

MIZORAM PUBLIC SERVICE COMMISSION

**COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POSTS OF
HIGH SCHOOL TEACHER (SCIENCE)
UNDER SCHOOL EDUCATION DEPARTMENT, SEPTEMBER, 2017**

TECHNICAL PAPER-I (PHYSICS & CHEMISTRY)

Time Allowed : 3 hours

Full Marks : 150

Attempt all questions.

All questions carry equal marks of 2 each.

1. According to Kinetic Theory, the mean kinetic energy of a molecule is
 - (a) directly proportional to square of absolute temperature.
 - (b) inversely proportional to absolute temperature.
 - (c) not related to absolute temperature.
 - (d) directly proportional to absolute temperature.
2. For an ideal diatomic gas, the specific heat capacity of gas at constant volume is
 - (a) $\frac{7}{2}R$
 - (b) $\frac{5}{2}R$
 - (c) $\frac{3}{2}R$
 - (d) $\frac{2}{3}R$
3. Pressure exerted by an ideal gas is equal to
 - (a) $\frac{1}{3}\rho C^2$ (ρ is density and C is the rms velocity)
 - (b) $\frac{1}{3}\rho^2 C^2$ (ρ is density and C is the rms velocity)
 - (c) $\frac{1}{3}\rho^2 C$ (ρ is density and C is the rms velocity)
 - (d) $\frac{1}{3}\rho C$ (ρ is density and C is the rms velocity)
4. The mean free path of a molecule increases with
 - (a) increase in density
 - (b) decrease in pressure
 - (c) increase in temperature
 - (d) decrease in temperature
5. Force which produces acceleration in body is equal to the rate of change of
 - (a) density
 - (b) velocity
 - (c) acceleration
 - (d) momentum

6. When two surfaces are coated with a lubricant, then they
 - (a) roll upon each other
 - (b) slide upon each other
 - (c) stick to each other
 - (d) none of these
7. When two bodies of equal masses suffer one-dimensional elastic collision, their velocities
 - (a) become zero
 - (b) become doubled
 - (c) interchanged
 - (d) become half
8. Which of the following is NOT an example of centripetal force?
 - (a) Rocket taking off
 - (b) The earth orbiting the sun
 - (c) Vehicle turning a corner
 - (d) Fairground ride
9. The centre of mass of a body is often called
 - (a) Centre of attraction
 - (b) Centre of repulsion
 - (c) Centre of gravity
 - (d) Centre of acceleration
10. The orbital speed of Jupiter is
 - (a) less than the orbital speed of the earth
 - (b) greater than the orbital speed of the earth
 - (c) equal to the orbital speed of the earth
 - (d) proportional to the distance from the earth
11. Escape velocity from earth is about
 - (a) 14.345 km/s
 - (b) 14.345 m/s
 - (c) 11.186 km/s
 - (d) 11.186 m/s
12. Velocity of geostationary satellite with respect to earth is
 - (a) 10 ms^{-1}
 - (b) 15 ms^{-1}
 - (c) 20 ms^{-1}
 - (d) Zero
13. According to Hooke's law, the ratio stress/strain is
 - (a) zero
 - (b) a constant
 - (c) infinity
 - (d) none of these
14. Hydraulic press works on the principle of
 - (a) Pascal's law
 - (b) Newton's law
 - (c) Avogadro's law
 - (d) Kepler's law
15. Bernoulli's equation cannot be applied when the flow is
 - (a) unsteady
 - (b) turbulent
 - (c) rotational
 - (d) all of these
16. Transmission of heat from one body to another separated body without heating the intervening medium is called
 - (a) Conduction
 - (b) Convection
 - (c) Radiation
 - (d) all of these

17. A perfectly black body
- (a) absorbs all the incident radiation
 - (b) allow all the incident radiation to pass through it
 - (c) reflects all the incident radiation
 - (d) has its surface coated with graphite
18. Which of the following gases contributes maximum to the Greenhouse effect on earth?
- (a) Chlorofluorocarbons
 - (b) Carbon Dioxide
 - (c) Methane
 - (d) Freon
19. The force between two charges is 120 N. If the distance between the charges is doubled, the force will be
- (a) 50 N
 - (b) 40 N
 - (c) 30 N
 - (d) 20 N
20. Resistivity of a wire depends on
- (a) length of the wire
 - (b) cross-sectional area of the wire
 - (c) material of the wire
 - (d) none of the above
21. Kirchhoff's second law is based on the conservation of
- (a) mass
 - (b) charge
 - (c) momentum
 - (d) energy
22. Which method can be used for absolute measurement of resistance?
- (a) Ohm's law method
 - (b) Wheatstone bridge method
 - (c) Raleigh method
 - (d) Lorentz Method
23. Biot-Savart law in magnetism is analogous to which law in electric field?
- (a) Faraday's law
 - (b) Gauss's law
 - (c) Ampere's law
 - (d) Coulomb's law
24. According to Faraday's law, EMF stands for
- (a) Electromotive force
 - (b) Electromagnetic field
 - (c) Electromagnetic force
 - (d) Electromagnetic friction
25. In a Cyclotron, charged particles moving in the field feel a force at
- (a) 0° to their direction of motion
 - (b) 360° to their direction of motion
 - (c) 180° to their direction of motion
 - (d) 90° to their direction of motion
26. In an iron cored coil the iron core is removed so that the coil becomes an air cored coil. The inductance of the coil will
- (a) increase
 - (b) decrease
 - (c) remain constant
 - (d) initially increase and then decrease
27. The refractive index of water is 1.33. what will be the speed of light in water?
- (a) 2.26×10^8 m/s
 - (b) 3×10^8 m/s
 - (c) 1.33×10^8 m/s
 - (d) 3.99×10^8 m/s

28. Huygen's wave theory of light cannot explain
- (a) interference
 - (b) diffraction
 - (c) polarization
 - (d) photoelectric effect
29. Myopia is due to
- (a) older age
 - (b) change in focal length
 - (c) shortening of eye ball
 - (d) elongation of eye ball
30. Sun appears red at sun rise and sunset. This is due to scattering of
- (a) longer wavelengths
 - (b) shorter wavelengths
 - (c) lower frequencies
 - (d) all frequencies
31. A single transistor can be used to build which of the following logic gates?
- (a) AND gates
 - (b) OR gates
 - (c) NOT gates
 - (d) NAND gates
32. Solar cells are made of
- (a) Silver
 - (b) Aluminium
 - (c) Germanium
 - (d) Silicon
33. A LED produces light when
- (a) forward biased
 - (b) reverse biased
 - (c) unbiased
 - (d) none of these
34. According to Rutherford, most of the space occupied by an atom is
- (a) filled
 - (b) partially filled
 - (c) empty
 - (d) none of these
35. Nuclei with equal number of neutrons are
- (a) Isotopes
 - (b) Isobars
 - (c) Isomers
 - (d) Isotones
36. The materials used to decelerate fast moving neutrons is called
- (a) coolant
 - (b) moderator
 - (c) controller
 - (d) reactor
37. The number of atoms disintegrating per second of a radioactive sample at any time is
- (a) directly proportional to the number of atoms present at that time
 - (b) inversely proportional to the number of atoms present at that time
 - (c) not related to the number of atoms present at that time
 - (d) none of these
38. Nuclear fusion occurs typically in
- (a) uranium mines
 - (b) the stars
 - (c) the upper atmosphere
 - (d) none of these
39. The electronic configuration of chromium contradicts
- (a) Hund's rule
 - (b) Aufbau principle
 - (c) Pauli's exclusion principle
 - (d) All of these

40. For the dumb-bell shaped orbital, the value of l is
(a) 3 (b) 2
(c) 1 (d) 0
41. The hybridization of the central atom in BrF_5 and the geometry of this molecule will be
(a) sp^3d^2 and square pyramidal (b) sp^3d^2 and octahedral
(c) sp^3d and trigonal bipyramidal (d) sp^3d and square pyramidal
42. The radius of Na^+ ion is 0.95 \AA and that of Cl^- ion is 1.81 \AA . Na^+ ions will prefer to occupy
(a) trigonal sites (b) tetrahedral sites
(c) cubic sites (d) octahedral sites
43. The general valence shell electronic configuration of p -block elements can be represented as
(a) $ns^{1-2} np^6$ (b) $ns^{1-2} np^{1-6}$
(c) $ns^2 np^6$ (d) $ns^2 np^{1-6}$
44. In moving downwards among the same group of the periodic table, electronegativity generally
(a) remains the same (b) decreases
(c) increases (d) changes irregularly
45. Element with the highest electron affinity is
(a) Fluorine (b) Sodium
(c) Chlorine (d) Francium
46. In the reaction of caustic soda with hydrochloric acid, the product is
(a) $\text{NaCl} + \text{H}_2\text{O}$ (b) $\text{NaCl} + \text{H}_2 + \text{O}_2$
(c) $\text{NaH} + \text{Cl}_2 + \text{O}_2$ (d) $\text{NaOCl} + \text{H}_2$
47. In a gaseous equilibrium: $\text{A} + 2\text{B} \rightleftharpoons \text{C} + \text{Heat}$; the forward reaction is favoured by
(a) High pressure and high temperature (b) High pressure and low temperature
(c) Low pressure and high temperature (d) Low pressure and low temperature
48. The K_a of an acid HA is 1×10^{-4} . The concentration of HA and its salt present in a buffer is 0.01 M and 0.1 M respectively. The pH of buffer solution will be
(a) 3.5 (b) 4
(c) 5 (d) 5.5
49. The oxidation number of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$ is
(a) +3 (b) +4
(c) +5 (d) +6
50. In the given redox reaction: $\text{MnO}_4^- + \text{H}^+ + \text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + \text{Fe}^{3+} + \text{H}_2\text{O}$
the number of electrons involve in the balanced reduction half-reaction is
(a) 5 (b) 4
(c) 3 (d) 2
51. In Lassaigne test, presence of nitrogen in organic compound is tested as
(a) N_2 (b) NH_3
(c) NO (d) CN^-

52. The correct IUPAC name of the compound, $\text{Cl}-\text{CH}_2-\text{CH}=\text{CH}-\text{OH}$ is
(a) 1-Chloro-3-hydroxyprop-2-ene (b) 3-Chloro-1-hydroxyprop-1-ene
(c) 3-Chloroprop-1-en-1-ol (d) 1-Chloroprop-2-en-3-ol
53. Which of the following species is an electrophile?
(a) H_2O (b) NH_3
(c) $\text{C}_2\text{H}_5\text{OH}$ (d) SO_3
54. The least energetic conformation of cyclohexane is
(a) Half chair form (b) Chair form
(c) Boat form (d) Twisted form
55. Which of the following halide is the most reactive towards nucleophilic substitution reactions?
(a) $\text{C}_2\text{H}_5\text{F}$ (b) $\text{C}_2\text{H}_5\text{Br}$
(c) $\text{C}_2\text{H}_5\text{I}$ (d) $\text{C}_2\text{H}_5\text{Cl}$
56. DDT is
(a) Greenhouse gas (b) Degradable pollutant
(c) Nondegradable pollutant (d) Air pollutant
57. Aldehydes are the first oxidation product of
(a) Primary alcohol (b) Secondary alcohol
(c) Tertiary alcohol (d) Alkyl cyanides
58. The antiseptic present in Dettol is
(a) Qodine (b) Chloroxylenol
(c) Bithional (d) Alizarin
59. The sequence in which amino acids are linked to one another in a protein molecule is called its
(a) Primary structure (b) Secondary structure
(c) Tertiary structure (d) Quarternary structure
60. The base unit that is absent in DNA is
(a) Adenine (b) Cytosine
(c) Guanine (d) Uracil
61. Which of the following vitamin is found in fish liver oil?
(a) Vitamin D (b) Vitamin C
(c) Vitamin A (d) Vitamin K and C
62. Polymer formation from monomer starts by
(a) Condensation reaction between monomers
(b) Coordination reaction between monomers
(c) Conversion of monomer to monomer ions by proton
(d) Hydrolysis of monomers
63. The most hazardous metal pollutant of automobile exhausts is
(a) Mercury (b) Lead
(c) Cadmium (d) Copper

64. The aim of Green chemistry is to:
- Design chemical products and process that maximize profits.
 - Design safer chemical products and processes that reduce or eliminate the use and generation of hazardous substances.
 - Design chemical products and processes that work most efficiently.
 - Utilize non-renewable energy.
65. The substances which affect the central nervous system and induce sleep are called
- Antipyretics
 - Tranquilizers
 - Analgesics
 - Antihistamine
66. The gas law showing relationship between volume and temperature is
- Boyle's law
 - Charles' law
 - Dalton's law
 - Graham's law
67. A gas can be liquefied by pressure alone when its temperature is
- higher than its critical temperature
 - higher than its Boyle's temperature
 - less than its Boyle's temperature
 - less than or equal to its critical temperature
68. The value of surface tension of a liquid at critical temperature is
- zero
 - Infinite
 - small and positive
 - small and negative
69. The coordination number of atom in simple cubic lattice is
- 12
 - 8
 - 6
 - 4
70. The standard reduction potentials of Zn and Ag in water at 25°C are
- $$\begin{array}{l} \text{Zn}^{2+}_{(\text{aq})} + 2\text{e}^- \rightarrow \text{Zn}(\text{s}), \quad E^\circ = -0.76\text{V} \\ \text{Ag}^+_{(\text{aq})} + \text{e}^- \rightarrow \text{Ag}(\text{s}), \quad E^\circ = +0.80\text{V} \end{array}$$
- Which reaction actually takes place?
- $\text{Zn}_{(\text{s})} + 2\text{Ag}^+_{(\text{aq})} \rightarrow \text{Zn}^{2+}_{(\text{aq})} + 2\text{Ag}_{(\text{s})}$
 - $\text{Zn}^{2+}_{(\text{aq})} + 2\text{Ag}_{(\text{s})} \rightarrow \text{Zn}_{(\text{s})} + 2\text{Ag}^+_{(\text{aq})}$
 - $\text{Zn}_{(\text{s})} + 2\text{Ag}_{(\text{s})} \rightarrow \text{Zn}^{2+}_{(\text{aq})} + 2\text{Ag}^+_{(\text{aq})}$
 - $\text{Zn}^{2+}_{(\text{aq})} + 2\text{Ag}^+_{(\text{aq})} \rightarrow \text{Zn}_{(\text{s})} + 2\text{Ag}_{(\text{s})}$
71. The unit of molar conductance is
- Siemens per meter
 - Siemens-meter
 - $\text{S m}^2 \text{mol}^{-1}$
 - $\text{S m}^{-1} \text{mol}^{-1}$
72. At infinite dilution, each ion of an electrolyte contributes a characteristic ionic conductance towards equivalent conductance of electrolyte which is independent of the nature of other ion present in solution. The statement was given by
- Arrhenius
 - Kohlrausch
 - Faraday
 - Ostwald
73. The unit of rate constant for 'n' order of reaction can be generally expressed as
- $\text{mol}^{n-1} \text{litre}^{1-n} \text{sec}^{-1}$
 - $\text{mol}^{1-n} \text{litre}^{1-n} \text{sec}^{-1}$
 - $\text{mol}^{1-n} \text{litre}^{n-1} \text{sec}^{-1}$
 - $\text{mol litre sec}^{-1}$

74. For a reaction: $A + B \rightarrow \text{Products}$; it is found that the rate of the reaction is proportional to the concentration of A, but it is independent of the concentration of B, then
- (a) The order of the reaction is 1 and molecularity is 2
 - (b) The order of the reaction is 2 and molecularity is 1
 - (c) The order of the reaction is 2 and molecularity is 2
 - (d) The order of the reaction is 1 and molecularity is 1

75. If we plot a graph between $\log K$ and $\frac{1}{T}$ by Arrhenius equation, the slope is

(a) $-\frac{E_a}{R}$

(b) $+\frac{E_a}{R}$

(c) $+\frac{E_a}{2.303R}$

(d) $-\frac{E_a}{2.303R}$

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