

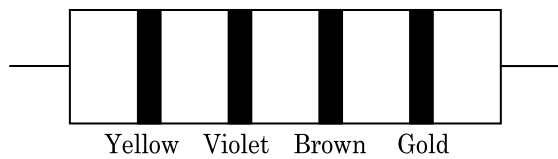
40. Identify a molecule which does **not** exist.
- (1)  $C_2$
  - (2)  $O_2$
  - (3)  $He_2$
  - (4)  $Li_2$
41. The correct option for free expansion of an ideal gas under adiabatic condition is :
- (1)  $q < 0, \Delta T = 0$  and  $w = 0$
  - (2)  $q > 0, \Delta T > 0$  and  $w > 0$
  - (3)  $q = 0, \Delta T = 0$  and  $w = 0$
  - (4)  $q = 0, \Delta T < 0$  and  $w > 0$
42. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is :
- (1)  $\frac{4}{\sqrt{3}} \times 288$  pm
  - (2)  $\frac{4}{\sqrt{2}} \times 288$  pm
  - (3)  $\frac{\sqrt{3}}{4} \times 288$  pm
  - (4)  $\frac{\sqrt{2}}{4} \times 288$  pm
43. The calculated spin only magnetic moment of  $Cr^{2+}$  ion is :
- (1) 5.92 BM
  - (2) 2.84 BM
  - (3) 3.87 BM
  - (4) 4.90 BM
44. Which of the following is a cationic detergent ?
- (1) Cetyltrimethyl ammonium bromide
  - (2) Sodium dodecylbenzene sulphonate
  - (3) Sodium lauryl sulphate
  - (4) Sodium stearate
45. What is the change in oxidation number of carbon in the following reaction ?
- $$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(l) + 4HCl(g)$$
- (1) -4 to +4
  - (2) 0 to -4
  - (3) +4 to +4
  - (4) 0 to +4
46. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth ?
- (1) 30 N
  - (2) 24 N
  - (3) 48 N
  - (4) 32 N
47. An iron rod of susceptibility 599 is subjected to a magnetising field of  $1200 \text{ A m}^{-1}$ . The permeability of the material of the rod is :
- $$(\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})$$
- (1)  $2.4\pi \times 10^{-5} \text{ T m A}^{-1}$
  - (2)  $2.4\pi \times 10^{-7} \text{ T m A}^{-1}$
  - (3)  $2.4\pi \times 10^{-4} \text{ T m A}^{-1}$
  - (4)  $8.0 \times 10^{-5} \text{ T m A}^{-1}$
48. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is :
- $$(\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})$$
- (1)  $6.28 \times 10^{-5} \text{ T}$
  - (2)  $3.14 \times 10^{-5} \text{ T}$
  - (3)  $6.28 \times 10^{-4} \text{ T}$
  - (4)  $3.14 \times 10^{-4} \text{ T}$
49. When a uranium isotope  ${}_{92}^{235}\text{U}$  is bombarded with a neutron, it generates  ${}_{36}^{89}\text{Kr}$ , three neutrons and :
- (1)  ${}_{36}^{101}\text{Kr}$
  - (2)  ${}_{36}^{103}\text{Kr}$
  - (3)  ${}_{56}^{144}\text{Ba}$
  - (4)  ${}_{40}^{91}\text{Zr}$

50. Find the torque about the origin when a force of  $3\hat{j}$  N acts on a particle whose position vector is  $2\hat{k}$  m.
- (1)  $-6\hat{i}$  N m
  - (2)  $6\hat{k}$  N m
  - (3)  $6\hat{i}$  N m
  - (4)  $6\hat{j}$  N m
51. Light with an average flux of  $20 \text{ W/cm}^2$  falls on a non-reflecting surface at normal incidence having surface area  $20 \text{ cm}^2$ . The energy received by the surface during time span of 1 minute is :
- (1)  $24 \times 10^3 \text{ J}$
  - (2)  $48 \times 10^3 \text{ J}$
  - (3)  $10 \times 10^3 \text{ J}$
  - (4)  $12 \times 10^3 \text{ J}$
52. A cylinder contains hydrogen gas at pressure of  $249 \text{ kPa}$  and temperature  $27^\circ\text{C}$ . Its density is : ( $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$ )
- (1)  $0.1 \text{ kg/m}^3$
  - (2)  $0.02 \text{ kg/m}^3$
  - (3)  $0.5 \text{ kg/m}^3$
  - (4)  $0.2 \text{ kg/m}^3$
53. The mean free path for a gas, with molecular diameter  $d$  and number density  $n$  can be expressed as :
- (1)  $\frac{1}{\sqrt{2} n^2 \pi d^2}$
  - (2)  $\frac{1}{\sqrt{2} n^2 \pi^2 d^2}$
  - (3)  $\frac{1}{\sqrt{2} n \pi d}$
  - (4)  $\frac{1}{\sqrt{2} n \pi d^2}$
54. A charged particle having drift velocity of  $7.5 \times 10^{-4} \text{ m s}^{-1}$  in an electric field of  $3 \times 10^{-10} \text{ Vm}^{-1}$ , has a mobility in  $\text{m}^2 \text{ V}^{-1} \text{ s}^{-1}$  of :
- (1)  $2.5 \times 10^{-6}$
  - (2)  $2.25 \times 10^{-15}$
  - (3)  $2.25 \times 10^{15}$
  - (4)  $2.5 \times 10^6$
55. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is :
- (1)  $\frac{\pi}{2}$  rad
  - (2) zero
  - (3)  $\pi$  rad
  - (4)  $\frac{3\pi}{2}$  rad
56. Two particles of mass  $5 \text{ kg}$  and  $10 \text{ kg}$  respectively are attached to the two ends of a rigid rod of length  $1 \text{ m}$  with negligible mass. The centre of mass of the system from the  $5 \text{ kg}$  particle is nearly at a distance of :
- (1)  $67 \text{ cm}$
  - (2)  $80 \text{ cm}$
  - (3)  $33 \text{ cm}$
  - (4)  $50 \text{ cm}$
57. Taking into account of the significant figures, what is the value of  $9.99 \text{ m} - 0.0099 \text{ m}$  ?
- (1)  $9.980 \text{ m}$
  - (2)  $9.9 \text{ m}$
  - (3)  $9.9801 \text{ m}$
  - (4)  $9.98 \text{ m}$
58. For transistor action, which of the following statements is **correct** ?
- (1) Both emitter junction as well as the collector junction are forward biased.
  - (2) The base region must be very thin and lightly doped.
  - (3) Base, emitter and collector regions should have same doping concentrations.
  - (4) Base, emitter and collector regions should have same size.
59. The average thermal energy for a mono-atomic gas is : ( $k_B$  is Boltzmann constant and  $T$ , absolute temperature)
- (1)  $\frac{5}{2} k_B T$
  - (2)  $\frac{7}{2} k_B T$
  - (3)  $\frac{1}{2} k_B T$
  - (4)  $\frac{3}{2} k_B T$

60. In a certain region of space with volume  $0.2 \text{ m}^3$ , the electric potential is found to be  $5 \text{ V}$  throughout. The magnitude of electric field in this region is :

- (1)  $1 \text{ N/C}$
- (2)  $5 \text{ N/C}$
- (3) zero
- (4)  $0.5 \text{ N/C}$

61. The color code of a resistance is given below :



The values of resistance and tolerance, respectively, are :

- (1)  $4.7 \text{ k}\Omega$ , 5%
- (2)  $470 \Omega$ , 5%
- (3)  $470 \text{ k}\Omega$ , 5%
- (4)  $47 \text{ k}\Omega$ , 10%

62. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is : ( $c$  = speed of electromagnetic waves)

- (1)  $1 : c$
- (2)  $1 : c^2$
- (3)  $c : 1$
- (4)  $1 : 1$

63. The Brewsters angle  $i_b$  for an interface should be :

- (1)  $45^\circ < i_b < 90^\circ$
- (2)  $i_b = 90^\circ$
- (3)  $0^\circ < i_b < 30^\circ$
- (4)  $30^\circ < i_b < 45^\circ$

64. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency  $6 \text{ Hz}$ . When tension in B is slightly decreased, the beat frequency increases to  $7 \text{ Hz}$ . If the frequency of A is  $530 \text{ Hz}$ , the original frequency of B will be :

- (1)  $536 \text{ Hz}$
- (2)  $537 \text{ Hz}$
- (3)  $523 \text{ Hz}$
- (4)  $524 \text{ Hz}$

65. A capillary tube of radius  $r$  is immersed in water and water rises in it to a height  $h$ . The mass of the water in the capillary is  $5 \text{ g}$ . Another capillary tube of radius  $2r$  is immersed in water. The mass of water that will rise in this tube is :

- (1)  $10.0 \text{ g}$
- (2)  $20.0 \text{ g}$
- (3)  $2.5 \text{ g}$
- (4)  $5.0 \text{ g}$

66. A resistance wire connected in the left gap of a metre bridge balances a  $10 \Omega$  resistance in the right gap at a point which divides the bridge wire in the ratio  $3 : 2$ . If the length of the resistance wire is  $1.5 \text{ m}$ , then the length of  $1 \Omega$  of the resistance wire is :

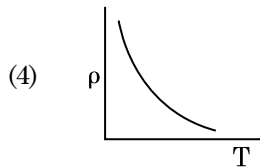
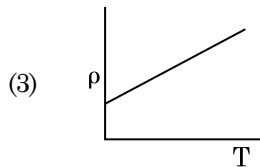
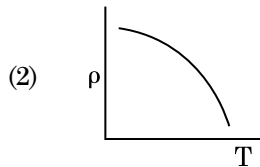
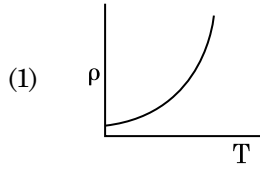
- (1)  $1.5 \times 10^{-1} \text{ m}$
- (2)  $1.5 \times 10^{-2} \text{ m}$
- (3)  $1.0 \times 10^{-2} \text{ m}$
- (4)  $1.0 \times 10^{-1} \text{ m}$

67. The capacitance of a parallel plate capacitor with air as medium is  $6 \mu\text{F}$ . With the introduction of a dielectric medium, the capacitance becomes  $30 \mu\text{F}$ . The permittivity of the medium is :

$$(\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2})$$

- (1)  $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
- (2)  $5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
- (3)  $0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
- (4)  $1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

68. Which of the following graph represents the variation of resistivity ( $\rho$ ) with temperature (T) for copper ?



69. For which one of the following, Bohr model is **not** valid ?

- (1) Deuteron atom
- (2) Singly ionised neon atom ( $\text{Ne}^+$ )
- (3) Hydrogen atom
- (4) Singly ionised helium atom ( $\text{He}^+$ )

70. A short electric dipole has a dipole moment of  $16 \times 10^{-9} \text{ C m}$ . The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of  $60^\circ$  with the dipole axis is :

$$\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2 \right)$$

- (1) 400 V
- (2) zero
- (3) 50 V
- (4) 200 V

71. A ray is incident at an angle of incidence  $i$  on one surface of a small angle prism (with angle of prism  $A$ ) and emerges normally from the opposite surface. If the refractive index of the material of the prism is  $\mu$ , then the angle of incidence is nearly equal to :

- (1)  $\mu A$
- (2)  $\frac{\mu A}{2}$
- (3)  $\frac{A}{2\mu}$
- (4)  $\frac{2A}{\mu}$

72. The energy equivalent of 0.5 g of a substance is :

- (1)  $1.5 \times 10^{13} \text{ J}$
- (2)  $0.5 \times 10^{13} \text{ J}$
- (3)  $4.5 \times 10^{16} \text{ J}$
- (4)  $4.5 \times 10^{13} \text{ J}$

73. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is :

- (1)  $7.32 \times 10^{-7} \text{ rad}$
- (2)  $6.00 \times 10^{-7} \text{ rad}$
- (3)  $3.66 \times 10^{-7} \text{ rad}$
- (4)  $1.83 \times 10^{-7} \text{ rad}$

74. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled ?

- (1) one-fourth
- (2) zero
- (3) doubled
- (4) four times

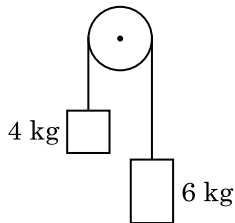
75. An electron is accelerated from rest through a potential difference of  $V$  volt. If the de Broglie wavelength of the electron is  $1.227 \times 10^{-2} \text{ nm}$ , the potential difference is :

- (1)  $10^3 \text{ V}$
- (2)  $10^4 \text{ V}$
- (3) 10 V
- (4)  $10^2 \text{ V}$

76. Dimensions of stress are :

- (1)  $[ML^0T^{-2}]$
- (2)  $[ML^{-1}T^{-2}]$
- (3)  $[MLT^{-2}]$
- (4)  $[ML^2T^{-2}]$

77. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity ( $g$ ) is :



- (1)  $g/5$
- (2)  $g/10$
- (3)  $g$
- (4)  $g/2$

78. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is  $\frac{\pi}{3}$ . If instead C is removed from the circuit, the phase difference is again  $\frac{\pi}{3}$  between current and voltage. The power factor of the circuit is :

- (1) 1.0
- (2) -1.0
- (3) zero
- (4) 0.5

79. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is :

- (1) isochoric
- (2) isobaric
- (3) isothermal
- (4) adiabatic

80. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is : ( $g = 10 \text{ m/s}^2$ )

- (1) 320 m
- (2) 300 m
- (3) 360 m
- (4) 340 m

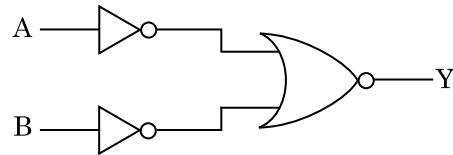
81. The solids which have the negative temperature coefficient of resistance are :

- (1) semiconductors only
- (2) insulators and semiconductors
- (3) metals
- (4) insulators only

82. The quantities of heat required to raise the temperature of two solid copper spheres of radii  $r_1$  and  $r_2$  ( $r_1 = 1.5 r_2$ ) through 1 K are in the ratio :

- (1)  $\frac{3}{2}$
- (2)  $\frac{5}{3}$
- (3)  $\frac{27}{8}$
- (4)  $\frac{9}{4}$

83. For the logic circuit shown, the truth table is :



- (1)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0
- (2)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0
- (3)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1
- (4)

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

84. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes :
- (1) four times
  - (2) one-fourth
  - (3) double
  - (4) half
85. A  $40 \mu\text{F}$  capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly :
- (1) 2.5 A
  - (2) 25.1 A
  - (3) 1.7 A
  - (4) 2.05 A
86. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is :
- (1) 0.5 mm
  - (2) 1.0 mm
  - (3) 0.01 mm
  - (4) 0.25 mm
87. The energy required to break one bond in DNA is  $10^{-20}$  J. This value in eV is nearly :
- (1) 0.06
  - (2) 0.006
  - (3) 6
  - (4) 0.6
88. A wire of length  $L$ , area of cross section  $A$  is hanging from a fixed support. The length of the wire changes to  $L_1$  when mass  $M$  is suspended from its free end. The expression for Young's modulus is :
- (1)  $\frac{MgL}{AL_1}$
  - (2)  $\frac{MgL}{A(L_1 - L)}$
  - (3)  $\frac{MgL_1}{AL}$
  - (4)  $\frac{Mg(L_1 - L)}{AL}$
89. The increase in the width of the depletion region in a p-n junction diode is due to :
- (1) both forward bias and reverse bias
  - (2) increase in forward current
  - (3) forward bias only
  - (4) reverse bias only
90. A spherical conductor of radius 10 cm has a charge of  $3.2 \times 10^{-7}$  C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere ?
- $$\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2 \right)$$
- (1)  $1.28 \times 10^6$  N/C
  - (2)  $1.28 \times 10^7$  N/C
  - (3)  $1.28 \times 10^4$  N/C
  - (4)  $1.28 \times 10^5$  N/C
91. Match the organism with its use in biotechnology.
- |                                      |  |
|--------------------------------------|--|
| (a) <i>Bacillus thuringiensis</i>    | (i) Cloning vector                       |
| (b) <i>Thermus aquaticus</i>         | (ii) Construction of first rDNA molecule |
| (c) <i>Agrobacterium tumefaciens</i> | (iii) DNA polymerase                     |
| (d) <i>Salmonella typhimurium</i>    | (iv) Cry proteins                        |
- Select the **correct** option from the following :
- |     | (a)   | (b)   | (c)   | (d)  |
|-----|-------|-------|-------|------|
| (1) | (iii) | (ii)  | (iv)  | (i)  |
| (2) | (iii) | (iv)  | (i)   | (ii) |
| (3) | (ii)  | (iv)  | (iii) | (i)  |
| (4) | (iv)  | (iii) | (i)   | (ii) |
92. Identify the basic amino acid from the following.
- (1) Lysine
  - (2) Valine
  - (3) Tyrosine
  - (4) Glutamic Acid