A

22724 **120 MINUTES**

1. Evaluate the Laguerre's polynomial $L_1(x)$ is:
   A) $1-2x$ B) $1-x$ C) $1-2x^2$ D) $2x^2+1$

2. The Hamiltonian of a charged particle in an electromagnetic field is:
   A) $\frac{q}{2m}(p+qA)^2+q\varphi$ B) $\frac{1}{2m}(p-qA)^2-q\varphi$
   C) $\frac{2}{qm}(p-qA)^2+q\varphi$ D) $\frac{1}{2m}(p-qA)^2+q\varphi$

3. The average lifetime of μ-mesons at rest is $2.3\times10^{-6}s$. A laboratory measurement on μ-meson gives an average lifetime of $6.9\times10^{-6}s$.What is the speed of the mesons in the laboratory?
   A) 0.5928c B) 9.0428c C) 0.9428c D) 0.09428c

4. The condition at which de Broglie wavelength equals the Compton wavelength:
   A) $v=\frac{C}{\sqrt{2}}$ B) $v=\frac{C^2}{\sqrt{2}}$ C) $v=\frac{1}{\sqrt{2C}}$ D) $v=\frac{\sqrt{C}}{2}$

5. In partial wave analysis, the expression for total cross section of scattering is:
   A) $\frac{4\pi}{k^2}\sum(2l+1)sin^2\delta_l$ B) $\frac{4\pi}{k}\sum(2l+1)sin^2\delta_l$
   C) $\frac{2\pi}{k^2}\sum(2l+1)sin^2\delta_l$ D) $\frac{\pi}{k^2}\sum(2l+1)sin^2\delta_l$

6. The statistics applies to system of indistinguishable particles not obeying Pauli's exclusion principle , such as photons, phonons and liquid helium:
   A) M-B statistics B) F-D statistics
   C) B-E statistics D) Both A & C

7. The nuclear process in which one or more particles may liberated when the target nucleus absorbs γ-rays:
   A) Photo disintegration B) Auger effect
   C) Compound nucleus D) None of the above

8. The relationship between wavelength and energy for neutron:
   A) $\frac{h}{\sqrt{3M_nE}}$ B) $\frac{h}{\sqrt{2M_pE}}$ C) $\frac{h}{\sqrt{M_nE}}$ D) $\frac{h}{\sqrt{2M_nE}}$

9. The expression for Fermi level in a metal is given by:
   A) $E_f=\frac{h^2}{8m}\left[\frac{3N}{\pi L^3}\right]^{2/3}$ B) $E_f=\frac{h^2}{8m}\left[\frac{3N}{\pi L^3}\right]^{3}$
   C) $E_f=\frac{h^2}{4m}\left[\frac{3N}{\pi L^3}\right]^{2}$ D) $E_f=\frac{h^2}{4m}\left[\frac{3N}{\pi L^3}\right]^{2/3}$

10. The material in which the Hall coefficient is found to be zero:
A) Metal B) Semiconductor
C) Insulator D) Ceramics

11. For a JET type BFW 10, the typical values of amplification factor and transconductance are specified as 80 and 200μS, respectively. Its dynamic drain resistance is:
A) 301KΩ B) 205KΩ C) 200KΩ D) 400KΩ

12. The total energy of an electron in the n^{th} orbit of hydrogen atom is:
A) $\frac{-e^2}{8\pi\epsilon_0 r}$ B) $\frac{-e^2}{4\pi\epsilon_0 r}$ C) $\frac{-e^2}{8\pi^2\epsilon_0 r}$ D) $\frac{-e^2}{16\pi\epsilon_0 r}$

13. The L_α line of X-rays emitted from an atom with principal quantum numbers n =1,2,3… arises from the transition:
A) n = 4 to n =2 B) n = 3 to n = 2
C) n = 5 to n = 2 D) n = 3 to n = 1

14. The splitting up of a spectral line into number of lines of slightly different frequencies, when applied magnetic field is stronger than the internal magnetic field due to orbital and spin motion of the electron is:
A) Stark effect B) Hall effect
C) Cotton–Mouton effect D) Paschen Back effect

15. Which of the following Einstein's coefficient represents spontaneous emission?
A) A_{21} B) A_{12} C) B_{12} D) B_{21}

16. In regions where there is no charge, so that $\rho = 0$, the Poisson's equation reduces to:
A) Gauss's law B) Fresnel's law
C) Laplace's equation D) Maxwell's equation

17. The electric potential due to octopole varies inversely with:
A) r B) r^4 C) r^2 D) r^3

18. The index of refraction (n) is related to the electric and magnetic properties of the material by the equation
A) $n = \sqrt{\frac{1}{\epsilon_0\mu_0}}$ B) $n = \sqrt{\frac{2\epsilon\mu}{\epsilon_0\mu_0}}$
C) $n = \sqrt{\frac{\mu}{2\epsilon_0\mu_0}}$ D) $n = \sqrt{\frac{\epsilon\mu}{\epsilon_0\mu_0}}$

19. If the dimension of mass, length, time and charge are designated as M,L,T,Q, then dimensional formula of magnetic induction B is:
A) $M L^2 T^{-1} Q^{-1}$ B) $M T^{-1} Q^{-1}$
C) $L^2 T^{-2} Q$ D) $L^{-1} T^{-1} Q$

20. The line integral per unit area along the boundary of small area around a point in vector field E is

A) $grad(\vec{E})$ B) $\nabla.\vec{E}$ C) $\nabla \times \vec{E}$ D) $\oint \vec{E}.\vec{dA}$

21. The residue of cot x at x = 0

A) -1 B) 1 C) π D) $\frac{1}{4}\sinh(x)$

22. If 'u' is a complex variable and f(u) = $1+\frac{1}{\sqrt{u}}$, then the function

A) has a simple pole at u =0
B) Has a branch cut from u =0 to u = infinity
C) Is finite at all point inside the unit circle centered at u =0
D) Has branch point at u=0

23. Which of the following matrix is Hermetian?

A) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ B) $\begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$ C) $\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$ D) $\begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$

24. The series $1+\frac{1}{4}+\frac{1}{9}+\frac{1}{16}+\frac{1}{25}+.....\infty$ is:

A) Convergent B) Divergent
C) Oscillatory D) Monotonic increasing

25. For the Bessel's equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+\left(x^2-n^2\right)y=0$

A) $x=0$ is a regular singularity and $x=\infty$ is irregular singularity
B) $x=0$ is a essential singularity and $x=\infty$ is regular singularity
C) Both $x=0$ and $x=\infty$ are regular singularity
D) Both $x=0$ and $x=\infty$ are irregular singularity

26. The function $\phi_{(x,t)}=e^{-t^2+2xt}$ represents the generating function for:

A) Legendre polynomial B) Laguerre function
C) Hermite polynomial D) Chebyshev Function of first kind

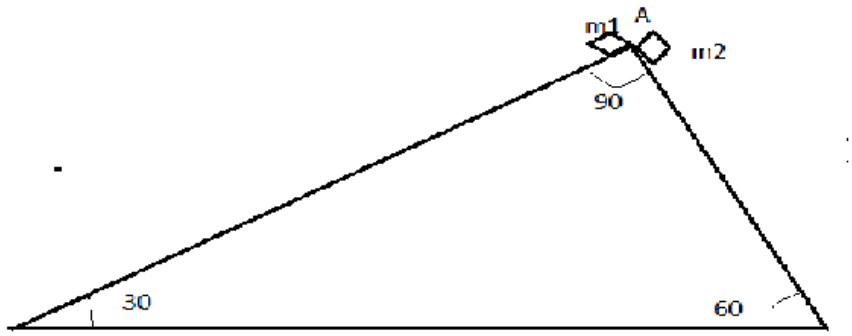
27. Trigonometric Fourier Series of a periodic function will have:

A) Sin terms and constant term only
B) Cos terms and constant term only
C) Constant term only
D) Sin terms and Cos terms only

28. If P(A)=2/3 ,P(B) =1/2 and P(AUB) = 5/6, the event A and event B are:

A) Mutually exclusive B) Independent
C) Depends only on A D) Depends only on B

29. Two inclined frictionless track one steeper than the other meet at A as shown below. If two bodies of mass m1, and m2 initially at rest on the edge A are allowed to slide down without slipping, one on each side as shown in the figure-
Which of the following statement is correct?



A) Both m1 and m2 reach the bottom at the same time, but not with same speed.
B) Both m1 and m2 reach the bottom with same speed and m1 reaches earlier than m2.
C) Both m1 and m2 reach the bottom with the same speed and m2 reaches earlier than m1.
D) Both m1 and m2 reach the bottom at different time and with different speed.

30. The generating functions corresponding to the transformation
$P = 2q^{1/2}\left(1 + q^{1/2}\cos p\right)$ and $Q = \log\left(1 + q^{1/2}\cos p\right)$ is:

A) $-\left(e^{Q} - 1\right)^2 \tan p$ B) $\left(e^{Q} - 1\right)^2 \cot p$

C) $\left(e^{Q} - 1\right)^2 \tan p$ D) $-\left(e^{Q} - 1\right)^2 \cot p$

31. For a particle moving under central force, which of the following statement is **incorrect**?
A) Its angular momentum is conserved
B) Motion take place in a plane
C) It total energy is conserved
D) It angular velocity will remain constant

32. In which of the following case the constraint is non holonomic?
A) Motion of body on an inclined plane under gravity.
B) A bead on a circular wire.
C) Particle moving on an ellipsoid under the influence of gravity.
D) A pendulum with variable length.

33. The Hamiltonian corresponding to the Lagrangian $L = a\dot{x}^2 + b\dot{y}^2$ is:

A) $\frac{p_x^{\,2}}{2a} + \frac{p_y^{\,2}}{2b}$ B) $\frac{p_x^{\,2}}{a} + \frac{p_y^{\,2}}{b}$ C) $\frac{p_x^{\,2}}{4a} + \frac{p_y^{\,2}}{4b}$ D) $\frac{p_x^{\,2} + p_y^{\,2}}{4ab}$

34. The eccentricity of a planet is found to be e. Then the ratio of maximum to minimum speed of the planet in its orbit is

A) $\frac{1+e^2}{1-e^2}$ B) $\frac{1+e}{1-e}$ C) $\left(\frac{1+e}{1-e}\right)^2$ D) $\frac{1-e^2}{1+e^2}$

35. The speed of electron at which it gain a mass of $2m_0$, where m_0 is the rest mass of electron is:

A) $\frac{\sqrt{3}}{2}c$ B) $\sqrt{\frac{3}{2}}\,c$ C) $\frac{2\sqrt{2}}{3}c$ D) $\frac{3}{4}c$

36. The action and angle variable have the dimension of:

A) Force and angle B) Angular momentum and angle
C) Energy and angle D) None of the above

37. The uncertainty in the velocity of an electron orbiting around nucleus of radius' r' is:

A) 0 B) $\frac{\hbar}{2\pi mr}$ C) 2hmr D) $\frac{h}{2\pi mr}$

38. The Compton shift in wavelength is found to vary with the:

A) Angle of scattering
B) Wavelength of the X ray used
C) Material used as the scatterer
D) All the above.

39. The Franck and Hertz experiment confirmed the:

A) Wave nature of the electrons
B) Quantization of magnetic moment
C) Energy quantization in atoms
D) Quantization of radiant energy

40. An electron of mass m and charge initially at rest is accelerated by a constant electric field E. The rate of change of de-broglie wavelength of this electron at the time 't' is:

A) $\frac{-h}{2\pi eE}$ B) $\frac{-h}{eEt}$ C) $\frac{-mh}{eEt^2}$ D) $\frac{-h}{eEt^2}$

41. The lowest energy possible for a particle in potential box is 3eV. The next higher energy the particle can have is:

A) 4eV B) 6 eV C) 9 eV D) 12 eV

42. Which one of the following belongs to Pauli's spin matrix?

A) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ B) $\begin{bmatrix}1 & i\\ -i & -1\end{bmatrix}$ C) $\begin{bmatrix}0 & -i\\ i & 0\end{bmatrix}$ D) $\begin{bmatrix}i & 1\\ 1 & -i\end{bmatrix}$

43. Law of conservation of linear momentum is a consequence of:

A) Rotational invariance of Hamiltonian
B) Translational invariance of Hamiltonian
C) Space inversion symmetry
D) All the above

44. Eigen value corresponding to particle exchange operator is:
A) +1 only B) -1 only C) ± 1 D) zero

45. All the velocity dependent forces which do **not** consume power are known as:
A) Corriolis force B) Gyroscopic force
C) Mendelevian force D) De-Alemberts force.

46. A black body at T K emits radiation at a peak wavelength λ. If the temperature of the black body becomes 4T K, the new peak wavelength:
A) $\frac{\lambda}{4}$ B) $\frac{\lambda}{16}$ C) $16\,\lambda$ D) $64\,\lambda$

47. Let N_{MB}, N_{BE}, N_{FD} denote the number of ways in which two particles can be distributed in two energy states according to Maxwell-Boltzmann statistics, Bose-Einstein Statistics and Fermi-Dirac Statistics. Then $N_{MB} : N_{BE} : N_{FD}$ is:
A) 1: 3: 4 B) 1: 4: 4 C) 4: 3: 1 D) 4: 3: 3

48. In Thermodynamics, Gibb's function is defined as G=H-TS, where H is enthalpy, T is temperature and S is entropy. In an isothermal, isobaric reversible process Gibb's function will:
A) Be a non zero constant. B) Be zero
C) Vary linearly D) Vary exponentially

49. In a micro canonical ensemble a system A of fixed volume is in contact with a large reservoir B. Then A can exchange:
A) Both energy and particle with B
B) Neither energy and nor particle with B
C) Only energy with B
D) Only particles with B

50. C_p and C_v are specific heat at constant pressure and volume respectively. It is observed that for Hydrogen gas, C_p-C_v= a and for Nitrogen gas C_p-C_v=b. Then:
A) a=14b B) a=b C) a=28b D) a= b/28

51. The temperature at which r.m.s speed of Hydrogen molecules becomes same as that of Oxygen at 47^0C is:
A) -20K B) 0K C) 20K D) 3K

52. A Carnot engine operating between temperature T_1 and T_2 has efficiency 1/6. When T_2 is lowered by 62K, its efficiency become 1/3. Then T_1 and T_2 are:
A) 372K and 310 K B) 372K and 330K
C) 330K and 260K D) 310K and 248K

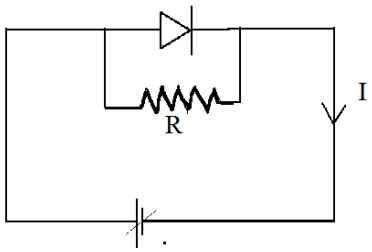
53. Which of the following is not Maxwell's relation in thermodynamics?
A) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ B) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$
C) $\left(\frac{\partial V}{\partial P}\right)_S = -\left(\frac{\partial T}{\partial S}\right)_V$ D) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$

54. The area enclosed by T-S diagram for a Carnot cycle represents
A) Heat absorbed form source per cycle
B) Heat rejected to sink per cycle
C) Net heat converted to work per cycle
D) Net energy lost per cycle.

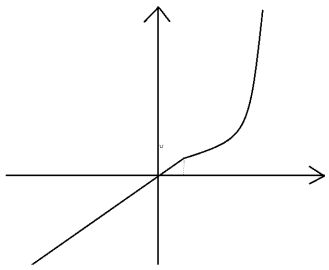
55. The slope of P-T phase diagram $\frac{dP}{dT} = \frac{L}{T\Delta V}$, represented in terms of Latent Heat(L) , absolute temperature (T) and specific volume change(ΔV) , is known as:

A) Joule-Kelvin equation B) Clausius Clapeyron equation
C) Gibbs Helmholtz equation D) Mayer's Relation

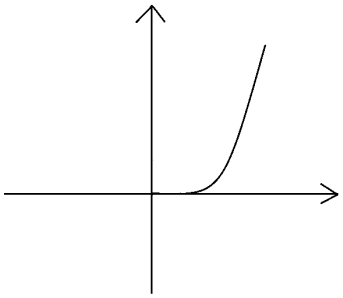
56. The graph that represents the pd across resistor against the current drawn from the cell shown in following diagram is:



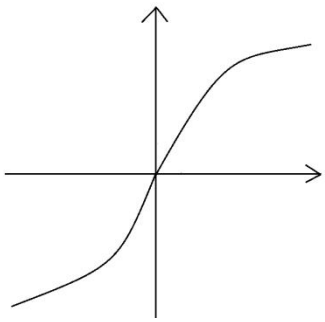
A)



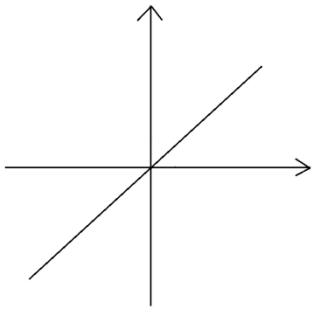
B)



C)



D)



57. A cube is uniformly charged so that the charge density is same everywhere inside the cube. Then the ratio of electrical potential at the center of cube to that at one of the corner of the cube is:

A) 1:1 B) 1:2 C) 2:1 D) $\sqrt{2}:1$

58. Suppose a magnetic monopole is detected in an experimental setup. Then which one of the following Maxwells relation has to be modified:

A) $\nabla . E = \frac{\rho}{\varepsilon_o}$ B) $\nabla . B = 0$

C) $\nabla \times E = \frac{-\partial B}{\partial t}$ D) $\nabla \times B = \frac{1}{c^2}\frac{\partial E}{\partial t} + \mu_o J$

59. For a plane electromagnetic wave propagating along z direction
$E_x = a\cos\omega z \cos\omega t$ and $B_y = -a\sin\omega z \sin\omega t$
Then the value of Poynting vector will be:

A) $\frac{1}{\mu_o} a^2 \sin(2\omega z) \sin(2\omega ct)$

B) $\frac{1}{4} a^2 \sin(2\omega z) \sin(2\omega ct)$

C) $a^2 \sin(2\omega z) \sin(2\omega ct)$

D) $-\frac{1}{4\mu_o} a^2 \sin(2\omega z) \sin(2\omega ct)$

60. A beam of unpolarised light of intensity I_0 is passed through a Polaroid A and then through another Polaroid B which is oriented so that its principal plane makes an angle of 45^0 related to that of A. The intensity of emergent light is:

A) $\frac{I_o}{8}$ B) I_o C) $\frac{I_o}{2}$ D) $\frac{I_o}{4}$

61. The electric flux passing out through the hemispherical surface of radius R placed in an electric field E with the axis parallel to the field is:

A) 0 B) $2\pi R^2 E$ C) $\pi R^2 E$ D) $3\pi R^2 E$

62. The ratio of electric field vector E and magnetizing field Vector H has the dimension of:

A) impedance B) inductance C) capacitance D) admittance

63. The maximum distance between inter atomic lattice planes in a solid is $12A^0$. The maximum wavelength of X-ray which are diffracted by this crystal will be ------.

A) $6A^0$ B) $12A^0$ C) $24A^0$ D) $48A^0$

64. In HeNe laser the most favorable ratio of He to Ne for achieving lasing action is:

A) 1:4 B) 7:1 C) 9:1 D) 1:9

65. The first line in rotational spectrum of CO is $3.842cm^{-1}$. Its bond length is:
(Given : reduced mass of CO is $11/384 \times 10^{-27}$kg)

A) $0.11A^0$ B) $1.13A^0$ C) $2.11A^0$ D) $2.13A^0$

66. Selection rule for Zeeman splitting is:

A) $\Delta M_J = 1 , \pm 2$

B) $\Delta M_J = 0 , -1$

C) $\Delta M_J = 0 , \pm 1, but \ M_J = 0 \leftrightarrow, M_J = 0 \ if \ \Delta J = 0$

D) $\Delta M_J = 1 , \pm 2, but \ M_J = 1 \leftrightarrow , M_J = 1 \ if \ \Delta J = 0$

67. The doublets observed in alkali spectra are due to:

A) Screening of K-electron

B) Spin orbit interaction of electrons

C) Presence of isotopes

D) All the above

68. For an atom in the state $^2D_{5/2}$, the lande g factor should be:

A) 2 B) 1.75 C) 1.20 D) 1.33

69. Oxygen has nuclear spin of 5/2. NMR of oxygen gives ---- lines.

A) 2 B) 3 C) 4 D) 6

70. Pure vibrational spectrum of a diatomic molecule is obtained when

A) It has a center of symmetry

B) It has a permanent dipole moment

C) It has no magnetic moment

D) It exhibit change in polarisabilty due to electronic transition

71. The continuous X-ray spectrum is the result of

A) Photo electric effect B) Inverse photo electric effect

C) Compton effect D) Auger effect

72. The pure rotational levels of a molecule in the far infrared region follows the formula E=BJ(J+1), where E is energy of rotational level with quantum number J and B is rotational constant. The lowest rotational energy gap in rotational Raman spectrum is:

A) 2B B) 4B C) 6B D) 8B

73. In the microwave spectrum of rigid diatomic molecule separation between the spectral lines is recorded to be 0.7143 cm^{-1}, moment of inertia of the molecule is:

A) 2.3 x 10^{-36} kgm^2 B) 2.3 x 10^{-40} kgm^2

C) 7.8 x 10^{-42} kgm^2 D) 7.8 x 10^{-46} kgm^2

74. Energy level between consecutive levels J and J+1 of a fine structure multiplet is proportional to J+1 to the larger of the two J values. This rule is known as:

A) Frank-Condon rule B) Lande interval rule

C) Fine structure interval rule D) Runge's rule

75. A nucleus rupture into two daughter nuclei. If the ratio of their velocities is 2:1, the ratio of nuclear radii of resulting nucleus will be:

A) 2:1 B) 8:1 C) $1:2^{\frac{1}{3}}$ D) $2^{\frac{1}{3}}:1$

76. A neutron of mass m, moving at a speed undergoes a head on collision with an atomic nuclei of mass M which is at rest. Then the fraction of decrease in Kinetic energy of neutron is:

A) $\frac{2m^2M}{(m+M)^2}$ B) $\frac{4m^2M^2}{(m+M)^2}$ C) $\frac{2mM}{(m+M)^2}$ D) $\frac{4mM}{(m+M)^2}$

77. The quark structure of Δ^{++} is:

A) uuu B) udu C) sss D) ddd

78. $^{60}Co_{27}$ is a radioactive nucleus of half life $2\ln(2\times10^8)$s.The activity of 10g of $^{60}Co_{27}$ in disintegration per second is:

A) $\frac{1}{5}\times10^{10}$ B) 5×10^{10} C) $\frac{1}{5}\times10^{14}$ D) 5×10^{14}

79. Which of the following statement is incorrect?

A) Strangeness is conserved in both strong and electromagnetic interactions.
B) Isospin is conserved only in strong interactions
C) Parity is not conserved in weak interactions
D) Strangeness is conserved only in weak interactions.

80. Which of the following is an example for spallation reaction?

A) $_{92}U^{235} + {}_0n^1 \rightarrow {}_{40}Zr^{98} + {}_{52}Te^{136} + 2{}_0n^1$

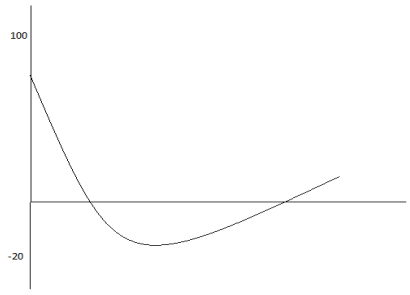
B) $_{12}Mg^{26} + {}_1H^1 \rightarrow {}_{13}Al^{27} + \gamma$

C) $N^{14} + Pb^{207} \rightarrow N^{13} + Pb^{208}$

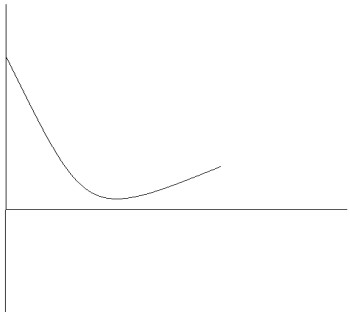
D) $_1H^2 + \gamma \rightarrow {}_1H^1 + {}_0n^1$

81. The graph which show the variation of packing fraction of a nucleus against its mass number is:

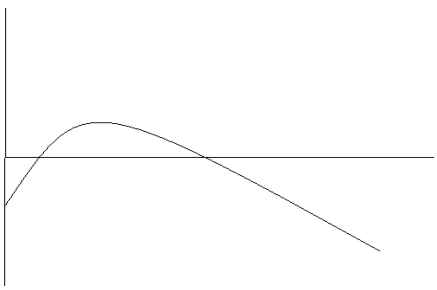
A)



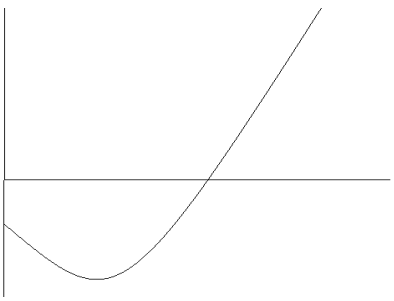
B)



C)



D)



82. Read the following three statements related to atomic nucleus.

1. Nuclear density is almost a constant for all nucleus
2. Total binding energy of a nucleus is proportional to their mass.
3. Nucleus with either atomic number or neutron number equal to 2, 8, 20, 28, 82 and 126 are relatively much more stable than other nuclei.

Liquid drop model of nucleus is based on:

A) 1 and 2 only B) 1 only
C) 1, 2 and 3 D) 1 and 3 only

83. The quadrupole moment of a nucleus is basically:

A) scalar B) vector C) Tensor D) Phasor

84. Hypercharge(Y) is related to Baryon number (B) and Strangness(S) by the equation:

A) Y= B-S B) Y= B+S C) Y= B x S D) Y= B/S

85. Half life $T_{1/2}$ and the mean life τ of a radioactive element is related as:

A) $T_{1/2} = \ln(2)\,\tau$ B) $T_{1/2} = \dfrac{\tau}{\ln(2)}$

C) $T_{1/2} = \tau$ D) $T_{1/2} = \dfrac{1}{2}\tau$

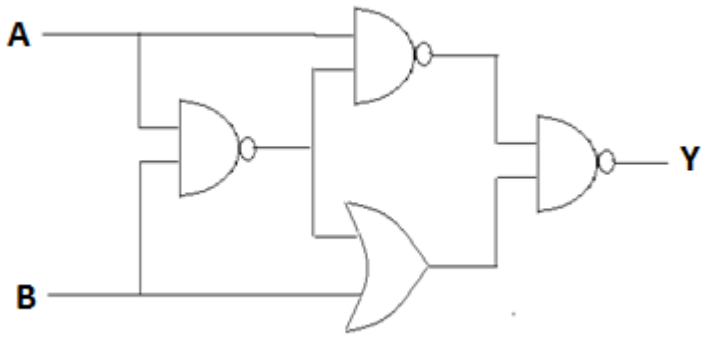
86. The specific charge of β ray is found to be less than that of cathode rays because ---- by virtue of large speed.

A) Charge decreases B) Charge increases
C) Mass increases D) Mass decreases

87. If the nuclear radius of ^{27}Al is 3.6 fermi, then the nuclear radius of ^{64}Cu in fermi unit is:

A) 2.4 B) 3.6 C) 4.8 D) 6.0

88. The output of given logic circuit is:



A) $\overline{A}B$ B) $A\overline{B}$ C) $\overline{AB} + AB$ D) $\overline{A}B + A\overline{B}$

89. A solid which is transparent to visible light and whose conductivity increases with temperature is formed by ----- bonding.
A) Metallic B) Ionic C) Covalent D) Vanderwalls

90. In the middle of depletion layer of a reverse biased pn junction the:
A) Electric field is zero B) Electric field is maximum
C) Potential is maximum D) Potential is zero

91. A microprocessor with 12 address lines is capable of addressing ----- locations.
A) 1024 B) 2048 C) 4096 D) 64k

92. Number of Flip Flops required to build a binary counter to count from 0 to 1023 are:
A) 10 B) 24 C) 12 D) 6

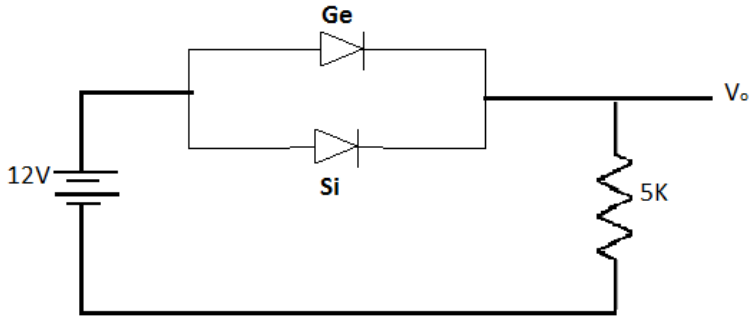
93. Avalanche photodiodes are preferred over PIN diodes in optical communication systems because of:
A) Speed of operation B) Higher sensitivity
C) Larger bandwidth D) Larger power handling capacity

94. A n- channel D-MOSFET with a positive V_{GS} operates in:
A) Depletion mode B) Enhancement mode
C) Cut off D) Saturation

95. Negative feed backing in amplifiers:
A) Increases input and output impedance
B) Increases input impedance and bandwidth
C) Decreases output impedance and bandwidth
D) Decreases input impedance and output impedance

96. Feedback element used in an integrator circuit is:
A) Resistor B) Capacitor
C) Zener diode D) Inductor

97. Germanium and silicon diodes start conducting at 0.3V and 0.7V respectively. In the following diagram if the Germanium diode connection is reversed the value of V_o changes by:



A) 0.4V B) 0.2V C) 0.6V D) 0.8V

98. Piezo electric transducer works under the variation of:

A) Intensity of light B) Mechanical pressure

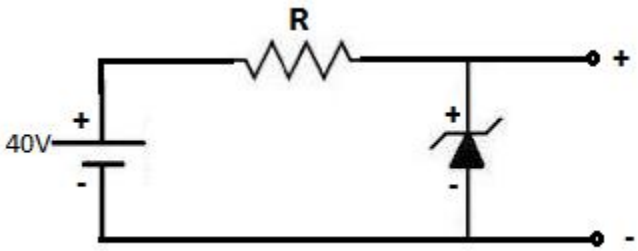
C) Temperature variation D) All of these

99. The Boolean expression $Y = \overline{AB + BC + CA}$ is equivalent to:

A) $\overline{AB} + \overline{BC} + \overline{CA}$ B) $\overline{A}\,B + \overline{B}\,C + C\,\overline{A}$

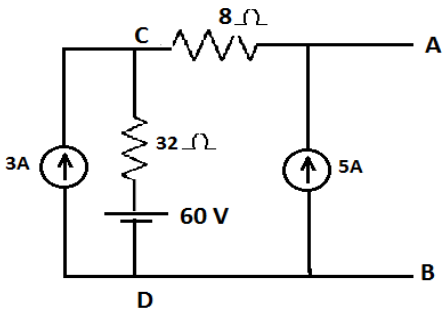
C) $\overline{A}\ \overline{B} + \overline{B}\ \overline{C} + \overline{A}\ \overline{C}$ D) $ABC + A\,\overline{B}\,C + A\,B\,\overline{C} + \overline{A}\,BC$

100. The minimum value of resistor 'R' required in the following circuit if the maximum zener current is 50mA. Given zener voltage=10V and maximum dc voltage applied at the input is 40V.



A) 200Ω B) 800Ω C) 600Ω D) 1kΩ

101. The Thevenin equivalent voltage across A and B for the given network is:



A) 60V B) 316V C) 356V D) 450V

102. The physical size of transmitter and receiver antenna in a communication system are:

A) Inversely proportional to modulation frequency

B) Proportional to carrier frequency

C) Independent of both carrier frequency and modulation frequency

D) Inversely proportional to carrier frequency

103. Programming language that make use of Mnemonic codes is:

A) High level language B) Assembly language

C) Machine language D) None of the above

104. Phase shift oscillators are suitable for generating:
A) Audio frequency ranges B) UHF
C) Microwave frequencies D) Square wave of high frequency

105. Schottky defect in crystals is observed when:
A) Unequal no. of cations and anions are missing from the lattice
B) Equal no. of cations and anions are missing from the lattice
C) An ion leaves its normal site and occupies an interstitial site
D) The crystal is highly compressed so that its density is increased

106. Reciprocal lattice of an fcc lattice is:
A) fcc lattice
B) bcc lattice
C) Body centered orthorhombic
D) Face centered orthorhombic

107. Classically molar electronic specific heat capacity:
A) 0.5R B) 1.5R C) 3R D) 4.5R

108. For a diamond structure packing fraction is given by:
A) $\pi\frac{\sqrt{3}}{8}$ B) $\pi\frac{\sqrt{3}}{4}$ C) $\pi\frac{\sqrt{3}}{2}$ D) $\pi\frac{\sqrt{3}}{16}$

109. Ice is an example of----- system.
A) Triclinic B) Hexagonal
C) Orthorhombic D) Monoclinic

110. Coordination number for a fcc crystal is:
A) 4 B) 6 C) 8 D) 12

111. Which types of crystals are generally good optical reflectors?
A) Covalent crystals B) Ionic crystals
C) Metallic D) All of them

112. Semiconductors with equal concentration of acceptor and donor impurities are termed:
A) Isotopic B) Isomorphic
C) Amphoteric D) Compensated

113. BCS theory is valid for:
A) Weak coupling super conductors
B) Strong coupling super conductors
C) Both weak and strong coupling super conductors
D) Metallic conductor at absolute zero

114. The relation $\frac{k}{\sigma} \propto T$ is:
A) Lorentz Drude relation B) Wiedemann–Franz
C) Kronig Penni relation D) Curie Weiss relation

115. Fermi energy level E_F is the highest energy state:
A) Below which all energy states are completely filled
B) Below which all energy states are completely empty
C) Above which all energy states are completely filled
D) Above which all energy states are partially filled and below which all the energy states are completely empty

116. According to Kronig-Penni model, in the energy spectrum of electrons in solid there are:
A) Regular region of only the allowed energy
B) Alternate regions of allowed and forbidden energy
C) Only the regular region of forbidden energy
D) None of the above

117. Electron concentration in a non degenerate semiconductor is:
A) $n = N_C \exp\left(\frac{E_F - E_C}{kT}\right)$ B) $n = N_C \exp\left(\frac{E_C - E_F}{kT}\right)$
C) $n = N_C \exp\left(\frac{E_C + E_F}{kT}\right)$ D) $n = N_C \exp\left(\frac{kT}{E_C - E_F}\right)$

118. Einstein's expression for specific heat capacity at constant volume is:
A) $C_V = 3R\left(\frac{\theta_E}{T}\right)^2 \left(e^{\frac{\theta_E}{T}} - 1\right)^{-2}$
B) $C_V = 3R\left(\frac{\theta_E}{T}\right)^2 \left(1 - e^{\frac{-\theta_E}{T}}\right)^{-2} e^{\frac{-\theta_E}{T}}$
C) $C_V = 3R\left(\frac{\theta_E}{T}\right)^3 e^{\frac{\theta_E}{T}}$
D) $C_V = 3R\left(\frac{\theta_E}{T}\right)^3 e^{\frac{-\theta_E}{T}}$

119. If $\vec{g}$ is a reciprocal lattice vector the Braggs law can be written as:
A) $\vec{k} + \vec{g} = 0$ B) $2\vec{k}.\vec{g} + g^2 = 0$
C) $2\vec{k}.\vec{g} + k^2 = 0$ D) $\vec{k}.\vec{g} = 0$

120. In non dispersive medium angular frequency ω and wave vector k are related to wave velocity v as:
A) $v = \omega/k$ B) $v = k/\omega$ C) $v = \omega^2/k$ D) $v = \omega^2 k$