MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF ASSISTANT CONTROLLER OF MINES UNDER COMMERCE & INDUSTRIES DEPARTMENT GOVERNMENT OF MIZORAM, SEPTEMBER, 2023

PAPER - II (TECHNICAL)

Time Allowed : 3 hours Full Marks : 200

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

1. Which is the right order of coal maturity?
(a) Lignite, peat, bituminous, anthracite
(b) Peat, bituminous, lignite, anthracite
(c) Peat, lignite, bituminous, anthracite
(d) lignite, Peat, anthracite, bituminous

2. What is the maximum allowed width of a gallery as per CMR 2017?
(a) 4.2 m
(b) 4.5 m
(c) 4.6 m
(d) 4.8 m

3. Tributary area method for stress estimation is valid for
(a) Development
(b) Depillaring
(c) Caving with Longwalling.
(d) Pastefill with Longwalling

4. If w/h (width/height) ratio of a sample is increased, its strength will
(a) Increase
(b) Decrease
(c) Either increase or decrease
(d) No effect

5. Ratio of horizontal to vertical in situ stress at shallow cover is generally
(a) >1
(b) 1
(c) <1
(d) 0

6. In case of tick ore body, the preferable stoping method is
(a) Longitudinal
(b) Transverse
(c) Both
(d) None

7. Longwall mining methods is best suited for
(a) seam with high cavability index
(b) steeply inclined seam
(c) geologically disturbed seam
(d) flat and moderately flat seam

8. Breaking of coal in hydraulic mining is done by
(a) coal drill
(b) jet monitor
(c) coal cutting machine
(d) blasting

9. The costliest stoping method is
(a) Cut & Fill method
(b) Sub-level caving stoping
(c) Block caving
(d) Shrinkage stoping

10. Crown pillar is

(a) just above the ore drawing cross-cut
(b) at the top of the stope
(c) on the side of the stope
(d) at the base of the stope

11. The point beyond which the mineral/coal cannot be economically extracted is called

(a) Stripping ratio
(b) Cost of stripping ratio
(c) Break even stripping ratio
(d) Limit of extraction

12. What is the relation between break-even stripping ratio and ordinary stripping ratio

(a) BESR = OSR
(b) BESR<OSR
(c) BESR>OSR
(d) No ratio

13. Vertical and steeply inclined openings is suitable for

(a) Square set stoping
(b) Cut & fill stoping
(c) Shrinkage stoping
(d) Stope and pillar method

14. Which of the following method is known as vertical crater retreat (VCR) method?

(a) Board and pillar mining
(b) Blasing gallery
(c) Sub level stoping
(d) Shrinkage stoping

15. Danger of air blast is maximum with

(a) Blasting gallery method
(b) Cut and fill method
(c) Bhaska and tipong method
(d) Shrinkage stoping

16. With the increase in slope angle, the removal of overburden material

(a) Increase
(b) Decrease
(c) Remain same
(d) Either increase or decrease

17. Subsidence decrease with the

(a) Increase in depth of cover
(b) Increase in panel width
(c) Increase in extraction percentage
(d) Increase in height of extraction

18. Ring pattern holes are provided in

(a) Long wall mining
(b) Board and pillar mining
(c) Highwall mining
(d) Blasting gallery method

19. A coal pillar of 30 m × 30 m (centre to centre) is situated at a depth of 100 m. The width of gallery is 4.8 m. Considering the unit weight of rock 0.025 MPa/m, the load on the pillar, calculated by tributary area method would be

(a) 3.14 MPa
(b) 3.54 MPa
(c) 3.94 MPa
(d) 3.84 MPa

20. Powered support is associated with

(a) Board and pillar mining
(b) Wide stall method
(c) Longwall mining
(d) Shrinkage stoping

21. Free face is created by making

(a) Footwall drive
(b) Slot raise
(c) Ore drive
(d) All of above

22. At critical width, subsidence occurs at
(a) Single point
(b) Multiple point
(c) No subsidence
(d) All of above

23. Pillar strength decrease with the
(a) Decrease in pillar height
(b) Increase in pillar height
(c) Increase in pillar width
(d) Decrease in panel width

24. With the increase in bench width, slope stability
(a) Increase
(b) Decrease
(c) Remain constant
(d) Either increase or decrease

25. Coal seams are called contiguous when they are situated within a vertical distance of
(a) ≤ 6
(b) ≤ 7
(c) ≤ 8
(d) ≤ 9

26. Which of the following term is not related with opencast mines
(a) Bench
(b) Haul road
(c) Decline
(d) Dump

27. Ultimate pit slope is the angle made by the imaginary line joining the
(a) average of the all bench angles
(b) top most crest of the bench to bottom most toe of the bench
(c) top most toe of the bench to the bottom most toe of the bench
(d) Top most crest of the bench to bottom most crest of the bench

28. Which is not a mass production technology in underground coal mining?
(a) Longwall mining
(b) Continuous miner technology
(c) Blasting gallery method
(d) Stowing method of mining

29. Stress on the pillar calculated by tributary area method
(a) increases with the increase in gallery width
(b) increases with the decrease in gallery width
(c) increases with the increase in height of the pillar
(d) increases with the decrease in height of the pillar

30. Cut & fill stoping can be done by
(a) Underhand method
(b) Overhand method
(c) Caving method
(d) All of above

31. Slope stability decrease with the
(a) increase in pore pressure
(b) increase in bench width
(c) decrease in slope angle
(d) none of above

32. Superimposition working is not necessary as per CMR, 2017 when the dip of seam and strata is
(a) 20°
(b) 25°
(c) 30°
(d) 35°

33. Mining method to protect the surface structure is
(a) Wide stall method
(b) Non effective width (NEW) of extraction method
(c) Both (a) & (b)
(d) None of these

34. Which is not a mode of slope failure?

(a) Wedge failure
(b) Circular failure
(c) Guttering
(d) Toppling failure

35. With an increase in the cubic size of coal sample, its strength

(a) Decreases
(b) Increases
(c) Remain constant
(d) Don't have any trend

36. The indirect formula for determination of RQD from number of discontinuities per unit volume is given by

(a) RQD = 114 - 4.4 Jv
(b) RQD = 115 - 3.3 Jv
(c) RQD = 116 – 3.3 Jv
(d) RQD = 117 – 3.3 Jv

37. Strain is given by

(a) $\varepsilon = \frac{\Delta l}{l}$
(b) $\varepsilon = \frac{l}{\Delta l}$
(c) $\Delta = \frac{\varepsilon l}{l}$
(d) $\Delta = \frac{l}{l}\varepsilon$

38. Tensile strength is determined by

(a) Brazilian Test
(b) Flat Jack Test
(c) Protodyknow test
(d) Hydro fracturing

39. In Slake durability index, the diameter of the drum is

(a) 130 mm
(b) 140 mm
(c) 120 mm
(d) 110 mm

40. Direct penetration method can be achieved by

(a) Recovery
(b) Core boring
(c) Core boring and recovery
(d) None of above

41. Seismic refraction method is used for

(a) High depth
(b) Shallow depth
(c) Moderate depth
(d) Very high depth

42. For a cylindrical specimen cross section area A, length L and Young's modulus E and axial load P, the strain energy stored will be

(a) $\frac{P^2 L}{2\ AE}$
(b) $\frac{PL^2}{2\ AE}$
(c) $\frac{P^2 L^2}{2\ AE}$
(d) $\frac{P^2 L}{AE}$

43. Bulk density refers to

(a) Voids contain both liquid and air
(b) Voids contain only air
(c) Voids contain only liquid
(d) None of above

44. Mohr's circle describes

(a) Three dimensional stresses
(b) One dimensional stress
(c) Two dimensional stresses
(d) None of above

45. Flat jack is used for measuring the

(a) In-situ stresses (b) Roof sagging

(c) Load (d) Bed separation

46. The relationship between the peak shear strength (τ) and normal stress (σ) is given by:

(a) $c = \tau + \sigma \tan \phi_p$ (b) $\sigma = c + \tau \tan \phi_p$

(c) $\tau = c + \sigma \tan \phi_p$ (d) $\tan \phi_p \tau = c + \tau$

47. The length of core obtained from 3 m section of NX size bore hole are 82, 32, 18, 101, 147, 40, 153, 102, 302, 53, 156, 300, 255, 180, 250, 173, 227, 150 and 200 cm. Then the RQD value of rock in that section is

(a) 97.3% (b) 87.3 %

(c) 77.3 % (d) 67.3 %

48. Barton's rock mass classification system is on the basis of

(a) RQD (b) RMR

(c) SMR (d) Q - System

49. As per Bieniawski (1987) the length of the bolt (L) is given as -

(a) B/2 (b) $B^{2/3}$

(c) $B^{1/3}$ (d) B/3

50. In the bending test, the tensile strength is given by

(a) $\sigma_t = \frac{3PLn}{bd^3}$ (b) $\sigma_t = \frac{2F}{\tau DL}$

(c) $\sigma_t = \frac{F}{\tau DL}$ (d) $\sigma_t = \frac{3PLn}{bd}$

51. The values of shear and normal stresses are = 10.99 MPa, = 5.90 MPa and = 1.2 MPa. The values of maximum and minimum principle stresses in MPa are

(a) 6.90 , 9 (b) 7.5 , 1.09

(c) 11.25 , 5.63 (d) 8.5 ,1.55

52. RQD represents

(a) Strength of the rock (b) Cohesion of the rock

(c) Weakness of the rock (d) None of above

53. Strain-stress curve shows

(a) Deformability (b) Porosity

(c) Degree of saturation (d) Permeability

54. Which geophysical prospecting method works on the principal of Newton's law?

(a) Seismic method (b) Electrical method

(c) Gravity method (d) All of above

55. When the moisture content in rock increases, the load bearing capacity of rock gets

(a) Increases (b) Decreases

(c) No effect on the load bearing capacity (d) None of these

56. The correct generalized form of Hoek and Brown criterion can be expressed as

(a) $\sigma_1 = \sigma_3 + \sigma_{ci}\left(m_b \frac{\sigma_3}{\sigma_{ci}} + s\right)^a$

(b) $\sigma_3 = \sigma_1 + \sigma_{ci}\left(m_b \frac{\sigma_3}{\sigma_{ci}} + s\right)^a$

(c) $\sigma_1 = \sigma_3 - \sigma_{ci}\left(m_b \frac{\sigma_3}{\sigma_{ci}} + s\right)^a$

(d) $\sigma_1 = \sigma_3 + \sigma_{ci}\left(m_b \frac{\sigma_3}{\sigma_{ci}} + s\right)$

57. For a circular opening of radius 'a' and the far –field stress value is P. The radial and tangential stresses at a distance 'r' from the centre of the opening are

(a) $\sigma_t = 0, \sigma_t = P(1+\frac{a^2}{r^2})$

(b) $\sigma_r = P(1-\frac{a^2}{r^2}), \sigma_t = P(1+\frac{a^2}{r^2})$

(c) $\sigma_r = 2P(1-\frac{a^2}{r^2}), \sigma_t = P(1+\frac{a^2}{r^2})$

(d) $\sigma_r = 3P, \sigma_t = 0$

58. Angle of internal friction (ϕ) and cohesion (c) is determined by

(a) Triaxial compression
(b) Uniaxial Compression
(c) Biaxial compression
(d) None of these

59. The immediate roof having RMR value of 40 is to be supported by roof bolts. If the width of gallery is 4.8, the minimum length of bolt will be

(a) 1.41 m
(b) 1.42 m
(c) 1.44 m
(d) 1.43 m

60. If the RQD falls between 25-50%, then quality of the rock is

(a) Poor
(b) Fair
(c) Good
(d) Excellent

61. The weight bulb temperature of air at a particular place in a mine is 31°C, then the air velocity in that place should be

(a) More than 1 m/s
(b) Less than 1m/s
(c) More than 0.5 m/s
(d) More than 1.5 m/s

62. The black damp accumulates _____ to the floor.

(a) Near
(b) Far
(c) Side
(d) All of the above

63. Ignition temperature of methane is

(a) 600 - 800°C
(b) 923 - 1023°C
(c) 675 - 975°C
(d) 423 - 823°C

64. Which equipment is commonly used for air velocity measurement in mines?

(a) Hygrometer
(b) Halden apparatus
(c) Anemometer
(d) Inclined Manometer

65. The lower and upper explosibility limit of hydrogen by volume in air is

(a) 2 - 74%
(b) 4 - 94%
(c) 4 - 74%
(d) 5.4 - 15.8%

66. The presence of CO in underground working atmosphere and its inhalation by miners reacts with hemoglobin to form

(a) Oxides of haemoglobin
(b) Doxy haemoglobin
(c) Oxy haemoglobin
(d) Carboxy haemoglobin

67. Which equipment is used for the reviving apparatus of miners in underground coal mine?

(a) Dragger BG 172
(b) Pulmometer
(c) Open circuit self rescuer
(d) Closed circuit self rescuer

68. Static pressure is measured by which instrument?

(a) Barometer
(b) Venturimeter
(c) U-tube
(d) All of the above

69. A fan running at 200 rpm develops a pressure of 50 mm water gauge. What will be the pressure when it is increased to 300 rpm?

(a) 75 mmwg
(b) 112.5 mmwg
(c) 164 mmwg
(d) None of the above

70. Effective temperature of air estimated from _____, _____ and _____.

(a) Dry bulb temperature, wet bulb temperature, and air velocity
(b) Dry bulb temperature, density of air, velocity of air
(c) Relative humidity, density of air, wet bulb temperature
(d) None of the above

71. Mine ventilation system has two splits A and B having resistance of 0.5 Ns^2M^{-8} and 2 Ns^2M^{-8} respectively. The combined resistance of two shafts and airways is 0.7 Ns^2M^{-8}. A quantity of 20 m^3/s of air passes through split A. The total air powers of the ventilation system in kW are

(a) 82.9
(b) 24.9
(c) 48.9
(d) 27.9

72. What is the conversion factor of barometric pressure in 'x' mm of mercury to SI units?

(a) $\frac{101325}{750} x \text{ N/m}^2$
(b) $\frac{102325}{750} x \text{ N/m}^2$
(c) $\frac{101325}{760} x \text{ N/m}^2$
(d) $\frac{102325}{760} x \text{ N/m}^2$

73. What will be the quantity of air required for 400 workers employed in a single largest shift having a production of 1000 tones per day?

(a) 2400 m^3/min
(b) 1000 m^3/min
(c) 6000 m^3/min
(d) 2500 m^3/min

74. What is the permissible limit of respirable dust concentration for any coal mines of India as per 12th National Conference of Safety in Mines, 2020?

(a) 1 mg/m^3
(b) 5 mg/m^3
(c) 2 mg/m^3
(d) 3 mg/m^3

75. What should be the reasonable air velocity required to operate the diesel operated equipment in any underground mines as per DGMS circular 2018?

(a) 45 m/min
(b) 25 m/min
(c) 15 m/min
(d) 60 m/min

76. The water gauge of an axial flow fan can be increased by

(a) increasing speed of rotation
(b) installing 2 or more stages,
(c) changing the pitch of blades
(d) enlarging the evasee of the fan

77. The low resistance mine has an arrangement of fan in parallel to increase in air quantity flow. What will be the percentage increase of air flow?

(a) Negligible quantity
(b) 10 %
(c) 20 %
(d) 50 %

78. What is the working efficiency of mine worker at 300 K?

(a) 80 %
(b) 30 %
(c) 75 %
(d) Nearly 100 %

79. The minimum thickness of a ventilation stopping made of masonry or not properly reinforced concrete is _____ as per CMR 2017.

(a) 25 cm
(b) 15 cm
(c) 30 cm
(d) 40 cm

80. The sensitivity/least count of the commonly used vertical U-tube manometer in mines is

(a) 1.0 Pa
(b) 10 Pa
(c) 20 Pa
(d) 100 Pa

81. Which of the following mineral groups would have the most noticeable reaction when dilute hydrochloric acid (HCl) was applied?

(a) oxides
(b) silicates
(c) carbonates
(d) phosphates

82. Economic minerals which commonly occur as evaporite deposits are

(a) calcite and gypsum
(b) gold and silver
(c) chalcopyrite and bornite
(d) galena and sphalerite

83. Mineral deposits that form in ocean basins near ridge-related hot springs are called

(a) evaporates
(b) hydrothermal
(c) pegmatites
(d) magmatic

84. Lead and iron are immobile in

(a) Siliceous environment
(b) Calcareous environment
(c) Both (a) and (b)
(d) None of these

85. Match the following:

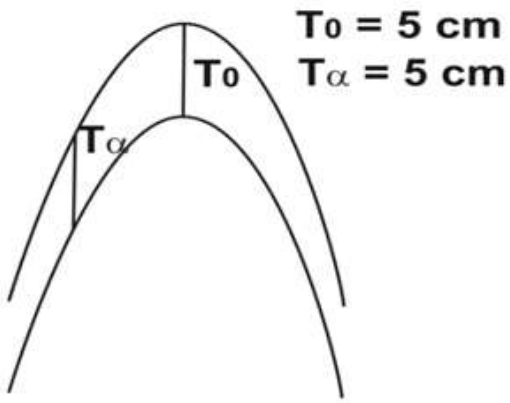
Deposits	Pathfinders
1. Copper	i Mercury
2. Gold	ii Arsenic
3. Lead-zinc	iii Antimony
4. Silver	iv Molybdenum

(a) 1-iv, 2-ii,3-iii,4-i
(b) 1-ii, 2-i, 3-iv, 4-iii
(c) 1-iv,2-i,3-iii,4-ii
(d) 1-iii, 2-ii, 3-iv, 4-i

86. The Mesozoic Era approximately ranges from

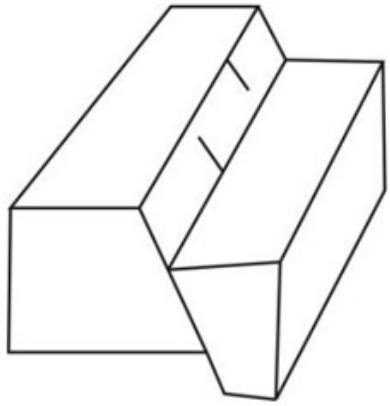
(a) 1000-540Ma
(b) 250-65 Ma
(c) 540-250 Ma
(d) 65 Ma-Present

87. Identify the fold in the given figure, where T0 and T α represent the axial plane thicknesses at the hinge and limb, respectively.



(a) Parallel fold
(b) Similar fold
(c) Supratenuous fold
(d) Flattened parallel fold

88. Identify the type of fault in the given figure.



(a) Normal fault
(b) Strike-slip fault
(c) Reverse fault
(d) Thrust fault

89. Which of the following pairs is NOT correctly matched?:

(a) Productus - Brachiopoda
(b) Redlichia - Arthropoda
(c) Belemnites – Cephalopoda
(d) Gryphea – Gastropoda

90. Which one of the following invertebrates has the most primitive visual system?

(a) Ammonites
(b) Brachiopods
(c) Trilobites
(d) Gastropods

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

(a) An Isotropic mineral remains dark through 360º rotation of stage under crossed polar
(b) Pleochroism is the change of colour of a mineral during rotation under crossed polars
(c) Minerals of the Triclinic system are optically uniaxial
(d) All of the above

92. Major mass extinction events occurred in the

(a) end Siliurian (b) end Carboniferous

(c) end Permian (d) early Devonian

93. Among the following rocks, the one with highest metamorphic grade is

(a) gneiss (b) glaucophane schist

(c) phyllite (d) chlorite schist

94. The host rock of Pb-Zn deposit at Zawar Group of Mines in Rajasthan is

(a) quartzite (b) phyllite

(c) dolomite (d) gneiss

95. The igneous body with dome or mushroom-like shape is known as a

(a) lopolith (b) laccolith

(c) sill (d) ring dike

96. The most abundant metal (by weight %) in the Earth's crust is?

(a) Al (b) Fe

(c) Na (d) Mg

97. Match the ore deposits in Group I with the localities in Group II:

Group I	Group II
i) Copper	P) Balaghat, M.P.
ii) Lead-Zinc	Q) Panchpatmali, Odisha
iii) Manganese	R) Rampura-Agucha, Rajasthan
iv) Bauxite	S) Khetri, Rajasthan

(a) i-S, ii - R, iii - Q, iv - P (b) i-S, ii - R, iii - P, iv - Q

(c) i-P, ii - R, iii - Q, iv - S (d) i-S, ii - Q, iii - R, iv - P

98. Which of the following is a geochronologic unit?

(a) System (b) Period

(c) Member (d) Formation

99. The apparent dip of a plane is measured to be 45° towards NE. The true dip of the plane is

(a) 557 towards SSW (b) 407 towards NNE

(c) 487 towards ENE (d) 407 towards E

100. Which of the following stratigraphic units not contain coal seams?

(a) Barakar Formation (b) Lakadong Formation

(c) Raniganj Formation (d) Panchet Formation

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