

# MIZORAM PUBLIC SERVICE COMMISSION

## TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF LEGAL METROLOGY UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS, GOVT. OF MIZORAM NOVEMBER, 2023

### PHYSICS PAPER-II

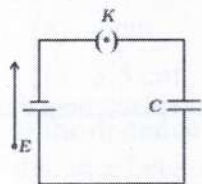
Time Allowed : 2 hours

Full Marks : 200

*All questions carry equal mark of 2 each.*

*Attempt all questions.*

- Gauss's law when applied to magnetic field, the net magnetic flux over the volume is
  - Positive
  - Negative
  - Zero
  - Maximum
- If a conductor carries any net charge, using Gauss's law, the charge will
  - reside at the center of the conductor
  - reside on the surface of the conductor
  - distribute equally throughout the conductor
  - all leave the conductor
- For a Gaussian surface  $S$ , the electric flux  $\Phi$  will be given as
  - $\Phi = \oint A.dE$
  - $\Phi = \oint E.dA$
  - $\Phi = 0$
  - $\Phi = \oint E^2.dA$
- For a line charge, the Gaussian Surface is
  - Cube
  - Square
  - Cylinder
  - Sphere
- Dielectrics are simply
  - conductors
  - semiconductors
  - insulators
  - superconductors
- In capacitors, dielectrics \_\_\_\_\_ the effective capacitance.
  - increase
  - decrease
  - reduce to half
  - minimize
- Dielectric constant of a material can never be
  - zero
  - infinity
  - positive
  - negative
- In a parallel plate capacitor connected to an emf source as shown in the figure:



Capacitor plates are moved apart with key 'K' being open, then

- Q remains same but V changes
- V remains same but Q changes
- Q remains same but C changes
- C remains same but Q changes

9. In LCR Circuit, if  $\frac{1}{LC} < \frac{R^2}{4L^2}$  the circuit will be
- (a) oscillatory (b) dead beat  
(c) critically damped (d) undamped
10. The equation  $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$  is representing
- (a) Ampere's law (b) Gauss's law  
(c) Ohm's law (d) Faraday's law
11. An impedance having phase shift between the voltage and current is
- (a) normal impedance (b) real impedance  
(c) complex impedance (d) alternating impedance
12. If a magnetic field is stationary and the magnetic flux through a loop of wire remains constant, what is the induced voltage?
- (a) Zero (b) Negative  
(c) Maximum (d) Random
13. What type of current is induced in a closed loop of wire when it cuts across magnetic field lines?
- (a) No current is induced (b) Pulsating current  
(c) Direct current (d) Alternating current
14. For a series resonant LCR circuit, resonant frequency is given by
- (a)  $f = \frac{1}{2\pi\sqrt{LC}}$  (b)  $f = \frac{1}{2\pi}\sqrt{LC}$   
(c)  $f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$  (d)  $f = \frac{1}{2\pi}\sqrt{\frac{R}{LC}}$
15. Q factor of a coil is measure of its
- (a) retentivity (b) mutual inductance  
(c) self-inductance (d) selectivity
16. An ideal inductor has \_\_\_\_\_ power dissipation.
- (a) minimum (b) maximum  
(c) infinite (d) zero
17. Increase in power factor \_\_\_\_\_ the efficiency of a device.
- (a) reduces (b) enhances  
(c) terminate (d) has no effect on
18. Magnetic field inside a long current carrying solenoid
- (a) decreases along its length (b) increases along its length  
(c) tends to zero (d) is same at all points
19. Which of the statement is true?
- (a) during charging of the capacitor, conduction current is discontinuous while displacement current is continuous in the connection wires.  
(b) during charging of the capacitor, conduction current is continuous while displacement current is discontinuous in the gap between the capacitor plates.  
(c) displacement current and conduction current are never equal  
(d) the current that flows through connection wires is called conduction current.

20. \_\_\_\_\_ reactance increases with increasing frequency.
- (a) Capacitive (b) Inductive  
(c) Resistive (d) Complex
21. \_\_\_\_\_ image formed with a lens can be projected on a screen.
- (a) Real (b) Virtual  
(c) Objective (d) Imaginary
22. In order to produce a real image, the minimum distance between the convex lens and the object is
- (a) 0 (b)  $f$   
(c)  $2f$  (d)  $4f$
23. How many cardinal points are there in thick lens?
- (a) 2 (b) 4  
(c) 6 (d) 8
24. The power of Huygens' eyepiece is
- (a) negative (b) positive  
(c) zero (d) infinity
25. Point out the true statement.
- (a) Field of view of Huygens' eyepiece is equal to that of Ramsden's eyepiece.  
(b) Field of view of Huygens' eyepiece is unequal to that of Ramsden's eyepiece.  
(c) Field of view of Huygens' eyepiece is greater than that of Ramsden's eyepiece.  
(d) Field of view of Huygens' eyepiece is smaller than that of Ramsden's eyepiece.
26. Ramsden eyepiece is also known as
- (a) negative eyepiece (b) positive eyepiece  
(c) zero eyepiece (d) infinite eyepiece
27. Two lenses of focal lengths 20 cm and - 40cm are held in contact. If an object lies at infinity, image formed by the lens combination will be at
- (a) infinity (b) 20 cm  
(c) 40 cm (d) 60 cm
28. Diffraction phenomenon can be acquainted with
- (a) Huygens principle (b) Fresnel principle  
(c) Uncertainty principle (d) Fraunhofer principle
29. In Fresnel diffraction, distance between source of light and aperture is
- (a) zero (b) negative  
(c) finite (d) infinite
30. In Fresnel biprism, the two positions of lens give separation between the slits as 9 cm and 4 cm respectively. What is the actual distance of separation?
- (a) 4 cm (b) 4.5 cm  
(c) 5.5 cm (d) 6 cm
31. If the distance between the slit and screen is doubled in Young's double slit experiment while the distance between the slits is reduced to half, then the fringe width will
- (a) not change (b) become half  
(c) become doubled (d) become four times

32. The principal points coincide with \_\_\_\_\_, when the medium on the two sides of a lens system is same.
- (a) centers of curvature (b) nodal points  
(c) focal points (d) aperture
33. In Young's double slit experiment, the fringe width  $\omega$  is given by
- (a)  $\frac{d\lambda}{2D}$  (b)  $\frac{2d\lambda}{D}$   
(c)  $\frac{D\lambda}{d}$  (d)  $\frac{D\lambda}{2d}$
34. In Newton's ring experiment, the diameter of bright rings is proportional to
- (a) odd natural numbers (b) even natural numbers  
(c) square root of odd natural numbers (d) square root of even natural numbers
35. In Newton's ring experiment, the diameter of  $n^{\text{th}}$  bright ring is given by
- (a)  $D_n^2 = \frac{2(2n-1)\lambda R}{\mu}$  (b)  $D_n^2 = \frac{(2n-1)\lambda R}{\mu}$   
(c)  $D_n^2 = \frac{4\lambda R}{\mu}$  (d)  $D_n^2 = \frac{2\lambda R}{\mu}$
36. In Michelson interferometer, when the two mirrors are perpendicular to each other, then the shape of the fringes are
- (a) elliptical (b) circular  
(c) straight line (d) inclined
37. \_\_\_\_\_ proved the transverse phenomenon of light wave.
- (a) Reflection (b) Interference  
(c) Diffraction (d) Polarization
38. The property that differentiate a laser beam from an ordinary light beam is
- (a) Color of the laser beam (b) Greater polarization of the laser beam  
(c) Higher frequency of the laser beam (d) Coherence of the laser beam
39. During population inversion in laser, \_\_\_\_\_ process is dominant.
- (a) Stimulated emission (b) Spontaneous emission  
(c) Induced absorption (d) Stimulated absorption
40. Einstein's B coefficients are related to the rate of
- (a) Stimulated emission (b) Spontaneous emission  
(c) Induced absorption (d) Stimulated absorption
41. According to Bohr's atomic theory, the radii of the orbits are in the ratio
- (a) 1:2:3:4 (b) 1:3:5:7  
(c) 1:4:9:16 (d) 1:5:11:19
42. In Bohr's theory of H-like atom The angular momentum of electron in an orbit is a multiple of
- (a)  $\frac{nh}{2\pi}$  (b)  $\frac{n\pi}{2h}$   
(c)  $\frac{2h}{n\pi}$  (d)  $\frac{h}{2\pi}$

43. The radius of Bohr's orbit is \_\_\_\_\_ proportional to \_\_\_\_\_ quantum number.
- (a) directly; principal (b) directly; square of principal  
(c) inversely; principal (d) inversely; square of principal
44. In order to explain and support his theory, Bohr used
- (a) conservation of energy (b) conservation of quantum frequency  
(c) conservation of linear momentum (d) conservation of angular momentum
45. What is the energy of 1<sup>st</sup> orbit in a hydrogen atom?
- (a)  $-2.18 \times 10^{-18}$  J (b)  $-3.18 \times 10^{-18}$  J  
(c)  $2.18 \times 10^{-18}$  J (d)  $3.18 \times 10^{-12}$  J
46. The types of electrons affected by the Pauli's Exclusion Principle are -
- (a) only the electrons in the outermost shell (b) only the electrons in the innermost shell  
(c) only the electrons in the valence shell (d) all the electrons in an atom
47. Pauli's exclusion principle can be applied to only
- (a) Protons (b) Electrons  
(c) Neutrons (d) Photons
48. How many electrons can fit in the lowest energy atomic orbital of a hydrogen atom?
- (a) Zero (b) One  
(c) Two (d) Many
49. Quantum numbers are used to solve
- (a) Schrodinger's Wave Equation (b) Heisenberg's Uncertainty Principle  
(c) Einstein's Mass Energy Relation (d) Lorentz Equation
50. The quantum numbers that defines the shell of the electron is
- (a) n (b) l  
(c) m (d) s
51. The range of Azimuthal quantum number is
- (a) 0 to n (b) 0 to s  
(c) 0 to n-1 (d) 0 to s-1
52. The maximum number of atomic orbitals associated with a principal quantum number 4 is
- (a) 4 (b) 8  
(c) 16 (d) 24
53. In Thomson's Parabola Method, the point where the positive ion strikes with no electric and magnetic field is called
- (a) Undelected spot (b) Bright spot  
(c) Dark spot (d) Spotless point
54. Due to velocity dispersion each parabolic trace in Thomson's Parabola Method is
- (a) of very high deflection (b) of very low deflection  
(c) of very high intensity (d) of very low intensity
55. The e/m value of positive rays in comparison to electrons is
- (a) greater (b) smaller  
(c) equal (d) not comparable

56. Experimental set up where all the particles having same  $e/m$  value are focused at a single point but having non-linear mass scale is
- (a) Thomson Method (b) Aston Mass Spectrograph  
(c) Bainbridge's Mass Spectrograph (d) Atomic Absorption Spectrograph
57. In Bainbridge's Mass Spectrograph, the mass scale is
- (a) parabolic (b) curved  
(c) non-linear (d) linear
58. Isotopes have the \_\_\_\_\_ number of protons and \_\_\_\_\_ number of neutrons.
- (a) same, same (b) same, different  
(c) different, same (d) different, different
59. Which of the following statement holds good for  $^{16}\text{O}_8$ ,  $^{14}\text{C}_6$  and  $^{15}\text{N}_7$ ?
- (a) they have equal number of protons (b) they have equal number of electrons  
(c) they have equal number of neutrons (d) they have equal mass number
60. Which of the following statements is true for  $^{40}\text{Ar}_{18}$ ,  $^{40}\text{K}_{19}$  and  $^{40}\text{Ca}_{20}$ ?
- (a) they have different mass number and same atomic number  
(b) they have same mass number and same atomic number  
(c) they have equal number of protons and electrons  
(d) they have equal number of protons and neutrons taken together
61. Choose the atom having the highest number of neutrons.
- (a)  $^{238}\text{U}_{92}$  (b)  $^{235}\text{U}_{92}$   
(c)  $^{207}\text{Pb}_{82}$  (d)  $^{208}\text{Pb}_{82}$
62. Device used to detect fission reaction is
- (a) Mass spectrograph (b) Spark Counter  
(c) Cloud chamber (d) Cathode Ray
63. Nuclei suitable for nuclear fusion is
- (a) heavier nuclei (b) lighter nuclei  
(c) any nuclei (d) halogens
64. Energy released in fission reaction is due to
- (a) mass defect (b) alpha radiation  
(c) beta radiation (d) gamma radiation
65. Size of nucleus is of the order of
- (a)  $10^{-5}$  m (b)  $10^{-10}$  m  
(c)  $10^{-15}$  m (d)  $10^{-25}$  m
66. Stability of a nucleus is measured using
- (a) Linear force (b) Nuclear energy  
(c) Proton energy (d) Binding energy
67. When the number of neutrons produced is less than the number of neutron loss in fission reaction, then it is called
- (a) Critical condition (b) Supercritical condition  
(c) Subcritical condition (d) Unbalance condition

68. If Uranium-238 nucleus splits into two identical nuclei, then these nuclei will be  
(a) Isotope (b) Isobar  
(c) radioactive (d) stable
69. The main fuel for stellar energy is  
(a) Hydrogen (b) Helium  
(c) Carbon (d) Uranium
70. The change in mass of U-235 after undergoing fission reaction is 0.002 kg. What is the amount of energy released from this mass difference?  
(a)  $9 \times 10^{12}$  J (b)  $1.8 \times 10^{12}$  J  
(c)  $9 \times 10^{14}$  J (d)  $1.8 \times 10^{14}$  J
71. 'Repeatable identity' of a 3D crystal structure is  
(a) Unit cell (b) Lattice  
(c) Crystal (d) Bravais index
72. How many different types of lattices (3D) are possible?  
(a) 4 (b) 8  
(c) 14 (d) 20
73. What type of solid is quartz?  
(a) Metallic (b) Molecular  
(c) Ionic (d) Covalent
74. The carbon atoms of diamond form a 3-D crystal lattice structure in which each carbon atom is positioned at the center of a  
(a) trihedron (b) tetrahedron  
(c) pentahedron (d) octahedron
75. X-Rays which are unable to resolve details of structure on atomic level are  
(a) longer wavelength (b) shorter wavelength  
(c) zero wavelength (d) negative wavelength
76. X-ray diffraction is based on  
(a) Newton's law (b) Boltzmann equation  
(c) Bragg's equation (d) Laue's equation
77. Coordination number for closest packed crystal structure  
(a) 16 (b) 12  
(c) 8 (d) 4
78. Miller indices for Octahedral plane in cubic crystal is  
(a) (101) (b) (100)  
(c) (110) (d) (111)
79. Atomic packing factor is the  
(a) distance between two adjacent atoms  
(b) volume fraction of atoms in cell  
(c) projected area fraction of atoms on a plane  
(d) distance between center and edge of the lattice

80. The packing factor of the fcc structure is  
(a) 52% (b) 68%  
(c) 74% (d) 92%
81. Miller indices of the line of intersection of  $(\bar{1}11)$  and  $(110)$  are  
(a)  $[110]$  (b)  $[101]$   
(c)  $[10\bar{1}]$  (d)  $[\bar{1}10]$
82. Atom A occupy the corners of the unit cell and atom B is present at the center. Compound formed by A and B will have the formula  
(a) AB (b)  $AB_2$   
(c)  $AB_3$  (d)  $A_2B_4$
83. When FCC iron is heated, it changed to BCC iron resulting in  
(a) crack in the material (b) increase in volume  
(c) no change in volume (d) contraction in volume
84. The compound, NaCl is an example of  
(a) Molecular solid (b) Covalent solid  
(c) Ionic solid (d) Metallic solid
85. The reciprocal lattice vector has the form  
( $a^*$  is normal to  $b$  and  $c$ ;  $b^*$  is normal to  $a$  and  $c$ ;  $c^*$  is normal to  $a$  and  $b$ )  
(a)  $G = ha^* + kb^* + lc^*$  (b)  $G = hkl(a^* + b^* + c^*)$   
(c)  $G = h(a^* + kb^*) + lc^*$  (d)  $G = ha^* + k(b^* + lc^*)$
86. In reciprocal lattice, the length of a simple cubic lattice is  
(a)  $\frac{\pi}{a}$  (b)  $\frac{2\pi}{a}$   
(c)  $\frac{1}{2a}$  (d)  $\frac{1}{a}$
87. Specific heat of solid is proportional to  
(a) T (b)  $\frac{1}{T}$   
(c)  $\Delta T$  (d)  $\frac{1}{\Delta T}$
88. Copper has a \_\_\_\_\_ specific heat capacity as compared to glass.  
(a) equal (b) lower  
(c) greater (d) incomparable
89. Which of the following statement is false?  
(a) Atomic oscillators vibrate with the same frequency.  
(b) Atomic oscillators vibrate with the different energy.  
(c) Atomic oscillators vibrate with the same amplitude.  
(d) Atomic oscillators vibrate with the different frequency.



90. Dulong Petit law is valid for  
(a) only liquid (b) only solid  
(c) solid and liquid (d) neither solid nor liquid
91. Einstein's theory of specific heat is not followed by solid substances  
(a) at very high temperature (b) at very low temperature  
(c) at latent heat of vaporization (d) at latent heat of fusion
92. At very low temperatures, the specific heat at constant volume varies as  
(a)  $T^3$  (b)  $T$   
(c)  $\frac{1}{T^3}$  (d)  $\frac{1}{T}$
93. At high temperature, according to Debye's theory of specific heat of solids  
(a)  $C_V \propto T$  (b)  $C_V \propto T^3$   
(c)  $C_V \propto R$  (d)  $C_V \propto 3R$
94. Among the forms of water given below, select the form having highest thermal conductivity.  
(a) Steam (b) Boiling water  
(c) Melting ice (d) Solid ice
95. Solid having the maximum thermal conductivity is  
(a) Silver (b) Diamond  
(c) Copper (d) Aluminium
96. Wiedemann-Franz law gives the relation between  
(a) electrical and thermal conductivities (b) electrical and specific heat  
(c) specific heat and thermal conductivities (d) structure and temperature of the solid
97. Which of the following law does not hold true for intermediate temperature?  
(a) Bragg's theory of specific heat (b) Einstein's theory of specific heat  
(c) Debye's law of specific heat (d) Wiedemann-Franz law
98. Fermi energy level is the maximum energy level for electrons at  
(a)  $T = 100 K$  (b)  $T = 0 K$   
(c)  $T = 100^\circ C$  (d)  $T = 0^\circ C$
99. Fermi level lies \_\_\_\_\_ the conduction band.  
(a) below (b) above  
(c) far above (d) at the same level of
100. Density of states of a classical system is expressed as a function of  
(a) mass (b) wave function  
(c) energy (d) electron spin