·5 m/day

(b) 10 m/day

(c) 100 m/day

(d) 1·6 m/day

115. Consider the following diagram, where two places A and B are at altitudes of 800 m and 300 m above Mean Sea Level, respectively. The water table lies at a depth of 600 m below A and at a depth of 100 m below B :



What will be the direction of groundwater movement ?

(a) From A to B

(b) From B to A

(c) Alternately between A and B

(d) No movement

116. As per Bernoulli's equation, the total head of groundwater at a given point in the aquifer includes :

(a) Elevation head and velocity head only

(b) Elevation head and pressure head only

(c) Velocity head and pressure head only

(d) Elevation head, pressure head and velocity head

117. The concentration of Na^+ in a water sample is 92 parts per million. What is the concentration of Na^+ in equivalents per million in the water sample ?

(Atomic mass of Na = 23)

(a) 8

(b) 2116

(c) 4

(d) 92

118. The Piper (trilinear) diagram is commonly used in which one of the following studies ?

(a) Groundwater flow

(b) Soil moisture

(c) Water chemistry

(d) Pumping tests

119. Consider the following statements regarding isotopes :

1. Isotopes have the same atomic number and different atomic weights.

2. Isotopes have the same atomic weight and different atomic numbers.

3. Isotopes have varying number of neutrons in the nucleus.

4. Radioactive isotopes can be used to determine the age of groundwater.

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 1, 3 and 4

(d) 2, 3 and 4

120. The stream channel method is generally applied for artificial recharge of groundwater from :

(a) Influent streams

(b) Effluent streams

(c) Both influent and effluent streams

(d) Ephemeral streams

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