MIZORAM PUBLIC SERVICE COMMISSION

Technical Competitive Examinations for Recruitment to the post of <u>Inspector of Legal Metrology</u> under Food, Civil Supplies & Consumer Affairs Department

Time Allowed : 2 hours
Full Marks : 150

<u>Physics Paper-II</u>

INVIGILATOR CENTRE SUPERINTENDENT

Date of Exam. : 26/03/2010

<u>Instructions to candidates:</u>

- Enter your Roll No. in the box provided on the front page.
- Attempt all the questions.
- Each question is followed by probable answers. Choose the appropriate answer and mark it by putting '✓' mark on the corresponding box.
- If more than one answer boxes are marked for a question, the answer will be treated as wrong.
- On completion, you are to submit the booklet to the Invigilator.

Code Number : .....
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Marks Obtained : .....

Examiner Scrutiniser

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1. The electric field E at the centre of a uniformly charged conductor is

(a) $\frac{qr}{4\pi\varepsilon_0 R^3}$ ☐ (b) $\frac{q}{4\pi\varepsilon_0 r^2}$ ☐

(c) Zero ☐ (d) $\frac{q}{4\pi\varepsilon_0 R^2}$ ☐

2. When a negative charge is placed at the centre of the sphere, then the direction of electric field on the Gaussian surface is

(a) radially outward ☐ (b) radially inward ☐

(c) along the tangent of the surface ☐ (d) None of these ☐

3. The electric field intensity on the surface of a charged conductor is

(a) zero ☐ (b) directed normally to the surface ☐

(c) directed tangentially to the surface ☐ (d) directed along 45º to the surface ☐

4. Electric Intensity of a point varies as r^{-1} for

(a) a point charge ☐

(b) spherically symmetric charge distribution ☐

(c) a plane infinite sheet of charge ☐

(d) a line charge of infinite length ☐

5. $\nabla^2 V = -4\pi\rho$ represents

(a) Maxwell's equation ☐ (b) Laplace's equation ☐

(c) Poisson's equation ☐ (d) None of these ☐

6. In an electromagnetic wave, the direction of magnetic field induction $\vec{B}$ is

(a) parallel to electric field $\vec{E}$ ☐ (b) perpendicular to the electric field $\vec{E}$. ☐

(c) antiparallel to Poynting vector $\vec{S}$ ☐ (d) random ☐

7. The displacement current arise due to

(a) positive charges only ☐ (b) negative charges only ☐

(c) both positive and negative charges ☐ (d) time varying electric field ☐

8. The electric field inside a spherical shell of uniform surface charge density

(a) zero ☐

(b) non zero constant ☐

(c) directly proportional to distance from centre ☐

(d) inversely proportional to distance from centre ☐

9. A body can be negatively charged by

(a) giving excess of electrons to it ..... ☐ (b) removing some electrons from it ..... ☐

(c) giving some protons to it ..... ☐ (d) removing some neutrons from it ..... ☐

10. Two charged spheres separated at a distance d exerts a force F on each other. If they are immersed in a liquid of dielectric constant 2, then the force (if all conditions are same) is

(a) $F/2$ ..... ☐ (b) F ..... ☐

(c) $2F$ ..... ☐ (d) $4F$ ..... ☐

11. Three charges $+4q$, Q and q are placed in a straight line of length l at points at distances 0, $l/2$, l respectively. What should be Q in order to make the net force on q to be zero?

(a) $-q$ ..... ☐ (b) $-2q$ ..... ☐

(c) $-q/2$ ..... ☐ (d) $4q$ ..... ☐

12. An electric dipole placed in a non-uniform electric field experiences

(a) both a torque and a net force ..... ☐ (b) only a force but no torque ..... ☐

(c) only a torque but no net force ..... ☐ (d) no torque and no net force ..... ☐

13. A charge (q) is enclosed in a cube. What is electric flux associated with one of the faces of the cube?

(a) $\frac{q}{\varepsilon_0}$ ..... ☐ (b) $\frac{\varepsilon_0}{q}$ ..... ☐

(c) $\frac{6q}{\varepsilon_0}$ ..... ☐ (d) $\frac{q}{6\varepsilon_0}$ ..... ☐

14. It is possible to have a positively charged body at

(a) zero potential ..... ☐ (b) negative potential ..... ☐

(c) positive potential ..... ☐ (d) All of these ..... ☐

15. The dielectric between the conductors reduces the electric intensity

(a) to zero ..... ☐ (b) between them ..... ☐

(c) with no charge ..... ☐ (d) None of these ..... ☐

16. A small metal ball is suspended in a uniform electric field with the help of an insulated thread. If high energy X-ray beam falls on it

(a) the ball will be deflected in the direction of electric field ..... ☐

(b) the ball will be deflected opposite to the direction of field ..... ☐

(c) the ball will not deflect at all ..... ☐

(d) the ball will fly to infinity ..... ☐

17. A non conducting solid sphere of radius R is uniformly charged. The magnitude of the electric field due to the sphere at a distance r from its centre

(a) zero ☐

(b) decreases as r increases, for $0 < r < \infty$ ☐

(c) decreases as r increases, for $R < r < \infty$ ☐

(d) is discontinuous at $r = R$ ☐

18. When the separation between two charges is increased, the electric potential energy of the system

(a) remains the same ☐ (b) may increase or decrease ☐

(c) increases ☐ (d) decreases ☐

19. Choose the correct answer

(a) Total charge present in the universe is constant ☐

(b) Total positive charge present in the universe is constant ☐

(c) Total negative charge present in the universe is constant ☐

(d) Total number of charged particles present in the universe is constant ☐

20. An electric dipole of moment p is placed in the position of stable equilibrium in a uniform electric field of intensity E. The torque required to rotate, when the dipole makes an angle θ with the initial position is

(a) zero ☐ (b) $\frac{\pi}{4}$ ☐

(c) $\frac{\pi}{2}$ ☐ (d) π ☐

21. Kirchhoff's first and second law of electrical circuits are consequences of

(a) conservation of energy and electric charge respectively ☐

(b) conservation of energy ☐

(c) conservation of electric charge and energy respectively ☐

(d) conservation of electric charge ☐

22. Which of the following are not electromagnetic waves?

(a) Cosmic rays ☐ (b) γ-rays ☐

(c) β-rays ☐ (d) X-rays ☐

23. The power factor varies between

(a) 2 to 2.5 ☐ (b) 3.5 to 5 ☐

(c) 0 to 1 ☐ (d) 1 to 2 ☐

24. An LC-circuit cannot produce oscillations when

(a) capacitance is large ..... ☐ (b) inductance is large ..... ☐

(c) resistance is large ..... ☐ (d) All the given above ..... ☐

25. In an LCR-series a.c. circuit, the current

(a) is always in phase with the voltage .... ☐ (b) always lags the generator voltage ..... ☐

(c) always leads the generator voltage .... ☐ (d) may lag behind or lead the voltage .... ☐

26. The magnitude of the induced emf produced in a coil when a magnet is inserted into it does not depend upon the

(a) number of turns in the coil ..... ☐ (b) resistance of the coil ..... ☐

(c) magnetic moment of the magnet ..... ☐ (d) speed of approach of the magnet ..... ☐

27. Transformers are used in

(a) dc circuits alone ..... ☐ (b) ac circuits alone ..... ☐

(c) both ac and dc circuits ..... ☐ (d) integrated circuits ..... ☐

28. A coil of metal wire is kept stationary in a non-uniform magnetic field,

(a) an emf and current are both induced in the coil ..... ☐

(b) a current but no emf is induced in the coil ..... ☐

(c) an emf but no current is induced in the coil ..... ☐

(d) neither emf nor current is induced in the coil ..... ☐

29. A metal conductor of length 1m rotates vertically about one of its ends at angular velocity 5 rad/s. If the horizontal component of earth's magnetic field is 0.2×10^{-4} T, the emf developed between the ends of the conductor is

(a) 5 mV ..... ☐ (b) 50 mV ..... ☐

(c) 5 mV ..... ☐ (d) 50 mV ..... ☐

30. A short circuited coil is placed in a time varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

(a) halved ..... ☐ (b) the same ..... ☐

(c) doubled ..... ☐ (d) quadrupled ..... ☐

31. The minimum energy required to ionize hydrogen atom from its ground state is about

(a) 13.6 eV ..... ☐ (b) 1.36 eV ..... ☐

(c) 0.136 eV ..... ☐ (d) 136 eV ..... ☐

32. The radius of a Hydrogen atom in its ground state is

(a) 10^{-4} cm ☐ (b) 10^{-6}cm ☐

(c) 10^{-8}cm ☐ (d) 10^{-10}cm ☐

33. The electron in a hydrogen atom with a radius equal to first Bohr radius has a velocity equal to

(a) c ☐ (b) c/10 ☐

(c) c/137 ☐ (d) c/8 ☐

34. Pauli's Exclusion Principle states that

(a) two electrons can have all the quantum numbers same ☐

(b) no two electrons can have all the quantum numbers same ☐

(c) particles with integer and half integer spin cannot exist in the same state ☐

(d) None of the above ☐

35. The continuous X-ray spectrum at constant voltage will have

(a) a minimum wavelength ☐ (b) a maximum wavelength ☐

(c) a minimum frequency ☐ (d) a maximum frequency ☐

36. The shortest wavelength produced in an X-ray tube operated at 2 million volts will be

(a) 10^{-1} Å ☐ (b) 10^{-2} Å ☐

(c) 10^{-3} Å ☐ (d) 10^{-4} Å ☐

37. In Zeeman effect a spectral line, upon the application of magnetic field, splits into more than three components because

(a) energy levels split into 2J +1 components ☐

(b) in magnetic field $\Delta M_J = 0, \pm 1$ no longer holds ☐

(c) of variation of Lande g-factor from one level to another ☐

(d) None of the above ☐

38. Which of the interaction cause the non-conservation of orbital angular momentum of the electrons in an atom?

(a) Spin-orbit interaction ☐

(b) Spin-spin interaction ☐

(c) Electrostatic interaction between electrons ☐

(d) Electrostatic interaction between electrons and nucleus ☐

39. Pure rotational spectrum of a diatomic molecule consists of

(a) two equally spaced lines ..... ☐ (b) three equally spaced lines ..... ☐

(c) many equally spaced lines ..... ☐ (d) no regular pattern ..... ☐

40. The total number of levels that could be formed by two electrons in the presence of an external magnetic field is

(a) 6 ..... ☐ (b) 36 ..... ☐

(c) 60 ..... ☐ (d) 10 ..... ☐

41. Characteristic or line X-ray spectra are not likely to be excited by the following

(a) Electron bombardment ..... ☐ (b) Irradiation by short X-rays ..... ☐

(c) Proton bombardment ..... ☐ (d) Neutron absorption ..... ☐

42. The photoelectric current in a photoelectric cell depends upon

(a) The nature of the metal used as the counter ..... ☐

(b) The wavelength of the incident light ..... ☐

(c) The intensity of the incident light ..... ☐

(d) All the above parameters ..... ☐

43. The photoelectrons emitted from a metal surface

(a) are all at rest ..... ☐

(b) have the same kinetic energy ..... ☐

(c) have the same momentum ..... ☐

(d) have speeds varying from zero up to a certain maximum value ..... ☐

44. The radius of a nucleus is

(a) proportional to its mass number ..... ☐

(b) inversely proportional to its mass number ..... ☐

(c) proportional to the cube root of its mass number ..... ☐

(d) not related to its mass number ..... ☐

45. The average number of neutrons released by the fission of one Uranium atom is

(a) 1 ..... ☐ (b) 2 ..... ☐

(c) 2.5 ..... ☐ (d) 3 ..... ☐

46. The critical mass of a fissionable material can be reduced by

(a) heating it ☐

(b) cooling it ☐

(c) adding impurities to it ☐

(d) surrounding it with a shield that will reflect neutrons ☐

47. Beta rays emitted by a radioactive material are

(a) electromagnetic radiation ☐

(b) the electrons orbiting around the nucleus ☐

(c) charged particles emitted by the nucleus ☐

(d) neutral particles ☐

48. In nuclear reaction there is conservation of

(a) mass only ☐ (b) energy only ☐

(c) momentum only ☐ (d) mass, energy and momentum ☐

49. A free neutron decays into a proton, an electron and

(a) a neutrino ☐ (b) an antineutrino ☐

(c) an alpha particle ☐ (d) a beta particle ☐

50. The Schrödinger wave equation is

(a) the general differential equation of wave motion ☐

(b) tatisfying the Broglie relation ☐

(c) satisfying the uncertainty relation ☐

(d) to obtain the energy state of the harmonic oscillator ☐

51. Davisson Germer experiments relates to

(a) interference ☐ (b) polarisation ☐

(c) electron diffraction ☐ (d) phosphorene ☐

52. In case of a potential step of height V_0. If a particle of energy $E < V_0$ the transmittance is

(a) zero ☐ (b) finite non-zero ☐

(c) infinite ☐ (d) 1 ☐

53. Which of the following is not a Fermion?

(a) Electron ☐ (b) Muons ☐

(c) Neutrons ☐ (d) Photon ☐

54. The Bohr magneton is of the order of

(a) 10^{-23}erg/gauss ..... ☐ (b) 10^{-20}erg/gauss ..... ☐

(c) 10^{-25}erg/gauss ..... ☐ (d) None of these ..... ☐

55. For Compton scattering at 90º, the shift of wavelength is

(a) 0.242 Å ..... ☐ (b) 2.42 Å ..... ☐

(c) 0.0242 Å ..... ☐ (d) 0.00242 Å ..... ☐

56. Schrödinger equation is a wave equation

(a) governing the behaviour of e.m. waves ..... ☐

(b) governing the behaviour of matter waves ..... ☐

(c) governing the probability behaviour of a wave ..... ☐

(d) governing the behaviour of a complex quantity ψ ..... ☐

57. According to de Broglie hypothesis

(a) particles have wavelike characteristic ..... ☐

(b) wave motion are quantized but particles have no wave nature ..... ☐

(c) radiation cannot be quantized but particles have wave character ..... ☐

(d) radiation having longer wavelength can never be quantized ..... ☐

58. In Quantum mechanical tunneling process energy

(a) remains conserved ..... ☐

(b) remains non-conserved ..... ☐

(c) varies with the advance penetrating wave ..... ☐

(d) None of the above ..... ☐

59. In Raman spectra Q branch is

(a) absent ..... ☐

(b) present ..... ☐

(c) presence or appearance depends on the state of polarization of the molecule ..... ☐

(d) None of the above ..... ☐

60. Bohr magneton is the unit of moment of electron which has spin angular momentum equal to

(a) zero ☐ (b) $\frac{1}{2}\hbar$ ☐

(c) $\frac{3}{2}\hbar$ ☐ (d) $\frac{5}{2}\hbar$ ☐

61. Consider an a, b and g-particles each having an energy 1 MeV. Arrange these particles in order of increasing distances that they travel in air

(a) a, b, g ☐ (b) g, b, a ☐

(c) g, a, b ☐ (d) a, g, b ☐

62. Nuclear fusion requires very high temperature because

(a) all nuclear reactions absorb energy ☐

(b) the binding energy must be supplied from an external source ☐

(c) the mass deficit must be supplied ☐

(d) None of the above ☐

63. The mean life time of one of the atoms of a radioactive sample is

(a) $1/\lambda$ ☐ (b) λ ☐

(c) $\lambda \ln 2$ ☐ (d) $2 \ln \lambda$ ☐

64. What is the average binding energy of a nucleon in the nucleus of an atom?

(a) 7.8 eV ☐ (b) 7.8 KeV ☐

(c) 7.8 MeV ☐ (d) 78 eV ☐

65. The particle which most easily penetrates through the nucleus of an atom is

(a) neutron ☐ (b) electron ☐

(c) proton ☐ (d) alpha particle ☐

66. In the first excited state of a one-dimensional harmonic oscillator with angular frequency w, the energy eigen value is given by

(a) $\frac{1}{2}\hbar\omega$ ☐ (b) $\hbar\omega$ ☐

(c) $\frac{3}{2}\hbar\omega$ ☐ (d) $2\hbar\omega$ ☐

67. Degeneracy of the first excited state of an isolated hydrogen atom is

(a) 2 ☐ (b) 4 ☐

(c) 6 ☐ (d) 8 ☐

68. The degeneracy of the first excited state of a three dimensional harmonic oscillator is

(a) 1 ..... ☐ (b) 2 ..... ☐

(c) 3 ..... ☐ (d) 6 ..... ☐

69. $_{92}U^{238}$ is bombarded with slow neutrons. The results in the

(a) formation of an atom with atomic number 93 ..... ☐

(b) formation of an isotope of Uranium with mass number 239 ..... ☐

(c) splitting up of uranium nucleus into two nearly equal fragments ..... ☐

(d) splitting up of Uranium nucleus into two exactly equal fragments ..... ☐

70. The phenomenon of nuclear fission can be understood on the basis of

(a) liquid drop model of the nucleus ..... ☐

(b) shell model of the nucleus ..... ☐

(c) independent particle model of the nucleus ..... ☐

(d) meson theory of nuclear forces ..... ☐

71. The bulk of energy released in nuclear fission appears as

(a) kinetic energy of nuclear fragments ... ☐ (b) heat energy ..... ☐

(c) radiant energy ..... ☐ (d) chemical energy ..... ☐

72. The phenomenon of nuclear fusion is used in the construction of

(a) the hydrogen bomb ..... ☐ (b) the atom bomb ..... ☐

(c) an ordinary bomb ..... ☐ (d) incendiary bomb ..... ☐

73. "No two electrons in an atom will have all the four Quantum numbers alike or equal". This statement is known as

(a) Exclusion principle ..... ☐ (b) Uncertainty principle ..... ☐

(c) Hund's rule ..... ☐ (d) Aufbau's principle ..... ☐

74. A sodium atom has 11 electrons around the nucleus. The eleventh electron as you go on filling up the shell from K shell is a

(a) s-electron ..... ☐ (b) p-electron ..... ☐

(c) d-electron ..... ☐ (d) f-electron ..... ☐

75. Number of p-electron in the L-shell is

(a) 1 ..... ☐ (b) 6 ..... ☐

(c) 10 ..... ☐ (d) 14 ..... ☐

76. Electron cannot exist inside the nucleus because

(a) its kinetic energy is too small ..... ☐ (b) its magnetic moment is too large ..... ☐

(c) its mass is too small ..... ☐ (d) it has a negative charge ..... ☐

77. Binding energy of a nucleus is

(a) a positive quantity ..... ☐ (b) a negative quantity ..... ☐

(c) positive or negative ..... ☐ (d) None of these ..... ☐

78. When the speed of electrons increases, the specific charge

(a) increases ..... ☐ (b) decreases ..... ☐

(c) remains unchanged ..... ☐ (d) increase and then decreases ..... ☐

79. The work function is

(a) the same for all metal surfaces ..... ☐

(b) the same for all type of surfaces ..... ☐

(c) different for different metal surfaces ..... ☐

(d) dependent on the frequency of the incident light ..... ☐

80. The de Broglie wavelength of the electron in the first Bohr orbit of the hydrogen atom is

(a) equal to the diameter of the first orbit ..... ☐

(b) equal to the circumference of the orbit ..... ☐

(c) equal to half the circumference of the first orbit ..... ☐

(d) independent of the size of the first orbit ..... ☐

81. Bohr postulated in his model quantization of

(a) energy ..... ☐ (b) linear momentum ..... ☐

(c) angular momentum ..... ☐ (d) spin ..... ☐

82. Of the following moving with the same velocity, the one which has largest wavelength is

(a) an electron ..... ☐ (b) a photon ..... ☐

(c) a neutron ..... ☐ (d) an a-particle ..... ☐

83. The uncertainty relation holds for

(a) microscopic particles only ..... ☐

(b) macroscopic particles only ..... ☐

(c) both microscopic and macroscopic particles ..... ☐

(d) neither microscopic nor macroscopic particles ..... ☐

84. The uncertainty relation cannot hold for following pairs

(a) position and momentum ..... ☐ (b) energy and time ..... ☐

(c) linear momentum and angle ..... ☐ (d) angular momentum and angle ..... ☐

85. The zero point energy of harmonic oscillator is

(a) $\hbar\omega$ ..... ☐ (b) $\frac{1}{2}\hbar\omega$ ..... ☐

(c) $2\hbar\omega$ ..... ☐ (d) $\frac{1}{4}\hbar\omega$ ..... ☐

86. Which of the following is not a Boson?

(a) Neutral helium atom ..... ☐ (b) a-particle ..... ☐

(c) Photon ..... ☐ (d) Muons ..... ☐

87. Eigen value of the particle exchange operator is

(a) 0 ..... ☐ (b) +1 ..... ☐

(c) -1 ..... ☐ (d) ±1 ..... ☐

88. In the scattering of a particle from a spherically symmetric potential, the conserved quantities are

(a) E only ..... ☐ (b) L^2 only ..... ☐

(c) E, L^2, L_z ..... ☐ (d) L_z only ..... ☐

89. If the oscillator is in its normal state, then the probability of finding the particle outside the classical limit is approximately

(a) 16% ..... ☐ (b) 24% ..... ☐

(c) 48% ..... ☐ (d) 84% ..... ☐

90. For a free particle of momentum $\hbar k$ moving in one dimension along the positive x-axis, the unnormalized wave function is

(a) sin kx ..... ☐ (b) cos kx ..... ☐

(c) e^{ikx} ..... ☐ (d) e^{-ikx} ..... ☐

91. A spherically symmetric potential leads to the atomic states which are

(a) all non-degenerate ..... ☐

(b) degenerate with degeneracy (2l+1), where l is the angular momentum ..... ☐

(c) degenerate or non-degenerate depending on the principal quantum number ..... ☐

(d) non-degenerate except for the ground state ..... ☐

92. The maximum frequency limit of the continuous X-ray spectrum depends on

(a) the nature of the target material ☐

(b) the kinetic energy of the incident electron ☐

(c) the intensity of the electron beam ☐

(d) the degree of vacuum in X-ray tube ☐

93. The production of continuous X-ray spectrum is due to

(a) the decrease in the kinetic energy of the incident electron which approaches the nucleus of the target atom ☐

(b) jumping of electrons of the target atom from higher to lower orbits ☐

(c) jumping of electrons of the target atom from lower to higher orbits ☐

(d) annihilation of the mass of the incident electrons ☐

94. Even though we can get X-ray by the bombardment of any charged particles on a target, what is the reason for using electrons to produce X-rays?

(a) Electrons have smallest possible charge ☐

(b) Electrons are common constituents of all matter ☐

(c) Electron mass is very small ☐

(d) Electrons can be produced very easily ☐

95. Hydrogen atom does not emit X-ray because

(a) its energy levels are close to each other ☐

(b) its energy levels are far too apart ☐

(c) it is too small in size ☐

(d) it has a single electron ☐

96. Moseley's law relates

(a) frequency and applied voltage ☐

(b) frequency and atomic number ☐

(c) wavelength and intensity of X-rays ☐

(d) wavelength and angle of scattering ☐

97. According to Bohr model of the hydrogen atom an electron can revolve around a proton indefinitely if its path is

(a) A perfect circle of any radius ☐

(b) A circle of constantly decreasing radius ☐

(c) A circle of an allowed radius ☐

(d) An ellipse ☐

98. The magnitude of energy of the electron in a hydrogen atom is proportional to

(a) r ☐ (b) 1/r ☐

(c) r^2 ☐ (d) $1/r^2$ ☐

99. In Bohr model of the Hydrogen atom, the ratio between the period of revolution of an electron in the orbit $n = 1$ to the period of revolution of the electron in the orbit of $n = 2$ is

(a) 1:4 ☐ (b) 1:2 ☐

(c) 2:1 ☐ (d) 1:8 ☐

100. To explain the fine structure of the spectrum of the hydrogen atom we must consider the

(a) finite size of the nucleus ☐

(b) presence of neutrons in the nucleus ☐

(c) spin angular momentum of the electron ☐

(d) orbital angular momentum of the electron ☐

101. The small value of binding energy of nucleus in the low mass number is due to

(a) surface effects ☐

(b) low mass ☐

(c) repulsive force which arises from protons ☐

(d) more potential energy of the nucleons ☐

102. The nuclear fusion can be explained by

(a) optical model of the nucleus ☐ (b) shell model of the nucleus ☐

(c) collective model of the nucleus ☐ (d) liquid drop model of the nucleus ☐

103. The rate of radioactive disintegration is

(a) affected by pressure ☐

(b) affected by temperature ☐

(c) affected by the number of original kind atoms present at any time ☐

(d) affected by the daughter nucleus ☐

104. After the completion of the average life of a radioactive substance, the activity is

(a) reduced to zero ☐ (b) increased to infinity ☐

(c) reduced to a small value ☐ (d) maintained as a constant ☐

105. To get sustained chain reaction, the neutron multiplication factor

(a) $k < 1$ ☐ (b) $k = 0$ ☐

(c) $k \geq 1$ ☐ (d) $k \leq 1$ ☐

106. The moderators are required

(a) for thermalization of fast neutrons ☐

(b) to increase the energy of the neutrons ☐

(c) to increase the number of neutrons ☐

(d) to decrease the number of delayed neutrons ☐

107. Positive rays

(a) are coming from anode of the discharge tube ☐

(b) are canal rays ☐

(c) consists of positively charged positrons ☐

(d) consists of α particles ☐

108. An atomic electron is in the quantum state $n = 3$. How many distinct energy values are possible for this electron?

(a) 3 ☐ (b) 7 ☐

(c) 14 ☐ (d) 18 ☐

109. According to Bohr's theory of the Hydrogen atom, the speed v_n of the electron in a stationary orbit is related to the principal quantum number n as (C is a constant)

(a) $v_n = C/n^2$ ☐ (b) $v_n = C/n$ ☐

(c) $v_n = C \times n$ ☐ (d) $v_n = C \times n^2$ ☐

110. Bohr radius is the radius

(a) of an atom ☐ (b) of first orbit electrons in an atom ☐

(c) of third orbit electrons in an atom ☐ (d) of fifth orbit electrons in an atom ☐

111. The kinetic energy of a 300 K thermal neutron is

(a) 300 eV ☐ (b) 300 MeV ☐

(c) 0.026 eV ☐ (d) 0.026 MeV ☐

112. In 1935, Yukawa suggested that nuclear forces arise as a result of interchange of certain particles between nucleons. These particles are

(a) protons ☐ (b) mesons ☐

(c) photons ☐ (d) positrons ☐

113. What is the rest mass energy of an electron?

(a) 1 eV ☐ (b) 0.51 MeV ☐

(c) 931 MeV ☐ (d) None of these ☐

114. If M is the mass of a nucleus and A its atomic mass, then the packing fraction is

(a) $\frac{M-A}{M+A}$ ☐ (b) $\frac{M-A}{M}$ ☐

(c) $\frac{M-A}{A}$ ☐ (d) $\frac{M+A}{M-A}$ ☐

115. Radiocarbon dating is done by estimating in the specimen

(a) the amount of ordinary carbon still present ☐

(b) the amount of radio carbon still present ☐

(c) the ratio of the amounts of ${}^{14}_{6}C$ to ${}^{12}_{6}C$ still present ☐

(d) None of the above ☐

116. The energy released by the fission of one Uranium atom is 200 MeV. The number of fissions per second required to produce 3.2 W of power is

(a) 10^7 ☐ (b) 10^{10} ☐

(c) 10^{15} ☐ (d) 10^{17} ☐

117. The half life of a substance is 20 minutes. What is the time interval between 33% decay and 67% decay?

(a) 40 minutes ☐ (b) 20 minutes ☐

(c) 30 minutes ☐ (d) 25 minutes ☐

118. The electron emitted in beta radiation originates from

(a) inner orbits of atoms ☐ (b) free electrons existing in nuclei ☐

(c) decay of a neutron in a nucleus ☐ (d) photon escaping from the nucleus ☐

119. During a negative beta decay

(a) an atomic electron is ejected ☐

(b) an electron which is already present within the nucleus is ejected ☐

(c) a neutron in the nucleus decays emitting an electron ☐

(d) a part of the binding energy of the nucleus is converted into an electron ☐

120. The mass m of a Uranium nucleus varies with its volume V

(a) $m \alpha \sqrt{V}$ ☐ (b) $m \alpha \frac{1}{V}$ ☐

(c) $m \alpha V$ ☐ (d) $m \alpha V^2$ ☐

121. In a half-wave rectifier, the r.m.s value of the a.c. component of the wave is

(a) equal to d.c. value ☐ (b) more than d.c. value ☐

(c) less than d.c. value ☐ (d) zero ☐

122. The average value of the output current in full wave rectifier is

(a) zero ☐ (b) $I_0/2$ ☐

(c) $2/\pi I_0$ ☐ (d) I_0 ☐

123. N-type semiconductor is obtained by doping germanium or silicon with an impurity like

(a) Aluminium ☐ (b) Phosphorus ☐

(c) Indium ☐ (d) Gallium ☐

124. Majority carriers in P-type semiconductor are

(a) electrons ☐ (b) neutrons ☐

(c) holes ☐ (d) neutrinos ☐

125. In a transformer coupled amplifier

(a) the primary of the transformer functions as a load resistor ☐

(b) there will not be a coupling between the primary and secondary coils ☐

(c) loss of power due to eddy current is absent ☐

(d) the secondary of the transformer functions as load resistors ☐

126. In the case of amplitude modulated wave, the power in conveying the signals is

(a) two third of the carrier power ☐

(b) one third of the carrier power ☐

(c) one half of the carrier power even with 50 percent modulation ☐

(d) only one half of the carrier power even with 100 percent modulation ☐

127. Suppose each state voltage gain is about 100, then the theoretical maximum voltage gain from a R. C coupled two stage transistor amplifier is

(a) 100 ☐ (b) greater than 100 but less than 200 ☐

(c) 200 ☐ (d) 10,000 ☐

128. Minority carriers produced by thermal agitation or vibration in a semi-conductor are

(a) holes in N-type and free electrons in P-type .....

(b) holes in N- and P-type .....

(c) free electrons in N-type and hole in P-type .....

(d) free electrons in N-type and P-type .....

129. The cause of a potential barrier in a P-N diode is the

(a) concentration of positive charge near the junction .....

(b) depletion of negative charges near the junction .....

(c) concentration of positive and negative charges near the junction .....

(d) depletion of positive charges near the junction .....

130. A Zener diode is always used

(a) with forward bias ..... (b) with reverse bias .....

(c) as a rectifier ..... (d) as a switch .....

131. Transistor is a

(a) voltage operated device .....

(b) current operated device .....

(c) both current and voltage operated device .....

(d) None of the above .....

132. The output frequency of a full wave rectifier is

(a) the same as input frequency ..... (b) one half of the input frequency .....

(c) double of the input frequency ..... (d) independent of the input frequency ...

133. Full wave rectifier is preferred over half wave rectifier because of the difference in

(a) the output level ..... (b) frequency .....

(c) ripples ..... (d) construction .....

134. A good frequency response characteristic over a relative wide frequency range is given by

(a) R. C. coupled amplifier ..... (b) an impedance coupled amplifier .....

(c) a phase shift coupled amplifier ..... (d) a transformer coupled amplifier .....

135. When transistor is operating in active region, collector junction is

(a) reverse biased of NPN transistor ☐

(b) reverse biased for PNP transistor ☐

(c) forward biased in both NPN and PNP transistor ☐

(d) reverse biased in both NPN and PNP transistor ☐

136. The circuits used to generate their own sinusoidal signals are called

(a) generators ☐ (b) mixers ☐

(c) oscillators ☐ (d) modulators ☐

137. The difference between an amplifier and an oscillator is that an oscillator

(a) needs no external input signal ☐

(b) needs no d.c. power supply ☐

(c) delivers a reshaped version of the input signal ☐

(d) delivers output signal without amplification of input signal ☐

138. The basic two conditions required for oscillations are

(a) generation and amplification ☐ (b) amplification and feedback ☐

(c) wave shape and feedback ☐ (d) generation and feedback ☐

139. Among the configurations the lowest input impedance is obtained by

(a) CE ☐ (b) CC ☐

(c) CB ☐ (d) both CB and CC ☐

140. Ripple factor of a full wave rectifier is

(a) 0.24 ☐ (b) 0.96 ☐

(c) 0.48 ☐ (d) 0.72 ☐

141. Among the three configurations the highest output impedance is obtained by

(a) CE ☐ (b) CC ☐

(c) CB ☐ (d) both CE and CB ☐

142. Zener diode is used as a

(a) current regulator ☐ (b) voltage booster ☐

(c) voltage regulator ☐ (d) power regulator ☐

143. A solar cell is an example of

(a) photovoltaic cell ☐ (b) photoconductive cell ☐

(c) photo emissive cell ☐ (d) photo radiation cell ☐

144. For T.V. channel 4 if the picture carrier frequency is 62.25 MHz, the sound carrier frequency\will be

(a) 67.75 MHz ☐ (b) 52.50 MHz ☐

(c) 70.25 MHz ☐ (d) 56.75 MHz ☐

145. A CRT generally has

(a) electrostatic focusing ☐ (b) magnetic focusing ☐

(c) electromagnetic focusing ☐ (d) optical focusing ☐

146. The output of OR gate is 1

(a) if both inputs are zero ☐ (b) if either or both inputs are 1 ☐

(c) only if both inputs are 1 ☐ (d) if either input is zero ☐

147. Crystalline solids are

(a) anistropic ☐ (b) isotropic ☐

(c) amporphus ☐ (d) None of these ☐

148. Diode is used as a/an

(a) oscillator ☐ (b) amplifier ☐

(c) rectifier ☐ (d) modulator ☐

149. When n-p-n transistor is used as an amplifier, then

(a) holes move from emitter to base ☐

(b) electrons move from base to collector ☐

(c) holes move from base to emitter ☐

(d) electrons move from collector to base ☐

150. Which of the following logic gates is a universal gate?

(a) OR ☐ (b) NOT ☐

(c) AND ☐ (d) NAND ☐

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