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ENTRANCE EXAMINATION FOR ADMISSION, MAY 2011.
M.Tech./Ph.D. (EXPLORATION GEOSCIENCES AND EARTH SCIENCES)
COURSE CODE : 306/110

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 306/110

Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. The boundary between _____ coincides with major changes in the life forms present on Earth

| | |
|--------------------------|-------------------------|
| (A) Precambrian-cambrian | (B) Cretaceous-tertiary |
| (C) Archean-proterzoic | (D) Plietocene-holocene |

2. Bedforms with the crest trending roughly parallel to the net sediment transport direction are called

| | |
|-----------------|-----------------------|
| (A) Linear dune | (B) Longitudinal dune |
| (C) Seif dune | (D) Parabolic dune |

3. The tonalite-trondhjemite-granodiorite magmatism ended at _____ boundary.

| | |
|--------------------------|-------------------------|
| (A) Precambrian-cambrian | (B) Cretaceous-tertiary |
| (C) Archean-proterzoic | (D) Paleozoic-mesozoic |

4. Epsilon cross-stratification is common in

| | |
|----------------------------|-------------------------|
| (A) Marine environment | (B) Fluvial environment |
| (C) Lacustrine environment | (D) Aeolian environment |

5. Foreland basins are associated with

| | |
|-----------------------|-------------------------|
| (A) Crustal extension | (B) Strike slip faults |
| (C) Thrusting | (D) Thermal contraction |

6. Major evolution of Atmospheric oxygen in Earth took place during

| | |
|---------------------------------|---------------------------------|
| (A) 3500-3700 million years ago | (B) 2100-2200 million years ago |
| (C) 540 million years ago | (D) 200 million years ago |

7. SEDEX type ore deposits are not older than 1.9 Ga, this is because of

| | |
|-------------------------------------------------------------------------------|-----------------------------------------------|
| (A) Widespread sea floor spreading after 1.9 Ga | (B) Widespread granite plutonism in continent |
| (C) Evolution of atmospheric oxygen and subsequent oxygenation of ocean water | (D) Increase of salinity in sea water |

8. Density driven currents tends to produce

| | |
|--------------------------------|----------------------------|
| (A) Coarsening upward sequence | (B) Fining upward sequence |
| (C) Thickening upward sequence | (D) Amalgamated sequence |

9. Architectures of fluvial facies of post-Devonian are distinctly different from that of pre-Devonian time. This change is due to
- (A) Climate change during Devonian period
 - (B) Global sea level rise after Devonian
 - (C) Evolution and proliferation of land plants during Devonian and post Devonian era and subsequent stabilization of flood plains
 - (D) Evolution of atmospheric oxygen
10. Quartzite-limestone litho-assemblages are characteristics of
- (A) Intracratonic basin
 - (B) Foreland basin
 - (C) Back arc basin
 - (D) Passive continental margin basin
11. Swaley cross stratification is characteristics of
- (A) Storm deposits in shallow marine condition
 - (B) Storm deposits in deep marine condition
 - (C) Turbidity current induced deposits
 - (D) Sheet flood facies in an alluvial basin
12. Ores of Cr, Ni, Pt, Au are associated with
- (A) Mafic-ultramafic igneous rocks
 - (B) Intermediate igneous rocks
 - (C) Felsic igneous rocks
 - (D) Sandstones
13. Ores of Li, Be, Cs associated with
- (A) Gabbro
 - (B) Diorite
 - (C) Granite-pegmatite pluton
 - (D) Acid volcanic rocks
14. Under isobaric (i.e. equal pressure) condition, H₂O solubility is highest in
- (A) Granitic magma
 - (B) Andesitic magma
 - (C) Basaltic magma
 - (D) Ultrabasic magma
15. In case you are doing reconnaissance geochemical exploration for granite pegmatite hosted Sn deposit, your most preferred sample media would be
- (A) Residual soil
 - (B) Stream sediment (fine fraction)
 - (C) Stream sediment (coarse fraction)
 - (D) Stream sediment (heavy mineral fraction)

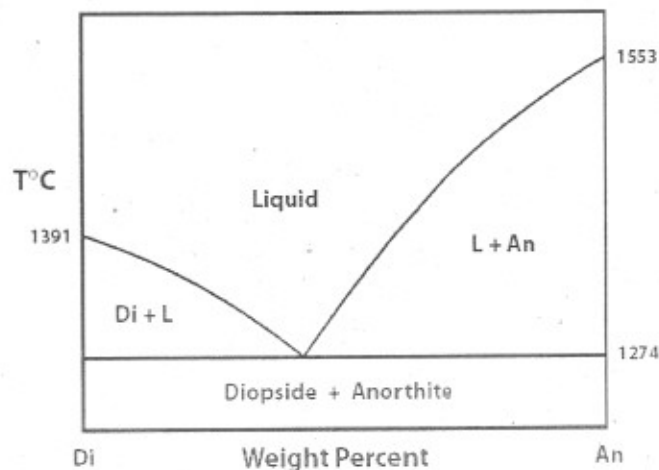
16. For locating Nb-Ta deposit, one should target following geological terrain
- (A) Sedimentary basin (B) Mafic-ultra mafic igneous terrain
(C) Granite batholith (D) Proterozoic fold belts
17. Which one of the following group represents the rare metals?
- (A) Sn-W-Mo (B) Li-Be-Nb
(C) Cu-Pb-Zn (D) Ce-Nd-Sm
18. For a steeply dipping vein type deposit, the most preferred method of ore reserve estimation method would be
- (A) Planar method with uniform area of influence
(B) Polygonal method
(C) Triangular method
(D) Cross sectional method
19. Porphyry type Cu-Mo-(Sn-W) are associated with following tectonic setting
- (A) Divergent plate margin (B) Conservative plate margin
(C) Collisional plate margin (D) Plate interior
20. Diamond deposits are associated with
- (A) Granitic intrusions (B) Kimberlite pipes
(C) Carbonatite (D) Komatiite
21. Which one of the following pairs does not form exsolution intergrowth in ore mineral assemblages?
- (A) chalcopyrite-sphalerite (B) magnetite-ilmenite
(C) pyrite-pyrrhotite (D) chalcopyrite-cubanite
22. Most economic iron deposits (BIF) were deposited during
- (A) 1000-670 ma (B) 3700-3500 ma
(C) 2600-1850 ma (D) 100-150 ma
23. Study of alteration assemblages yield best results in case of geochemical exploration for
- (A) Porphyry type hydrothermal deposits (B) VMS-SEDEX deposits
(C) Stratiform deposits (D) Orthomagmatic deposits

24. Which one of the following was NOT the major source of heat in the primordial earth?
- (A) Decay of short-lived radioactive isotopes
 (B) Decay of long-lived radioactive isotopes
 (C) Impact of planetesimals
 (D) Energy from the sun
25. Minerals whose fields of stability on a P-T diagram are extended on the introduction of a non-hydrostatic stress are described as
- (A) Stress minerals (B) Anti-Stress minerals
 (C) Elastic minerals (D) Plastic minerals
26. Stress minerals are characterized by
- (i) High packing index of crystal lattice (ii) Low molar volume
 (iii) High density (iv) Equidimensional habit
- (A) (i) and (iii) only (B) (i) and (ii) only
 (C) (i), (ii) and (iii) only (D) (ii), (iii) and (iv) only
27. Which trace elements can substitute the major ions present in M1 and M2 sites of olivine?
- (A) Ba and Rb (B) U and Th
 (C) Nb and Sr (D) Ni and Cr
28. Serpentinites and spilites are characteristics of which one of the following settings?
- (A) Continental collision zones (B) Along shallow faults
 (C) Mid-ocean ridges (D) Mid-continental regions
29. The major difference between rock deformation experiments conducted in a laboratory and rock deformation that occurs naturally is that
- (A) The temperatures are much lower in laboratory experiments than in nature
 (B) The pressures are much lower in laboratory experiments than in nature
 (C) The time of deformation is much shorter in laboratory experiments than in nature
 (D) Real rocks are not used in laboratory experiments as they are in nature
30. S- or Z-shaped inclusion trails in garnets indicate
- (A) Syn-tectonic crystallization (B) Pre-tectonic crystallization
 (C) Post-tectonic crystallization (D) Magmatic crystallization

31. Which of the following statements about metamorphism of shale is false?
- (A) With increasing metamorphism, the clay minerals breakdown to form micas
 - (B) With increasing metamorphism, the grain size of the minerals gets smaller
 - (C) With increasing metamorphism, foliation develops
 - (D) With increasing metamorphism, the amount of water decreases
32. An overturned fold is characterized by
- (A) Two limbs at right angles to one another
 - (B) Two limbs dipping in the same direction - with one tilted beyond vertical
 - (C) Two limbs dipping in opposite directions
 - (D) Two limbs not parallel to each other
33. How do rock particles move during the passage of a P wave through the rock?
- (A) Back and forth parallel to the direction of wave travel
 - (B) Back and forth perpendicular to the direction of wave travel
 - (C) In a rolling circular motion
 - (D) The particles do not move
34. Shear strain is measured by
- (A) Change in length of a line
 - (B) Change in angle between two lines
 - (C) Displacement of a line
 - (D) Bending of line
35. If the net slip of a fault is parallel to the trace of the bedding on the fault plane then
- (A) Strike separation is zero
 - (B) Dip separation is zero
 - (C) Both strike and dip separations are zero
 - (D) Both strike and dip separations are nonzero
36. The intensity of diffracted X-ray depends on
- (A) Electron density
 - (B) Atomic nuclei
 - (C) Chemical bonds
 - (D) Unit cell volume
37. Polymorphic transformation does NOT involve change in
- (A) Crystal class
 - (B) Chemical composition
 - (C) Density
 - (D) Refractive index

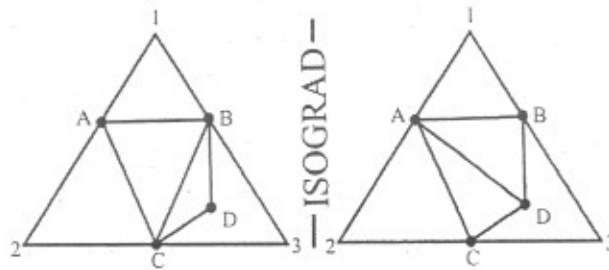
38. Minerals belonging to a solid solution series have
- (A) Similar crystal structure (B) Same physical properties
 (C) Different crystal structure (D) Similar chemical composition
39. The abundance of elements in the Earth's mantle is about 1.8 times the primitive chondrites. This is due to
- (A) Formation of the Moon from Earth
 (B) Early differentiation of Earth to core and mantle
 (C) Later addition of elements by meteorite impacts
 (D) Abundance of elements in bulk earth is about 1.8 times the primitive chondrites

Study the figure given below and answer the following two questions.



40. A melt of composition 20% diopside + 80 % anorthite at 1550 °C undergoes cooling and crystallization. Which of the following minerals will be formed as phenocryst?
- (A) Diopside (B) Enstatite
 (C) Forsterite (D) Anorthite
41. A rock consisting of 70% diopside + 30 % anorthite is heated. At what temperature it will start melting?
- (A) 1553°C (B) 1391°C
 (C) 1300°C (D) 1274°C
42. The Andes Mountains of South America are a result of which type of plate boundary?
- (A) Ocean-continent convergence (B) Ocean-ocean convergence
 (C) Continent-continent convergence (D) Divergent

43. The change in the compatibility diagram for a ternary system across the metamorphic isograd is depicted schematically. The governing reaction at the isograd is



- (A) $A + B = C + D$ (B) $B + D = A + C$
 (C) $A + B + C = A + C + D$ (D) $B + C = A + D$
44. Out of the following which of the point groups are not possible?
 (A) 222 (B) 446 (C) 334 (D) 422
45. The change in the plagioclase composition from albite to oligoclase indicate the transition from
 (A) Amphibolite \rightarrow granulite (B) Greenschist \rightarrow amphibolite
 (C) Blueschist \rightarrow eclogite (D) Greenschist \rightarrow blueschist
46. Clay minerals are common examples of _____ silicate structures.
 (A) Framework (B) Single chains
 (C) Sheet silicates (D) Isolated tetrahedral
47. Spinifex texture is characteristic of
 (A) Komatiite (B) Gabbro (C) Andesite (D) Basalt
48. Which one of the following minerals is useful to determine the initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of a granodiorite rock?
 (A) Plagioclase (B) Orthoclase (C) Biotite (D) Hornblende
49. Negative Eu anomaly will be formed in the residual magma by fractional crystallization of
 (A) Olivine (B) orthopyroxene (C) clinopyroxene (D) plagioclase
50. A drainage pattern whose plan resembles ring-like structure is called as
 (A) Dendritic (B) Trellis (C) Annular (D) Radial

51. The two words in Binomial nomenclature designate
 (A) Order & family (B) Family & genus
 (C) Genus & species (D) Phylum & class
52. Coral reefs are generally found in
 (A) Polar region (B) Tropical region
 (C) Sub polar region (D) All regions
53. Brain and Cranial capacity of humans ranges from
 (A) 450 cc to 600 cc (B) 1200 cc to 1250 cc
 (C) 1350 cc to 2000 cc (D) 2000 cc to 3500 cc
54. Fossil Ammonites indicate _____ period of time.
 (A) Cretaceous (B) Tertiary (C) Carboniferous (D) Cambrian
55. Petrified wood is an example of
 (A) Encrustation (B) Substitution (C) Alteration (D) Desiccation
56. Entrenched meanders are developed due to
 (A) Diastrophism (B) Retrogradation (C) Degradation (D) Rejuvenation
57. The age of Muth quartzite is
 (A) Silurian (B) Devonian (C) Ordovician (D) Cambrian
58. Salinity is the amount of dissolved solids in the ocean water, and hence, normally one kilogram of sea water contains _____ grams of salt.
 (A) 25 (B) 30 (C) 35 (D) 40
59. More than 50% of the ocean bottom is covered with _____ sediments.
 (A) Lithogenous (B) Hydrogenous (C) Biogenous (D) Cosmogenous
60. Hercynian or Variscan Orogeny took place during
 (A) Silurian (B) Devonian
 (C) Permo carboniferous (D) Jurassic
61. Chemical weathering is more effective in _____ regions
 (A) Warm & humid (B) Arid
 (C) Semi arid (D) Arid & semi arid

62. Permian is represented in Spiti region by
 (A) Kanawar group (B) Kuling system
 (C) Agglomerate shale (D) Tal shale
63. Deccan volcanic flow started at the end of _____ period.
 (A) Permian (B) Triassic (C) Jurassic (D) Cretaceous
64. Invertebrates of _____ group move with fastest speed.
 (A) Cephalopoda (B) Echinodermata
 (C) Gastropoda (D) Brachiopoda
65. Which of the following energy resources is renewable?
 (A) Coal (B) Hydroelectric power
 (C) Nuclear energy (D) Petroleum
66. Which one of the rock types is the best cap rock for oil and gas reservoirs?
 (A) Evaporites (B) Limestone (C) Shale (D) Sandstone
67. Which of the following types of global change is unidirectional (i.e. not reversible)?
 (A) Orogenic uplift (B) Rock cycle
 (C) Evolution of life on Earth (D) Global warming
68. Which of the following may not cause melting in mantle?
 (A) Subduction of water bearing minerals in mantle
 (B) Rise of plume from core-mantle boundary
 (C) Divergence of plate at mid-oceanic ridges
 (D) Convection of mantle
69. A radioactive isotope decays with a mean life of 10 hours. Half of its atoms would remain without decaying after
 (A) 5 hours (B) 10 hours (C) 1.44 hours (D) 6.93 hours
70. An experiment to determine elemental concentration yields following results when repeated 3 times (i) 10.12 ppm (ii) 10.11 ppm (iii) 10.13 ppm; if actual concentration is 12 ppm, it means that the experimental results are
 (A) More precise than accurate
 (B) More accurate than precise
 (C) Correct within the uncertainty of the experiment
 (D) Correct within the errors of measurement

71. Garnet usually forms under high pressure and temperature conditions. A geologist reports a garnet rich rock type from a field area. It means
- (A) That rock is under high pressure and temperature conditions when the geologist discovered it
 - (B) Garnet is in metastable condition
 - (C) The mineral reported as garnet is not a garnet
 - (D) Thermodynamically the rock is in equilibrium conditions
72. A rock dated with Rb-Sr method yields an age of 550 Ma, the same rock when dated with Sm-Nd method yields an age of 2.5 Ga. One of the likely explanations for these results is
- (A) Rb-Sr method does not give a correct age
 - (B) Sm-Nd method does not give correct age
 - (C) 550 Ma is age of metamorphism while 2.5 Ga is age of protolith formation
 - (D) This rock can not be dated by any method
73. Comparatively higher concentrations of incompatible elements are expected in a rock which formed by
- (A) Small degree of partial melting of upper mantle
 - (B) Large degree of partial melting of upper mantle
 - (C) Small degree of partial melting of pre-existing crustal rock
 - (D) Residue of melting in upper mantle
74. A liquid remaining after progressive fractionation of early formed crystals from a basaltic melt is likely to be enriched in
- (A) K and REE
 - (B) Ca and Mg
 - (C) Mg and Fe
 - (D) Cr and Ni
75. A granulite facies rock is usually characterized by dry mineral assemblage because
- (A) With progressive metamorphism metamorphic reactions remove all the water
 - (B) Original protolith does not contain any water bearing minerals
 - (C) Granulite facies metamorphism takes place before the amphibolite facies in prograde sequence
 - (D) Igneous rocks are protoliths of these rocks
76. Two rocks metamorphosed at same temperature pressure conditions have different mineral assemblages. This may mean that
- (A) They belong to different facies
 - (B) They have different bulk compositions
 - (C) They have different tectonic settings
 - (D) They are metamorphosed at different depths

77. A nucleus decays by alpha decay. The daughter would have
 (A) Mass number 4 less than parent but same atomic number
 (B) Same mass number and same atomic number
 (C) Atomic number less by 2 and same mass number as parent
 (D) Atomic number less by 2 and mass number less by 4 compared to parent
78. During β^- decay of a nucleus
 (A) A proton gets converted to a neutron
 (B) A neutron gets converted to a proton
 (C) An outer electron is captured by nucleus
 (D) No change takes place in proton or neutron number
79. Following is one of the shear sense indicators to help identify shearing in field
 (A) c-s fabric (B) gneissic bands
 (C) upright symmetric folds (D) normal faulting
80. A crystal appears unchanged when rotated 120° . Such an axis of rotation is axis of
 (A) 1-fold symmetry (B) 2-fold symmetry
 (C) 3-fold symmetry (D) 4-fold symmetry
81. Crystals that have three 2-fold axes of symmetry perpendicular to each other belong to
 (A) Monoclinic system (B) Triclinic system
 (C) Orthorhombic system (D) Tetragonal system
82. In a crystal 4 non-parallel faces intersect in a point. Form of these faces is
 (A) Prism (B) Pinacoid (C) Pyramid (D) Dome
83. Di-octahedral micas have
 (A) 2 cations in octahedral co-ordination
 (B) 3 cations in octahedral co-ordination
 (C) 4 cations in octahedral co-ordination
 (D) 6 cations in octahedral co-ordination
84. Divalent Ca and monovalent Na substitute for each other in Plagioclase to give rise to different members of plagioclase series. The charge balance is achieved by
 (A) Incorporation of another monovalent cation like H in the structure
 (B) Keeping one cation site vacant
 (C) Simultaneous substitution of Al and Si
 (D) Creating or breaking one bond with one of the non-bridging oxygen

85. Seismic stations around the world have recorded a 'push' as the first motion. It means
 (A) A single-couple source (B) A double-couple source
 (C) Strong p-wave arrival (D) An underground explosion
86. Epicentral distance of 180° equals to approximately how many kilometers on the surface of the earth. (radius of the earth is 6371 km)
 (A) 18000 km (B) 20005 km (C) 40010 km (D) 180 km
87. S- waves cannot travel through liquid because
 (A) Their velocity is slower than P- waves
 (B) S-wave travel by shear deformation and liquids can not be deformed by shearing
 (C) Because their amplitudes are larger than liquids capacity
 (D) Because they are secondary waves
88. Deflection of a moving object on Earth's surface is due to
 (A) Coriolis force (B) Centripetal force
 (C) Milankovitch force (D) Lorentz force
89. Which is NOT true for older oceanic floor?
 (A) It has comparatively lower heat flow
 (B) It is comparatively denser
 (C) It is away from mid-oceanic ridges
 (D) It is usually in center of the oceans
90. The mean radius of the Earth is 6371 km. On taking a gravimeter 1 km up in a balloon you would expect the value of g to decrease by
 (A) 3% (B) 1%
 (C) 0.03% (D) 0.007%
91. An isostatically over-compensated mountain is likely to experience
 (A) Vertical uplift (B) Erosion
 (C) Shear (D) Gravitational collapse
92. Which of the following types of sediments is most abundant?
 (A) Coarse clastics (B) Fine clastics
 (C) Chemical (D) Biochemical

93. Which of the following is an example of a continental-marine transitional environment?
- (A) Alluvial (B) Continental shelf
(C) Deltaic (D) Organic reef
94. Coarse clastic material can be transported into a deep marine environment by
- (A) Rivers (B) Wind
(C) Turbidity currents (D) Long shore currents
95. Marine sediments deposited in water depths greater than 3500 m usually lack
- (A) Carbonate shells
(B) Silica-rich shells
(C) Fine grained material transported by the wind
(D) Cosmogenic sediments
96. In which of the following environments would you expect to find oscillation ripples?
- (A) Alluvial (B) Shore face
(C) Deep-sea (D) Desert
97. Which of the following processes is not an important cause of subsidence during the development of a sedimentary basin?
- (A) Cooling and contraction of the crust (B) Deposition of sediments
(C) Erosion of sediments (D) Tectonic down faulting
98. Which of the following sedimentary environments is characterized by sand, gravel and mud?
- (A) Active margin beach (B) Alluvial fans
(C) Glacial (D) Deep marine
99. Which of the following sandstone types is most likely to form by the mechanical weathering of a granite?
- (A) Quartz arenite (B) Litharenite
(C) Arkose (D) Shale
100. Which type of weathering creates clay minerals?
- (A) Dissolution (B) Frost wedging
(C) Hydrolysis (D) Oxidation