MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF

GEOLOGIST JUNIOR UNDER COMMERCE & INDUSTRIES DEPARTMENT, GOVERNMENT OF MIZORAM, AUGUST, 2023

GEOLOGY PAPER - II

Time Allowed : 2 hours Full Marks : 200

All questions carry equal mark of 2 each.
Attempt all questions.

1. The Hermann-Mauguin notation for the symmetry of the orthorhombic mineral is
(a) 432 (b) 622
(c) 4/m2/m2/m (d) 2/m2/m2/m

2. Braggs' Law can be expressed by the equation
(a) $n\lambda = 2d \sin\theta$ (b) $\lambda = 2d (\sin\theta)^n$
(c) $n/\lambda = \sqrt{2}d \sin\theta$ (d) $n\lambda = 2d \sin^2\theta$

3. A Becke line method is a technique to identify
(a) pleochroic scheme of mineral in thin section
(b) uniaxial and biaxial interference figure of minerals in thin section
(c) negative and positive relief of mineral in thin section
(d) behaviour of extinction of mineral under the microscope

4. In the determination of values of 2V, which of the following statements is correct?
(a) the higher the value of 2V, the lower is the distance between the isogyres
(b) the higher the value of 2V, the greater is the distance between the isogyres
(c) the higher the value of 2V, there will be a single and straight isogyres
(d) the higher the value of 2V, there will be two isogyres intersecting with each other

5. In biaxial minerals, determination of optic sign is done with the help of
(a) Off-Center Figure (b) Obtuse Bisectrix Figure
(c) Acute Bisectrix Figure (d) Optic Normal (Flash) Figure

6. Which of the following mineral is having the highest birefringence?
(a) Dolomite (b) Tremolite
(c) Cordierite (d) Olivine

7. The spacing between the melatopes in an acute bisectrix figure depends on
(a) the value of apparent optic angle, 2E
(b) optic sign of the mineral
(c) thickness of the minerals thin section
(d) speed of light waves that propagate parallel to optic axes

8. The retardation produced by mica plate is
(a) 230 nm (b) 147 nm
(c) 550 nm (d) 430 nm

9. When a monoclinic mineral is cut parallel to {001} cleavage, it will show
(a) Extinction once every 45° rotation of the stage
(b) Inclined extinction
(c) Parallel extinction to both cleavages
(d) Symmetrical extinction

10. Pleochroism in minerals result due to
(a) absorption of the two rays of light differently.
(b) absorption of different wavelength in same direction.
(c) transmission of all wavelength by the minerals in different directions.
(d) absorption of all wavelengths by the minerals in different directions.

12. In mineral classifications, which one among following groups is most abundant?
(a) Native elements
(b) Carbonates
(c) Sulfides and sulfosalts
(d) Oxides and hydroxides

13. The absolute cosmic abundances of elements depends on
(a) Nuclear stability
(b) The neutron number of elements
(c) The atomic weight of elements
(d) Decay properties of elements

14. In Fluorite, the Coordination Number between calcium and fluorine ions is
(a) C.N. 4
(b) C.N. 6
(c) C.N. 8
(d) C.N. 12

15. The high temperature polymorph of quartz is
(a) b-Cristobalite
(b) a-tridymite
(c) b-quartz
(d) Chalcedony

16. Which of the following is the high temperature variety of feldspar group of minerals?
(a) Adularia
(b) Microcline
(c) Orthoclase
(d) Sanidine

17. The general formula of Amphibole is
(a) $X_{1-p}Y_{1+p}Z_2O_6$
(b) $X_2Y_{4-6}Z_8O_{20}(OH)_4$
(c) $A_{0-1}X_2Y_5Z_8O_{22}(OH)_2$
(d) X_2SiO_4

18. A non-destructive geochemical analysis of rock samples in thin section is carried in the technique of
(a) XRF
(b) EPMA
(c) AAS
(d) ICPMS

19. The decay constant of ^{87}Rb is
(a) $\lambda = 1.42\times10^{-11}yr^{-1}$
(b) $\lambda = 1.33\times10^{-12}yr^{-1}$
(c) $\lambda = 1.46\times10^{-10}yr^{-1}$
(d) $\lambda = 1.89\times10^{-11}yr^{-1}$

20. Twinning is microcline is the result of
(a) Penetration and Japan twin laws
(b) Albite and Pericline laws
(c) Albite and Carlsbad laws
(d) Manebach and Baveno laws

21. The granitic magmas originate by
(a) differential fusion of mixed rocks in the continental basement
(b) plate tectonics and drifting of the continents
(c) radioactive processes that contribute large amount of heat beneath the earth
(d) orogenic activities that increase pressure to surrounding environments

22. The source of basaltic magma is attributed to be

(a) Werhlite. (b) Harzburgite.

(c) Peridotite. (d) Lherzolite.

23. Which of the following is the product of derivative magma?

(a) Basalt (b) Granite

(c) Phonolite (d) Pyroxenite

24. In the IUGS Classififcation of plutonic rocks, trondhjemite is defined by

(a) 20-60% quartz with 10% mafic minerals.

(b) 30-70 quartz without any mafic minerals.

(c) More than 90% quartz with less than 5% feldspars.

(d) 20-60% quartz with 40-90% alkali feldspar.

25. The volcanic equivalent of monzonite is

(a) Latite (b) Dacite

(c) Trachyte (d) Phonolite

26. The given mineral reaction indicates which one of the following magmatic process?

$$CaMg(CO_3)_2 + NaAlSi_3O_8 \leftrightarrow CaMgSi_2O_6 + NaAlSiO_4 + 2CO_2$$

Dol Ab Di Ne

(a) Fractional crystallization (b) Liquid immiscibility

(c) Magma mixing (d) Assimilation

27. The efficient mixing of two different types of magma is controlled by

(a) Density, viscosity and temperature. (b) Pressure, temperature and composition.

(c) Viscosity, forces of mixing and depth of mixing. (d) Temperature, density and volatile compositions

28. A phase relation of the system Forsterite-Fayalite explain about

(a) The physics of magma.

(b) Assimilation process of magma.

(c) Fractional as well as equilibrium crystallization.

(d) The effects of chemistry on behaviour of magma with changes in P-T conditions.

29. The significance of Bowen's Reaction principle to natural rock system is that

(a) late crystallizing minerals are formed at relatively high T from residual liquids of magma.

(b) diversification of rock types from a common basaltic magma source.

(c) magmas of different composition or similar magma crystallizing under different condition may not directly precipitate a variety of different minerals.

(d) There are fixed mechanism of crystallization of minerals that new minerals formed form earlier crystallizing minerals, i.e., Mg Proxene derived by reaction from olivine.

30. When interstitial spaces of laths of plagioclase in random orientation are filled by glass, the texture is called

(a) Pilotaxitic texture (b) Hyalopilitic texture

(c) Ophitic texture (d) Intersertal texture

31. Texture of igneous rock which indicate simultaneous crystallization of minerals at the close of crystallization of alkaline magma is

(a) Myrmekitic texture (b) Granophyric texture

(c) Pertithic texture (d) Spinifex tuxture

32. Which of the following is the odd one with respect to textures in igneous rocks?

(a) Reaction rim (b) Kelyphitic border

(c) Corona texture (d) Perlitic texture

33. Which of the following is the ultramafic type of lamprophyre?

(a) Vogesites (b) Alnoites

(c) Camptonites (d) Kersantites

34. The granularity of igneous rocks is controlled by crystallization behaviour, which is in turn controlled by

(a) Rate of cooling and chemistry of magma (b) Viscosity and volatile content

(c) Molecular concentration and chemical activity (d) All of the above

35. The first formed crystals of forsterite in Anorthite-Forsterite-Silica system are

(a) Euhedral (b) Anhedral

(c) Subhedral (d) Rimmed by enstatite

36. What is the temperature of reaction point (R) in the Forsterite-Silica system which converts forsterite to enstatite?

(a) 1453°C (b) 1557°C

(c) 1629°C (d) 1780°C

37. Peraluminous igneous rocks are those in which

(a) $Al_2O_3 \geq (Na_2O + K_2O)$ (b) $(Na_2O + K_2O)/Al_2O_3 > 1$

(c) $Al_2O_3/(Na_2O + K_2O) = 1$ (d) $Al_2O_3/(CaO + Na_2O + K_2O) > 1$

38. The characteristic(s) magma series in convergent plate margin is/are

(a) tholeiitic and alkaline (b) komatiitic in nature

(c) Tholeiitic, calc-alkaline and alkaline (d) Tholeiitic and komatiitic

39. Which of the following statement is true with reference to alkaline rocks?

(a) Tephrites composed of calcic-plagioclase and clinopyroxene with foids>10%.

(b) Basanites are a group of tephrites with olivine but foids<10%.

(c) Leucitites are extrusive to subvolcanic foidites with high percentage of plagioclase.

(d) Assam, Himachal Pradesh, Jamu & Kashmir, Utter Pradesh.

40. The essential mineral compositions in most carbonatites are

(a) Calcite, dolomite or ankerite (b) Aegirine, aegirine-augite or pyrochlore

(c) Phlogopite, melilite or parisite (d) Pyrochlore, perovskite or apatite

41. The translational region between metamorphism and diagenesis is known as

(a) catazone (b) epizone

(c) anchizone (d) mesozone

42. Choose a correct statement from the following.

(a) Metamorphic rocks should have constant chemical composition as its parental rocks.

(b) Recrystallization during metamorphic process does not yield deviated chemical compositions relative to the parent rocks.

(c) Hydrothermal reactions during metamorphism disturb consistency in chemical composition of pre-existing rocks.

(d) Textures of metamorphic rocks are the result of phase changes during metamorphism.

43. The regional metamorphism is characterized by

(a) Low temperature, low strain and variable fluid pressure.

(b) High temperature, high pressure and low strain.

(c) High temperature, low pressure and variable strain.

(d) Low temperature, high strain and high fluid pressure.

44. According to Phase Rule, the high temperature phase of Al_2SiO_5 is

(a) Kyanite (b) Andalusite

(c) Sillimanite (d) Corundum

45. Which one of the following is a characteristic mineral of metapelite?

(a) Garnet (b) Hornblende

(c) Olivine (d) Pyroxene

46. The pressure gradient of a continental crust at the base of 35 km is calculated to be

(a) 4 GPa (b) 3 GPa

(c) 2 GPa (d) 1 GPa

47. When heat transfer is the dominant agent, the metamosphism is known as

(a) Dynamic metamorphism (b) Dynamothermal metamorphism

(c) Thermal metamorphism (d) Metasomatism

48. The convenient term used to express the general increase in degree of metamorphism without specifying the exact relationship between pressure and temperature is

(a) Metamorphic facies (b) Metamorphic grade

(c) Reaction isograd (d) Metamorphic zone

49. Which of the following is classed under contact metamorphism?

(a) Orogenic metamorphism (b) Burial metamorphism

(c) Ocean floor metamorphism (d) Pyrometamorphism

50. A 'Migmatite' is a mixed rock in which

(a) An older metamorphic rock is mixed with younger granitic material.

(b) An older granitic rock is mixed with newly metamorphosed gneissic sediments.

(c) A primary gneiss mixes with metamorphosed gneissic sediments.

(d) Fragments of igneous, sedimentary and metamorphic rocks are complexly mixed together.

51. Metamorphic facies are defined by

(a) The conditions of temperature and pressure (b) A single dominant rock type

(c) Peculiar texture and structures of the rocks types (d) Critical mineral assemblages

52. The conversion: Granulite '!Amphibolites is an example of

(a) Progressive regional metamorphism (b) Retrogressive metamorphism

(c) Autometamorphism (d) Paired metamorphic belt

53. If we designate the number of phases in a system as P, the number of components by C and the number of degree of freedom by F, then the phase relation can be expressed as

(a) $P - F = C - 2$ (b) $P + F = C + 2$

(c) $F - C = P - 2$ (d) $C + P = F - 2$

54. Which of the following is correct arrangement as per increasing grade of metamorphism?

(a) Slate–phyllite–granulite–amphibolite (b) Phyllite–slate–amphibolite–granulite

(c) Slate–phyllite–granulite–eclogite (d) Amphibolite–slate–eclogite–granulite

55. Carbonate metamorphism is recognised in the field when the mineral assemblage contain

(a) wollastonite (b) high alumina minerals

(c) glauconite (d) garnet

56. Which one of the following is the protoliths of Eclogite?

(a) Typically basaltic rocks (b) Mafic igneous rocks or greywacke

(c) Ultramafic rocks (d) Pelitic or quartzo-feldspathic rocks

57. Which of the following is the texture found in contact metamorphism?

(a) Decussate (b) Pseudotachylite

(c) Mylonites (d) Augen texture

58. Gibbs Phase rule applied to systems at equilibrium is expressed by

(a) C = F (f + 2) (b) F = f + 2 – C

(c) C = F – f + 2 (d) F = C – f + 2

59. In the AKF diagram, 'F' stands for

(a) $Al_2O_3 + Fe_2O_3 \leq Na_2O \leq K_2O \leq CaO$ (b) FeO + MgO + MnO

(c) Fe_2O_3 - K_2O + CaO (d) MnO + CaO ‹ FeO

60. Which one of the following is an indication of redox reaction in metamorphic process?

(a) $2\,KAlSi_3O_8 + 2H^+ + H_2O = Al_2Si_2O_5(OH)_4 + SiO_2 + 2K^+$

(b) $CaCO_3 + SiO_2 = CaSiO_3 + CO_2$

(c) $6Fe_2O_3 = 4Fe_3O_4 + O_2$

(d) $Mg_2SiO_4 + SiO_2 = 2MgSiO_3$

61. The characteristic of arkose is

(a) Quartz>95% (b) Feldspar>25%

(c) Lithic fragments>75% (d) Matrix>75%

62. The oldest sedimentary strata in Mizoram is represented Barail Group of which are mostly

(a) Subarkose (b) Arkose to feldspathic arenite

(c) Quartz arenite to arenite (d) Litharenite and wacke

63. In Udden-Wentworth size classes, ö values of sandstone ranges between

(a) 8.5 to 14 (b) -2 to -8.0

(c) -1.0 to 4.0 (d) 4.0 to 8.0

64. Which of the following represents the internal sedimentary structure?

(a) rib and furrow (b) synaeresis crack

(c) parting lineation (d) mud cracks

65. Normal grading of sedimentation unit indicates

(a) lateral migration of environment and fluctuation in sea level

(b) rapid deceleration of transporting current and minimal sorting

(c) grain flows characterized by grain-to-grain collision

(d) short term changes in discharge and sediment load related to climate change

66. The significance of overturned cross bedding is that

(a) it indicates earthquake shock prior to its formation

(b) it evidenced rapid deposition of relatively thick sand

(c) it indicates liquefaction associated with rapid deposition

(d) it indicates foundering of sand beds or repeated detachment of liquidized sand

67. Limestones are deposited in several kinds of shelf environments which include
(a) rimmed platform
(b) open shelves
(c) ramps
(d) all of the above

68. Which of the following sedimentary structure is useful in Palaeocurrent analysis?
(a) dish and pillar structures
(b) load casts
(c) ball and pillow structures
(d) sole marks

69. The modern example of convergent settings of backarc basins is
(a) The Marianas
(b) The Gulf of Mexico
(c) The Red Sea
(d) The Sumatra

70. Which one of the following is biogenic sedimentary structure?
(a) liesegang
(b) flasers
(c) cruziana
(d) lapilli

71. The carbonate compensation depth is generally not exceeding
(a) 4500 m
(b) 4000 m
(c) 3500 m
(d) 3000 m

72. The ultimate goal of sedimentary basin analysis is
(a) to find out stages of basin evolution and architecture.
(b) to unravel complete history and hydrocarbon prospects.
(c) to investigate nature of sediment fills and feasibility of oil and gas deposits.
(d) to determine basin floor patterns, paleo-hydraulics and maturation of sediments.

73. The process of diagenesis in sandstone and shale which results in porosity enhancement is
(a) Recrystallization and inversion
(b) Dissolution and decementation
(c) Replacement and albitization
(d) Oxidation of ferromagnesian minerals

74. The Indian example of a type of remnant ocean basins under the tectonic class of Convergent Settings is
(a) Cuddapah Basin
(b) Cambay Basin
(c) Bay of Bengal Basin
(d) Vindhyan Basin

75. In seismic stratigraphic analysis, the sand:shale ratio is determined with the help of
(a) Calipar log
(b) Gamma-ray log
(c) Neutron logs
(d) Ultrasonic imaging logs

76. The origin of cataclstic breccias are attributed to
(a) shattering of rocks owing to meteorite impact
(b) breakdown of older rocks by the process of weathering and erosion
(c) breakup of rock owing to tensile stresses and impact during crustal collapse
(d) penecontemporaneous fragmentation of weakly consolidated sedimentary beds

77. The application of trace elements and REEs in sedimentological studies is
(a) to determine tectonic provenance
(b) to evaluate maturity
(c) to find out palaeocurrent directions
(d) to evaluate transport phenomena

78. The polymict conglomerate has the composition ratio of
(a) 50% Metamorphic, 40% Igneous and 10% Sedimentary
(b) 50% Metamorphic, 25% Igneous and 25% Sedimentary
(c) 30% Metamorphic, 20% Igneous and 50% Sedimentary
(d) relative amount between 0-50% each of metamorphic, igneous and sedimentary

79. Which of the following clay mineral is formed particularly during burial diagenesis?

(a) Smectite
(b) Kaolinite
(c) Chlorite
(d) Sepiolite

80. In geosynclinals model and concept, the zone which receives sedimens mainly from the cratonic source are termed

(a) miogeosyncline
(b) eugeosyncline
(c) geanticline
(d) borderland

81. Concept II of the Fundamental concept of Environmental Geology deals with

(a) Earth as a system
(b) Human population growth
(c) Hazardous Earth Process
(d) Sustainability

82. In the current seismic hazard map of India, Mizoram falls under Zone V which may be due to the fact that

(a) the region is tectonically deformed and resulting into crustal shortening
(b) subduction is still found to be active between Indo-Burma plates
(c) the region is earlier a thick sedimentary basin that became uplifted
(d) the region is entirely composed of soft sedimentary rocks with highly fractured characteristics

83. The permissible limit of noise level in India in residential areas, for day time and night time is

(a) 75 dB and 70 dB respectively
(b) 65 dB and 55 dB respectively
(c) 55 dB and 45 dB respectively
(d) 50 dB and 40 dB respectively

84. According to the USGS and GCMT, the moment magnitude of Turkey-Syria earthquake on 6th February 2023 at 01:17 UTC was

(a) M_W 8.0
(b) M_W 7.8
(c) M_W 7.7
(d) M_W 7.4

85. The concept of Neotectonics was coined by Vladimir Obruchev in 1948 defining the field as tectonics activities during

(a) Tertiary and Quaternary Periods
(b) Tertiary Period
(c) Quaternary Period
(d) Palaeogene to Quaternary Period

86. The highest greenhouse gases released from anthropogenic activities is

(a) CO_2
(b) Methane
(c) CFCs
(d) N_2O

87. Which of the following is the effect of air pollutant, SO_2 on human beings?

(a) Reduce the ability of circulatory system
(b) Increase risk of chest cold, bronchitis and pneumonia in children
(c) Increase in chronic respiratory disease and shortness of breath
(d) Headache, fatigue and nausea and eye irritation

88. Which of the following served the best site for landfill solid-earth waste disposal?

(a) Limestone and highly fractured rocks
(b) Clay pits
(c) Swampy areas
(d) Flood plains and areas with close proximity to coast

89. The immediate environmental impact of deforestation and land degradation is

(a) sudden drop of groundwater table

(b) disturbance in biodiversity and ecological system

(c) fluctuation in seasonal rainfall period

(d) reduction in CO_2 concentration in the environment

90. Which of the following statement is correct with reference to the event of El Nino?

(a) Upwelling of cool nutrient-rich water initiated in eastern Pacific Ocean

(b) Upwelling of cool nutrient-rich water suppressed in eastern Pacific Ocean

(c) Slight reductions in the trade winds that, in turn, cause warm water in the eastern equatorial Pacific Ocean to flow westward

(d) The decrease of heat and water in the atmosphere produces cool atmospheric phenomenon leading to rainfall in western Pacific Ocean

91. What are the toxic elements that led to *Itai-Itai* disease in Japan due to mismanagements of industrial waste disposal?

(a) Uranium, cobalt, sulphur

(b) Arsenic, fluorine, nitrate

(c) Lead, zinc, cadmium

(d) Lithium, mercury, chromium

92. Uncontrolled solid earth-waste disposal in Mizoram will immediately lead to

(a) Siltation and disturbance in aquatic ecosystem

(b) Groundwater pollution.

(c) Soil quality degradation.

(d) Low efficiency of bio-geochemical cycles.

93. Which of the following could be responsible for drying out of surface water channels?

(a) Constructions of lake and ponds in the upstream areas.

(b) Overexploitation of groundwater.

(c) Deforestation and uncontrolled system of Jhuming cultivation.

(d) All of the above

94. The 2006 Amendment to the EIA notification in India introduce

(a) Centralization of project clearance through online digital mode

(b) Three categories of development projects

(c) Four stages in the EIA cycles: screening, scoping, public hearing and appraisal

(d) Projects such as mining, thermal power plant, infrastructures and industries do not require screening but only appraisal

95. Acid mine drainage is a severe environmental issue related to mining of

(a) Coal

(b) Iron ore

(c) Bismuth

(d) Platinum Group Elements

96. Currently, the Environment Impact Assessment in India is statutorily backed by the Environment Protection Act of

(a) 1970

(b) 1982

(c) 1986

(d) 1992

97. The segment of coast that includes an entire cycle of sediment released to the coast, longshore sediment transport and eventual loss of sediments from the nearshore environment is called

(a) Groins

(b) Jetties

(c) Littoral cell

(d) Sea walls

98. The seismic hazard maps are prepared by considering what we currently know about

(a) Past fault and earthquake

(b) Land surface processes and topography

(c) Different vulnerability levels of people living in the area

(d) Economics and livelihood at regional scale

99. The immediate cause of landslide in NE India, particularly in Mizoram which affect peaceful living of the society is

(a) Rainfall and mismanage sewage disposals

(b) Geologically uncontrolled development activities

(c) Highly dipping rocks and topographic slopes

(d) Both (a) & (b)

100. Under the portfolio of Environmental Legislations in India, when did the Union Ministry release the Solid Wastage Management (SWM) Rules which replaced the Municipal Solid Wastes (Management and Handling) Rules, 2000?

(a) 2006 (b) 2012

(c) 2014 (d) 2016

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