A

18224 **120 MINUTES**

1. The energy of the hydrogen atom in the n^{th} state is ------

   A) $+\frac{13.56}{n^2}\ ev$ B) $-\frac{13.56}{n^2}\ ev$
   C) $+13.56n^2ev$ D) $-13.56n^2ev$

2. If A and B are Hermitiian Operators:
   A) AB + BA is Hermitian and AB – BA is not Hermitian
   B) AB + BA is Hermitian and AB – BA is Hermitian
   C) AB + BA is not Hermitian and AB – BA is Hermitian
   D) Both AB + BA and AB – BA are not Hermitian

3. A harmonic oscillator is in the Ground state. What is the value of maximum probability density?
   A) $\frac{mw}{\hbar\pi}$ B) $\left(\frac{mw}{\hbar\pi}\right)^2$ C) $\left(\frac{mw}{\hbar\pi}\right)^{1/2}$ D) $\left(\frac{mw}{\hbar\pi}\right)^{1/3}$

4. The expectation value of r in the general state of hydrogen atom in terms of Bohr radius a_0 is:
   A) $\frac{3}{2}\ a_0$ B) $\frac{1}{2}\ a_0$ C) ${a_0}^2$ D) ${a_0}^{1/2}$

5. For Pauli's matrices
   A) $\sigma x\ \sigma y\ \sigma z = i\hbar$ B) $\sigma x\ \sigma y\ \sigma z = \hbar$
   C) $\sigma x\ \sigma y\ \sigma z = 0$ D) $\sigma x\ \sigma y\ \sigma z = i$

6. Which of the following are allowed electric dipole transitions?
   A) $1s \rightarrow 2s$ B) $1s \rightarrow 2p$ C) $3s \rightarrow 5d$ D) $2s \rightarrow 1s$

7. Light elements in stars are produced by:
   A) Nuclear fission B) Nuclear fusion
   C) Chemical reaction D) Nuclear transmutation

8. The de-Broglie wave length of an electron accidental through a potential difference of V volts is:
   A) $\sqrt{\frac{150}{V}}\ ,$ B) $V\sqrt{150}\ ,$ C) $\frac{\sqrt{150}}{V}\ ,$ D) $\sqrt{150V}\ ,$

9. The uncertainty relation in quantum mechanics applies to:
   A) Any pair of variables
   B) Pairs of dynamical variables, the operators corresponding to which commute
   C) Pairs of dynamical variables, the operators corresponding to which do not commute
   D) Position and momentum only

10. A quantum mechanical system having mass m is described by the wave function $\psi(r) = \exp(ikr)/r$. The probability current density is:

A) $\frac{\hbar k}{mr^2}$ B) $\frac{i\hbar k}{mr^2}$ C) $\frac{\hbar k}{imr^2}$ D) $\frac{\hbar k}{mr}$

11. A state is denoted as $^4D_{5/2}$. The value of L, S and J are:

A) L = 2, S = 3/2, J = 5/2 B) L = 5, S = 5/2, J = 3/2

C) L = 1, S = 3/2, J = 5/2 D) L = 3, S = 5/2, J = 7/2

12. The average spacing between adjacent rotational lines of CO molecule is 3.8626 cm^{-1}. The value of rotational constant B is -----

A) 7.7252 cm^{-1} B) 3.8626 cm^{-1}
C) 1.9313 cm^{-1} D) 2.302 cm^{-1}

13. For an anharmonic oscillator the selection rule $\Delta v = \pm 1$ corresponds to

A) Fundamental transition B) First overtone
C) Second overtone D) Third overtone

14. When an atom is placed in an external magnetic field, the electron precesses about the field direction as axis. This precession is known as:

A) Lande's precession B) Gyromagnetic precession
C) Pauli's precession D) Larmor precession

15. A charge Q is placed at the centre of a cube. The electric flux through one of the face is:

A) $\frac{Q}{24\pi\varepsilon_0}$ B) $\frac{Q}{12\pi\varepsilon_0}$ C) $\frac{q}{6\varepsilon_0}$ D) $\frac{q}{\varepsilon_0}$

16. The electric field at a point 5 cm from a long line of charge density 2.5 x 10^{-6} Cm^{-1} is:

A) $9\ X\ 10^3\ Nc^{-1}$ B) $9\ X\ 10^4\ Nc^{-1}$
C) $9\ X\ 10^5\ Nc^{-1}$ D) $9\ X\ 10^6\ Nc^{-1}$

17. An electron enters a magnetic field acting vertically downwards with a velocity v from east. The electron is deflected along

A) North B) South C) North east D) South east

18. A wire of length l carries a current i along x-axis. A magnetic field exists given by $B = B_0\ (\hat{\imath} + \hat{\jmath} + \hat{k})$ T. The magnitude of magnetic force acting in the wire is:

A) ilB_0 B) $\sqrt{3}\ ilB_0$ C) $2\ ilB_0$ D) $\sqrt{2}\ ilB_0$

19. The Hall effect says that when a magnetic field B, is applied in a direction perpendicular to the direction of current flow j , in a conductor, an electric field produced is in the direction of :

A) B B) j C) j. B D) j x B

20. The dimensions of $\varepsilon_0 \ \vec{E} \ X \ \vec{B}$ are:
A) Power B) Energy / volume
C) Momentum / volume D) Intensity

21. Pointing Vector is:
A) $\vec{E} \ X \ \vec{B}$ B) $\vec{E} \ X \ \vec{H}$ C) $\vec{H} \ X \ \vec{E}$ D) $\vec{B} \ X \ \vec{E}$

22. Which of the following is not an electromagnetic radiation?
A) Heat rays B) X-rays C) γ- rays D) β – rays

23. The intensity of sunlight on earth is 1300 w/m^2. Assuming normal incidence, find the magnitude of Electric field in sunlight
A) 4.9 x 10^5 v/m B) 7.0 x 10^2 v/m
C) 6.4 x $10^{5\ V/m}$ D) 8.0 x 10^2 v/m

24. When a ray of light enters a glass slab from air:
A) Its wavelength decreases B) Its wavelength remains unchanged
C) Its frequency increases D) Its wavelength increases

25. The sky appears blue because of:
A) Refraction B) Scattering
C) Reflection D) Total internal reflection

26. Two coherent sources of different intensities send waves that interfere. The ratio of maximum to minimum intensity is 25. The intensity ratio of the sources is:
A) 25 : 1 B) 5 : 1 C) 9 : 4 D) 625 : 1

27. What is the fractional change in fringe width in Young's double slit experiment if the wavelength of incident ray is changed from 500 nm to 600 nm.
A) 20 % B) 30 % C) 40 % D) 50 %

28. In an Young's double slit experiment, the distance between the two holes is, 0.5mm, λ = 5 x 10^{-5} cm and D = 50 cm. The fringe width will be:

A) 10^{-2} cm B) 5x10^{-2} mm C) 5x10^{-5} cm D) 5x10^{-2} cm

29. Why does a compact disc (CD) show a rainbow of colours with white light? It is due to:
A) Interference B) Diffraction
C) Scattering D) Dispersion

30. For maximum polarization of light by reflection from a plane dielectric, what is the angle between reflected and refracted light?
A) 0^0 B) 45^0 C) 60^0 D) 90^0

31. The wavelength of Mossabauer spectrum lies in the range of:
A) X-rays B) Radio waves
C) Visible light D) Gamma rays

32. If B_{12} and B_{21} are Einstein's Coefficients of stimulated absorption and emission respectively and g_1 and g_2 are the degenerates of the energy levels E_1 and E_2 respectively, then

A) $g_1 B_{12} = g_2 B_{21}$ B) $g_1 B_{21} = g_2 B_{12}$

C) $g_1 g_2 = B_{12} B_{21}$ D) $g_1 g_2 B_{12} B_{21} = 1$

33. The mass density of nucleus varies with its mass number A as:

A) A B) A^2 C) A^{-1} D) Remains constant

34. The energy required to break a hydrogen molecule into hydrogen atoms is:

A) 4.5 eV B) 4.5 KeV
C) 9 eV D) 10 eV

35. In the nuclear reaction ${}_1H^2 + {}_1H^2 \rightarrow {}_2H^3 + {}_0n^1$
If the mass of the deuterium atom = 2.014741 amu mass of ${}_2He^3$ atom = 3.016977 amu and mass of neutron = 1.008987 amu, then the Q value of the reaction is nearly

A) 0.000352 Mev B) 3.27 Mev
C) 0.82 Mev D) 2.45 Mev

36. For a dielectric the polarisation vector $\vec{P}$ is given by:

A) $\vec{P} = \varepsilon_0 \vec{E}$ B) $\vec{P} = \frac{\varepsilon_0 \chi}{\vec{E}}$
C) $\vec{P} = \varepsilon_0 \mu_0 \vec{E}$ D) $\vec{P} = \varepsilon_0 \chi \vec{E}$

37. In the process of nuclear fission of 1 gm Uranium, the mass lost is 0.92 mg. The efficiency of power house run by the fission reactor is 10 %. To obtain 400 megawatt power from the power house, how much Uranium will be required per hour?

A) 174 g B) 208 g C) 416 g D) 104 g

38. The term symbols of the ground states of ${}^{12}Mg$ and ${}^{13}Al$ are respectively:

A) ${}^1S_0$ and ${}^2P_{1/2}$ B) ${}^1S_0$ and ${}^2P_{3/2}$
C) ${}^3S_0$ and ${}^1P_{1/2}$ D) ${}^1S_{1/2}$ and ${}^2P_{1/2}$

39. The width of the energy gap of a superconductor is maximum at:

A) 0K B) Transition temperature
C) Room temperature D) None of these

40. The magnetic dipole moment is the product of current in the loop and ---

A) Flux enclosed by current loop
B) Square of area enclosed by current loop
C) Area enclosed by current loop
D) None of these

41. At Neel temperature:

A) Permeability is minimum B) Permeability is maximum
C) Susceptibility is minimum D) Susceptibility is maximum

42. Bohr magneton is defined as:
A) Magnetic moment of an electron spin
B) Magnetic moment of a nucleus
C) Magnetic moment of an electron in orbital motion
D) Magnetic moment per unit volume of electron

43. In a simple cubic lattice $d_{100} : d_{110} : d_{111}$ is :
A) $6 : 3 : 2$ B) $6 : 3 : \sqrt{2}$ C) $\sqrt{6} : \sqrt{3} : \sqrt{2}$ D) $\sqrt{6} : \sqrt{3} : 2$

44. The Miller indices of the plane parallel to y and z axes are:
A) (100) B) (010) C) (001) D) (111)

45. A proton and an $\propto$- particle has the same Kinetic energy. If the mass of the $\propto$- particle is four times that of a proton, how do their de Broglie wavelength compare

A) $\lambda_p = \frac{\lambda_\propto}{2}$ B) $\lambda_p = \frac{\lambda_\propto}{4}$ C) $\lambda_p = 2\lambda_\propto$ D) $\lambda_p = 4\,\lambda_\propto$

46. Ohms law relates to the electric field E, conductivity σ and current density J as:
A) $J = \sigma E$ B) $J = \frac{E}{\sigma}$ C) $J = E\sigma^2$ D) $J = \frac{\sigma}{E}$

47. If E_1 is the energy of the lowest state of a one dimensional potential box of length a and E_2 is the energy of the lowest state when the length of the box is halved, then
A) $E_2 = E_1$ B) $E_2 = \frac{E_1}{2}$ C) $E_2 = 2E_1$ D) $E_2 = 4E_1$

48. If the Fermi energy of a metal is 1.4 ev, the Fermi temperature of the metal is approximately:
A) 1.6×10^4 K B) 1.6×10^3 K C) 1.6×10^2 K D) 1.6×10^5 K

49. The spacing between the n^{th} energy level and the next higher level in an one dimensional potential box increases by:
A) (2n – 1) B) (2n + 1) C) (n – 1) D) (n+1)

50. Four physical quantities are given in Column I and their order of values in Column II. Match approximately

Column I	**Column II**
a. Thermal energy of air at room temperature	1. 0.02 ev
b. Binary energy of heavy nuclei per nucleon	2. 2 ev
c. X-ray Photon energy	3. 10 kev
d. Photon energy of visible light	4. 7 Mev

A) a-1, b-4, c-3, d- 2 B) a-2, b-1, c-3, d-4
C) a-3, b-4, c-2, d-1 D) a-4, b-3, c-2, d-1

51. AND gate can be produced using two ----- gates.
A) NOT B) NOR C) XOR D) NAND

52. The space lattice of sodium chloride crystal is:
A) fcc B) bcc
C) simple cubic D) orthorhombic

53. Which of the following device is a negative resistance device?
A) Triode B) Transistor
C) Thyristor D) Zener diode

54. When base current is changed from 30 μA to 80 μA, the collector current changes from 1 mA to 3.5 mA. The current gain in C-E configuration is:
A) 50 B) 75 C) 100 D) 125

55. Two amplifiers of gain A_1 and A_2 are RC coupled, then the net gain is:
A) $A_1 + A_2$ B) $A_1 - A_2$ C) $\frac{A_1 + A_2}{2}$ D) $A_1 \, x \, A_2$

56. The number of flip-flops needed to construct a shift register capable of storing a 6- bit Binary number is:
A) 6 B) 4 C) 2 D) 12

57. The output voltage of a 6-bit binary ladder with the input 101001 is:
A) 0.641 v B) 0.923 v C) 0.766 v D) 0.810 v

58. The relation between $\propto$ and β parameters of a transistor are given by:
A) $\propto = \frac{1-\beta}{\beta}$ B) $\propto = \frac{1+\beta}{\beta}$ C) $\propto = \frac{\beta}{1-\beta}$ D) $\propto = \frac{\beta}{1+\beta}$

59. Which of the following has the highest input resistance?
A) NPN transistor in C B configuration
B) PNP transistor in C E configuration
C) N type channel JFEP
D) P type channel MOSFET

60. For a Germanium P-N junction, the maximum value of barrier potential is:
A) 0. 3 v B) 0. 7 v C) 1. 3 v D) 1. 7 v

61. If the lattice temperature is increased, the Hall coefficient of a semiconductor will
A) Decrease
B) Increase
C) First increases and then deceases
D) Remain constant

62. A Solar cell is actually a device which utilises:
A) Photo conductive effect B) Photo voltaic effect
C) Photo emissive effect D) Photo resistive effect

63. A Schmitt trigger converts slowly varying wave form into:
A) Sine wave B) Saw tooth wave
C) Triangular wave D) Square wave

64. For two vectors $\vec{A}$ and $\vec{B}$, $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$ only when

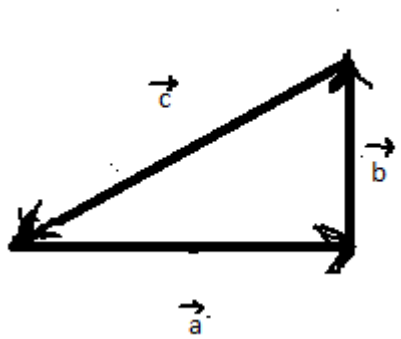
A) $|\vec{A}| = |\vec{B}| \neq 0$

B) $\vec{A} \perp \vec{B}$

C) $|\vec{A}| = |\vec{B}| \neq 0$ and $\vec{A}$ and $\vec{B}$ are parallel

D) $|\vec{A}| = |\vec{B}| \neq 0$ and $\vec{A}$ and $\vec{B}$ are antiparallel

65. Three vectors add to zero, as in the right triangle. The value of $\vec{a} \cdot \vec{b}$ is:



A) 0 B) a b C) 1 D) infinity

66. The value of the gamma function: $\Gamma(\frac{1}{2})$ is:

A) 1 B) π C) $\sqrt{\pi}$ D) 0

67. If $|\vec{A}| = 2$ and $|\vec{B}| = 4$, then match the relations in Column I with the angle θ between $\vec{A}$ and $\vec{B}$ in Column II

	Column I		**Column II**
a.	$\vec{A} \cdot \vec{B} = 0$	1.	$\theta = 0$
b.	$\vec{A} \cdot \vec{B} = +8$	2.	$\theta = 90^0$
c.	$\vec{A} \cdot \vec{B} = 4$	3.	$\theta = 180^0$
d.	$\vec{A} \cdot \vec{B} = -8$	4.	$\theta = 60^0$

A) a-2, b-1, c-4, d-3 B) a-1, b-2, c-4, d-3
C) a-3, b-4, c-1, d-2 D) a-4, b-1, c-2, d-3

68. The relationship between the Bessel functions $J_n(x)$ and $J_{-n}(x)$ is:

A) $J_{-n}(x) = -J_n(x)$ B) $J_{-n}(x) = J_n(x)$

C) $J_{-n}(x) = (-1)^{n+1} J_n(x)$ D) $J_{-n}(x) = (-1)^n J_n(x)$

69. Which of the following is not a unit of time?

A) Second B) Par second

C) Year D) Micro second

70. The value of the integral $\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$ is:

A) 1 B) π C) $\frac{1}{\pi}$ D) $\frac{1}{2\pi}$

71. The component of a vector $\vec{R}$ along X-axis will have maximum value if:

A) $\vec{R}$ is along positive Y-axis

B) $\vec{R}$ is along positive X-axis

C) $\vec{R}$ makes an angle of 45^0 with the X-axis

D) $\vec{R}$ is along negative Y-axis

72. An object of mass m moves to the right with a speed v. It collides head on in a perfectly inelastic collision with an object twice the mass but half the speed moving in the opposite direction. What is the speed of the combined mass after collision?

A) 0 B) $\frac{v}{2}$ C) v D) $2v$

73. A system of N particles is forced with k constraints, then the degree of freedom of the system is:

A) 3N B) 3N-k C) N-k D) k -N

74. If the Lagrangian of a system is $L = \frac{1}{2}m(\dot{r}\,\vartheta + r\,\dot{\vartheta}^3 + \dot{z}^2)$, then:

A) r alone is a cyclic coordinate

B) z alone is a cyclic coordinate

C) z and r are cyclic coordinates

D) ϑ and r are cyclic coordinates

75. The angular momentum L of a rotating object is:

A) Iw B) $\frac{1}{2}Iw^2$ C) $I \propto$ D) $\sum mr^2$

76. The equation of a progressive wave is

$y = 8\,Sin\left[\pi\left(\frac{t}{10} - \frac{x}{4}\right) + \frac{\pi}{3}\right]$

The wavelength of the wave is:

A) 8 m B) 4 m C) 2 m D) 10 m

77. A particle is executing motion $x = A\cos(\omega t - \theta)$. The maximum velocity of the particle is:

A) $A\omega$ B) $A\omega\,cos\theta$ C) $A\omega\,sin\theta$ D) $A\,sin\theta$

78. $x = 4\,cos\omega t + 3\,sin\omega t$ is the equation of a particle executing SHM. The initial phase angle is:

A) $tan^{-1}(\frac{3}{2})$ B) $tan^{-1}(\frac{4}{3})$ C) $tan^{-1}(\frac{3}{4})$ D) $tan^{-1}(\frac{1}{2})$

79. According to Stefan's law, the internal energy of a thermal system at temperature T is proportional to:

A) T^3 B) T^4 C) its volume D) its pressure

80. In superconductors electrons form Cooper pairs. This pairing is due to:
A) Electrostatic forces
B) Magnetic interactions
C) Interaction of electrons with the lattice
D) Interaction of electrons with photons

81. The energy differences between the spin up and spin down states of a proton in a magnetic field of B = 1.0 T is:
A) $24.0\ x\ 10^{-7} ev$ B) $12.2\ x\ 10^{-7} ev$
C) $8.7\ x\ 10^{-7} ev$ D) $1.76\ x\ 10^{-7} ev$

82. A stationary body explodes into two fragments each of mass 1.0 Kg that move apart at speeds or 0.6c relative to the original body. The mass of the original body is:
A) 2.5 kg B) 5.0 kg C) 1.0 kg D) 1.5 kg

83. Spacecraft Alpha is moving at 0.90c with respect to the earth. If spacecraft Beta is to pass Alpha at a relative speed of 0.5c in the same direction, what speed must Beta have with respect to the earth?
A) 0.30 c B) 0.52 c C) 0.97 c D) 0.12 c

84. At what speed does the Kinetic energy of a particle equal to its rest energy?

A) $\left(\frac{\sqrt{3}}{2}\right)c$ B) $\left(\frac{\sqrt{3}}{4}\right)c$ C) $\left(\frac{\sqrt{3}}{5}\right)c$ D) $\left(\frac{\sqrt{3}}{7}\right)c$

85. If 1 kg of a substance is fully converted into energy, how much energy is produced?
A) $3\ x\ 10^8$ J B) $9\ x\ 10^{16}$ J C) $1.5\ x\ 10^8$ J D) $4.5\ x\ 10^8$ J

86. The momentum (in $Mev\ /\ c$) of a electron whose speed is 0.60c is

A) $0.38\ Mev\ /\ c$ B) $0.42\ Mev\ /\ c$ C) $0.51\ Mev\ /\ c$ D) $0.72\ Mev\ /\ c$

87. A proton is confined to a nucleus of radius $5\ x\ 10^{-15} m$. The minimum uncertainty in momentum is:
A) $1.05\ x\ 10^{-15}\ Kg\ m\ s^{-1}$ B) $1.05\ x\ 10^{-20}\ Kg\ m\ s^{-1}$

C) $2.80\ x\ 10^{-15}\ Kg\ m\ s^{-1}$ D) $2.01\ x\ 10^{-20}\ Kg\ m\ s^{-1}$

88. If v is the velocity of a distant galaxy at a distance of r from us, then Hubble's law states that (H is the Hubble's constant):
A) $v = H r^2$ B) $v = H r^{-1}$ C) $v = Hr$ D) $v = H\ r^{-2}$

89. The quark content of proton is:
A) ud B) dud C) dd D) uud

90. Choose the wrong answer
A) Nuclear force is non-central
B) Nuclear force is charge independent
C) Nuclear force does not obey inverse square law
D) Nuclear force is charge dependent

91. The value of spin for the particle P ion is:
A) 0 B) $+\frac{1}{2}$ C) $+\frac{3}{2}$ D) + 1

92. The charges of up Quark and down Quark are:
A) $+\frac{2}{3}\ e\ and - \frac{1}{3}\ e$ B) $+\frac{1}{2}\ e\ and - \frac{1}{2}\ e$

C) $+ e\ and -\ e$ D) $+\frac{3}{4}\ e\ and - \frac{3}{4}\ e$

93. A particle linked to the x-axis has the wave function $\psi = ax$ between $x = 0\ and\ x = 1$ $\psi = 0$ elsewhere. The expectation value $< x >$ of the particle position is:

A) a^2 B) $\frac{a^2}{2}$ C) $\frac{a^2}{3}$ D) $\frac{a^2}{4}$

94. An eigen function of the operator $\frac{d^2}{dx^2}$ is $\psi = e^{2x}$. The corresponding eigen value is:
A) 1 B) 2 C) 4 D) 6

95. Electron with energy of 1 *ev* is incident on a barrier 10.0 *ev* high and 0.50 nm wide. The transmission probability is nearly
A) 10^{-2} B) 10^{-4} C) 10^{-5} D) 10^{-7}

96. A student writes the wave function of a free particle as
$\psi(x) = N \exp\ [i\ (kx^2 - \omega t)]$
This is not correct because:
A) It is not normalizable
B) It does not satisfy the wave equation
C) The sign of the first term in the exponent is wrong
D) It does not satisfy the required boundary conditions

97. The Pauli's Exclusion principle is:
A) A consequence of identity of particles
B) Follows from Bohr's quantization rules
C) Follows from the Schrodinger wave equation
D) Necessary to explain the periodic table

98. If $j = \frac{5}{2}$, what values of *l* are possible
A) 2, 3 B) 1, 4 C) 5, 7 D) $\frac{1}{2}, \frac{3}{2}$

99. Atoms are neutral. When they combine to form molecules, the force between them which is responsible for binding is:
A) Nuclear force B) Gravitational force
C) Electromagnetic force D) Vanderwaal force

100. When a conductor becomes a superconductor its specific heat capacity
A) Remains unaltered
B) Decreases continuously
C) Increases showing a discontinuity at the transition temperature
D) Decreases showing a discontinuity at the transition temperature

101. Hyperfine splitting of atomic spectral lines is due to,
A) Spin-orbit coupling
B) The effect of nuclear spin on the electron angular momentum
C) Application of external magnetic field
D) Application of external electric field

102. The rate at which information can be carried through a communication channel depends on
A) Transmission loss B) Transmitted power
C) Bandwidth D) None of the above

103. The role of a moderator in a reactor is:
A) To slow down neutrons
B) To prevent harmful radiation to escape
C) To produce neutrons
D) To monitor the nuclear reaction

104. In a particle detector, positively and negatively charged particles can very often be distinguished. This is because:
A) Their ionization properties are different
B) They curve differently in a magnetic field
C) The reactions which produce them have different characteristics
D) Only negatively charged one react strongly with atomic nuclei

105. A plane electromagnetic wave of frequency 25 MHz travels in free space along x-direction. At a particular point in space and time, $\vec{E} = 6.3\hat{j}\,\frac{v}{m}$. The value of $\vec{B}$ at this point is:
A) $2.1\,x\,10^{-8}\,\hat{k}$ T B) $2.1\,x\,10^{-8}\,\hat{j}$ T
C) $0.4\,x\,10^{8}\,\hat{k}$ T D) $0.48\,x\,10^{8}\,\hat{j}$ T

106. The frequencies of X-rays, γ- rays and Ultraviolet rays are respectively a, b and c. Then:
A) a < b, b > c B) a > b, b > c C) a > b, b < c D) a < b, b < c

107. If ε_0 and μ_0 represent the permittivity and permeability of vacuum and ε and μ represent the permittivity and permeability of medium, then refractive index of the medium is given by:

A) $\sqrt{\frac{\epsilon_0\mu_0}{\epsilon\mu}}$ B) $\sqrt{\frac{\epsilon\mu}{\epsilon_0\mu_0}}$ C) $\sqrt{\varepsilon\varepsilon_0\mu\mu_0}$ D) $\sqrt{\frac{\epsilon_0\mu}{\epsilon\,\mu_0}}$

108. A thin spherical shell of radius a has total charge Q distributed uniformly over its surface. The electric field inside the shell is:

A) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{a^2}$ B) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{a}$ C) 0 D) Infinite

109. The electric field due to a non conducting infinite charge per unit area σ is:

A) $\frac{\sigma}{2\varepsilon_0}$ B) $\frac{\sigma}{\varepsilon_0}$ C) $\frac{\varepsilon_0}{\sigma}$ D) 0

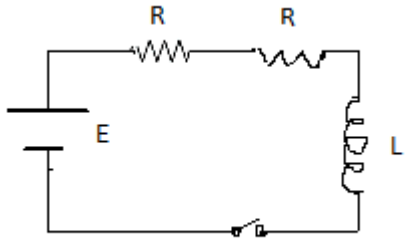
110. A thin Copper rod 1.0 m long has a mass of 50 g. What is the minimum current in the rod and would allow it to "float" in a magnetic field of 0.1 T

A) 1.2 A B) 2. 5 A C) 4. 9 A D) 9. 8 A

111. A bar magnet is falling through a loop of wire with constant velocity with the North Pole entering first. Viewed from the same side of coil as the magnet, as the North Pole enters the wire, the direction of the induced current will be:

A) Clockwise B) Counter clockwise
C) Zero D) Along the length of magnet

112. What is the time constant for the circuit shown?



A) $\frac{L}{R}$ B) $\frac{2L}{R}$ C) $\frac{L}{2R}$ D) $\frac{4L}{R}$

113. The frequency of oscillation of an L C circuit is:

A) $\frac{1}{2\pi\sqrt{LC}}$ B) $\frac{\sqrt{LC}}{2\pi}$ C) $\frac{1}{\pi\sqrt{LC}}$ D) $\frac{\sqrt{LC}}{\pi}$

114. Which one of the following is not a Boolean identity?

A) $A + \acute{B} = \acute{A}\acute{B}$ B) $A + \acute{A}B = A + B$
C) $(A + \acute{B})B = AB$ D) $A(A + B) = A$

115. Which of the following molecules would show a microwave (rotational) spectrum?

A) Br_2 B) H Br C) CS_2 D) None of the above

116. The longest wavelength present in the Balmer series of hydrogen, corresponding to H_α line is:

A) 656 nm B) 1312 nm C) 6560 nm D) 13120 nm

117. A helium – neon laser is:

A) Solid state laser B) Two–level laser
C) Three–level laser D) Four–level laser

118.

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

The above truth table corresponds to:

A) OR gate B) NOR gate C) AND gate D) NAND gate

119. Resistance of a semiconductor:

A) Decreases with increase in temperature
B) Increases with increase in temperature
C) Increases for Germanium and decreases for Silver
D) Is not affected by charge in temperature

120. For a common base amplifier the power gain is:

A) g_m B) $\frac{g_m}{R_L}$ C) $g_m + R_L$ D) $g_m R_L$
