UP-CPMT - 2004

Paper-2

Physics

1. A sphere of diameter 0.2 m and mass 2 kg is rolling on an incline plane with velocity v = 0.5 m/s. The kinetic energy of the sphere is :
   1) 0.14 J
   2) 0.28 J
   3) 0.68 J
   4) 0.42 J

2. Which of the following statements is true for an n-type semiconductor ?
   1) The donor level lies closely below the bottom of the conduction band
   2) The donor level lies closely above the top of the valence band
   3) The donor level lies at the halfway mark of the forbidden energy gap
   4) None of the above

3. A short linear object of length b lies along the axis of a concave mirror of focal length f at a distance u from the pole of the mirror, what is the size of image ?
   1) (f/u - f)b
   2) $(f/u - f)^2 b$
   3) $(f/u - f)b^2$
   4) (f/u - f)

4. A monoatomic gas supplied the heat Q very slowly keeping the pressure constant. The work done by the gas will be :
   1) (1/3)Q
   2) (3/5)Q
   3) (2/5)Q
   4) (5/2)Q

5. The dimensional formula for Young's modulus is :
   1) $[ML^{-1}T^{-2}]$
   2) $[M^0LT^{-3}]$
   3) $[ML^0T^{-2}]$
   4) $[M^2L^2T^{-2}]$

6. A particle executing SHM has amplitude 0.01 m and frequency 60 Hz. The maximum

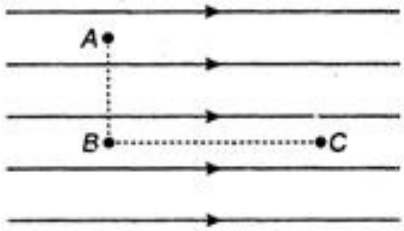
acceleration of particle is :

1) $36\pi^2 m/s^2$
2) $72\pi^2 m/s^2$
3) $128\pi^2 m/s^2$
4) $144\pi^2 m/s^2$

7. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.17 s. The frequency of the wave is :

1) 1.47 Hz
2) 3.94 Hz
3) 1.73 Hz
4) 1.36 Hz

8. Figure shows three points A, B and C in a region of uniform electric field $\vec{E}$. The line AB is perpendicular and BC is parallel to the field lines. Then, which of the following holds good ?



where, $V_A > V_B$ and Vc represent the electric potential at points A, B and C respectively.

1) $V_A = V_B = Vc$
2) $V_A = V_B > Vc$
3) $V_A = V_B < Vc$
4) $V_A > V_B = Vc$

9. The radius of the convex surface of plano-convex lens is 20 cm and the refractive index of the material of the lens is 1.5. The focal length is :

1) 10 cm
2) 15 cm
3) 25 cm
4) 40 cm

10. An electron moves at right angle to a magnetic field of 1.5×10^{-2} T with a speed of 6×10^7 m/s. If the specific charge of the electron is 1.7×10^{11} C/kg, the radius of the circular path will be :

1) 1.29 cm
2) 4.9 cm
3) 2.35 cm
4) 4.25 cm

11. To make the frequency double of a spring oscillator, we have to :

1) reduce the mass to one-fourth
2) quardruple the mass
3) double the mass
4) half the mass

12. A bar magnet of moment $\vec{M}$ is placed in the magnetic field $\vec{B}$. The torque acting on the magnet is :

1) $\vec{M} \times \vec{B}$
2) $\vec{M} - \vec{B}$
3) $(1/2)\ \vec{M} \times \vec{B}$
4) $\vec{M} + \vec{B}$

13. Two similar coils are kept mutually perpendicular such that their centres coincide. At the centre, find the ratio of the magnetic field due to one coil and the resultant magnetic field through both coils, if the same current is flown.

1) $1 : \sqrt{2}$
2) 4 : 3
3) 3 : 4
4) $\sqrt{3} : 1$

14. When temperature of an ideal gas is increased from 27°C to 227°C. Its rms speed is changed form 400 m/s to v_s. The v_s is :

1) 516 m/s
2) 256 m/s
3) 324 m/s
4) 724 m/s

15. A cone filled with water is revolved in a vertical circle of radius 4 m and the water does not fall down. What must be the maximum period of revolution ?

1) 2 s
2) 4 s
3) 8 s
4) 10 s

16. A particle is executing two different simple harmonic motions, mutually perpendicular, of different amplitudes and having phase difference of $\pi/2$. The path of the particle will be :

1) circular
2) straight line
3) parabolic
4) elliptical

17. When sound waves travel from air to water, which one of the following remains constant ?
    1) Time period
    2) Frequency
    3) Velocity
    4) Wavelength

18. Nuclear fusion is common to the pair :
    1) thermonuclear reactor, uranium based nuclear reactor
    2) energy production in sun, uranium based nuclear reactor
    3) energy production in sun, hydrogen bomb
    4) disintegration of heavy nuclei, hydrogen bomb

19. A particle is executing the motion $x = a\cos(\omega t - \theta)$. The maximum velocity of the particle is :
    1) $a\omega\cos\theta$
    2) $a\omega$
    3) $a\omega\sin\theta$
    4) none of these

20. Five particles of mass 2 kg are attached to the rim of a circular disc of radius 0.1 m and negligible mass. Moment of inertia of the system about the axis passing through the centre of the disc and perpendicular to its plane is :
    1) 1 kg m^2
    2) 0.1 kg m^2
    3) 4 kg m^2
    4) 0.4 kg m^2

21. A police jeep is chasing with velocity of 45 km/h, a thief in another jeep moving with velocity 153 km/h. Police fires a bullet with muzzle velocity of 180 m/s. The velocity with which it will strike the jeep of the thief, is :
    1) 150 m/s
    2) 120 m/s
    3) 90 m/s
    4) 60 m/s

22. If a_r and a_t represent radial and tangential accelerations, the motion of particle will be uniformly circular if :
    1) $a_r = 0$ and $a_t = 0$
    2) $a_r = 0$ and $a_t \neq 0$
    3) $a_r \neq 0$ and $a_t = 0$
    4) $a_r \neq 0$ and $a_t \neq 0$

23. A transparent cube of 15 cm edge contains a small air bubble. Its apparent depth when viewed through one face is 6 cm and when viewed through the opposite face is 4 cm. Then the refractive index of the material of the cube is :

1) 6.0
2) 4.5
3) 3.0
4) 1.5

24. An ice-cude of density 900 kg/m^3 is floating in water of density 1000 kg/m^3. The percentage of volume of ice-cube outside the water is :

1) 15% 2) 30% 3) 10% 4) 40%

25. The radius R of the soap bubble is doubled under isothermal condition. If T be the surface tension of soap bubble, the required surface energy in doing so is given by :

1) $16\pi R^2T$
2) $24\pi R^2T$
3) $36\pi R^2T$
4) $2\pi R^2T$

26. Radius of orbit of satellite of earth is R. Its kinetic energy is proportional to :

1) $1/R$
2) $1/R^3$
3) R^3
4) $1/R^{3/2}$

27. The radius of orbit of a planet is two times that of the earth. The time period of planet is :

1) 1.4 T
2) 2.8 T
3) 6.3 T
4) 0.7 T

28. Equations of motion in the same direction are given by :
$y_1 = 2a \sin(\omega t - kx)$
$y_2 = 2a \sin(\omega t - kx - \theta)$
The amplitude of the medium particle will be :

1) $2a \cos\theta$
2) $\sqrt{2a \cos^2\theta}$
3) $4a \cos\theta/2$
4) $\sqrt{2a \cos^2\theta/2}$

29. An L-C circuit is in the state of resonance. If C = 0.1μF and L = 0.25 H, neglecting ohmic resistance of circuit, what is the frequency of oscillations ?

1) 1007 Hz
2) 1020 Hz
3) 1090 Hz
4) 1500 Hz

30. A capacitor of capacitance 6μF is charged upto 100 V. The energy stored in the capacitor is :

1) 0.15 J
2) 0.015 J
3) 0.03 J
4) 0.3 J

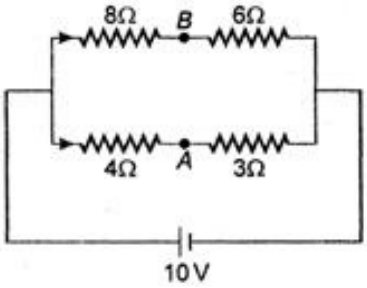
31. Regarding a semiconductor which one of the following is wrong ?

1) There are no free electrons at room temperature
2) There are no free electrons at 0 K
3) The number of free electrons increases with rise of temperature
4) The charge carries are electrons and holes

32. The length, breath and thickness of a block are given by *l* = 12 cm, b = 6 cm and t = 2.45 cm. The volume of the block, according to idea of significant figures should be :

1) $1 \times 10^2 cm^3$
2) $2 \times 10^2 cm^3$
3) $2.763 \times 10^2\ cm^3$
4) $3.763 \times 10^2\ cm^3$

33. The potential difference between points A and B is :



1) (25/7)V
2) (50/7)V
3) (60/7)V
4) zero

34. A prism of refractive index √2 has a refracting angle of 60°. At what angle a ray must be incident on it so that it suffers a minimum deviation ?

1) 45°
2) 75°
3) 105°
4) 135°

35. If work function of a metal is 4.2 eV, the cut-off wavelength is :
1) 1500 Å
2) 3000 Å
3) 6000 Å
4) 2950 Å

36. A tank is filled with water upto height H. When a hole is made at a distance h below the level of water, what will be the horizontal range of water jet ?
1) $2\sqrt{h(H-h)}$
2) $4\sqrt{h(H+h)}$
3) $4\sqrt{h(H-h)}$
4) $2\sqrt{h(H+h)}$

37. The minimum wavelength of X-rays emitted by X-ray tube is 0.4125 Å. The accelerating voltage is :
1) 30 kV
2) 60 kV
3) 90 kV
4) 120 kV

38. A person who can see things most clearly at a distance of 10 cm, requires spectacles to enable to see clearly things at a distance of 30 cm. What should be the focal length of the spectacles ?
1) 15 cm (concave)
2) 15 cm (convex)
3) 5 cm
4) Zero

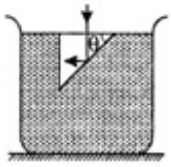
39. A raft of wood of mass 120 kg floats in water. The weight that can be put on the raft to make it just sink, should be (d_{raft} = 600kg/ m^3) :
1) 80 kg
2) 70 kg
3) 100 kg
4) 120 kg

40. A body falls from a height h = 200 m. The ratio of distance travelled in each 2s, during t =

0 to t = 6s of the journey is :

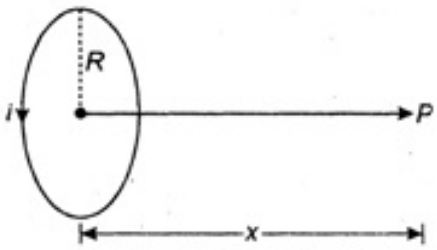
1) 1 : 2 : 9
2) 1 : 2 : 8
3) 1 : 3 : 5
4) 1 : 2 : 3

41. The refractive index of the material of the prism and liquid are 1.56 and 1.32 respectively. What will be the value of θ for the following refraction ?



1) sin θ ≥ (13/11)
2) sin θ ≥ (11/13)
3) sin θ ≥ (√3/2)
4) sin θ ≥ (1/√2)

42. A coil having N turns carries a current as shown in the figure. The magnetic field intensity at point P is :



1) $\frac{\mu_0 NiR^2}{2(R^2+x^2)^{3/2}}$
2) $\frac{\mu_0 Ni}{2R}$
3) $\frac{\mu_0 NiR^2}{(R^2+x^2)}$
4) zero

43. A steel scale measures the length of a copper wire as 80.0 cm, when both are at 20°C, the calibration temperature for the scale. What would the scale read for the length of the wire both are at 40°C ?

Given, α for steel = 11 x 10^{-6}/ °C and α for Cu = 17 x 10^{-6}/°C

1) 80.0096 cm
2) 70.0272 cm
3) 1 cm
4) 35.2 cm

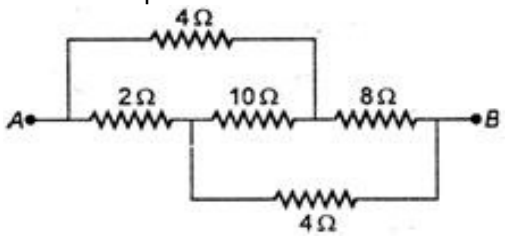
44. A capacitor is connected to a cell of emf E having some internal resistance r. The potential difference across the :

1) cell is < E
2) cell is E
3) capacitor is > E
4) capacitor is < E

45. If 300 mL of a gas at 27°C is cooled to 7°C at constant pressure, then its final volume will be :

1) 140 mL
2) 350 mL
3) 280 mL
4) 70 mL

46. Find the equivalent resistance between the points A and B.



1) 2 Ω
2) 4 Ω
3) 6 Ω
4) 10 Ω

47. Mercury boils at 367°C. However, mercury thermometers are made such that they can measure temperature upto 500°C. This is done by :

1) maintaining vacuum above mercury column in the stem of the thermometer
2) filling nitrogen gas at high pressure above the mercury column
3) filling oxygen gas at high pressure above the mercury column
4) filling nitrogen gas at low pressure above the mercury column

48. A closed organ pipe and an open organ pipe are tuned to the same fundamental frequency. What is the ratio of their lengths ?

1) 1 : 2
2) 2 : 1
3) 3 : 4
4) 4 : 3

49. When a wave travels in a medium the particles displacement is given by the equation $y = 0.03 \sin \pi (2t - 0.01x)$, where x and y are in metres and t in second. The wavelength of the wave is :

1) 200 m

2) 100 m

3) 50 m

4) 25 m

50. The temperature of the black body increases from T to 2T. The factor by which the rate of emission will increase, is :

1) 1

2) 6

3) 16

4) 4

Chemistry

51. When Cu reacts with $AgNO_3$ solution, the reaction takes place is :

1) oxidation of Cu

2) reduction of Cu

3) oxidation of Ag

4) reduction of NO_3^-

52. Ionisation depends upon :

1) pressure

2) volume

3) dilution

4) none of these

53. Which of the following is a use of alum ?

1) Making explosives

2) Bleaching clothes

3) Water softening

4) All of the above

54. Water gas is :

1) $CO + N_2$

2) $CO + CO_2 + CH_4$

3) $CO_2 + N_2$

4) $CO + H_2$

55. The oxidation number of carbon in CH_2O is :

1) + 2 2) +1 3) 0 4) +4

56. Which of the following oxide does not form acidic aqueous solution ?

1) N_2O_3
2) NO_2
3) N_2O_5
4) NO

57. The electrophile involved in the nitration of benzene is :
1) NO_2
2) NO_2^+
3) NO
4) NO_2^-

58. What will be the pH value of 0.05 M $Ba(OH)_2$ solution ?
1) 10
2) 13
3) 11
4) 11.96

59. Chloroform, when kept open, is oxidised to :
1) CO_2
2) $COCl_2$
3) CO_2, Cl_2
4) none of these

60. I_2 dissolves in KI solution due to the formation of :
1) KI_2 and I^-
2) K^+, I^- and I_2
3) KI_3^-
4) none of these

61. Which of the following element is a metalloid ?
1) Bi 2) Sn 3) Ge 4) C

62. The bond order of O_2^+ is the same as in :
1) N_2^+
2) CN^-
3) CO
4) NO^+

63. Which of the following elements never show positive oxidation number ?

1) O 2) Fe 3) Ga 4) F

64. Aldol condensation will not occur in :

1) HCHO
2) CH_3CH_2CHO
3) CH_3COCH_3
4) CH_3CHO

65. Bleaching action of SO_2 is due to its :

1) oxidising property
2) acidic property
3) basic property
4) reducing property

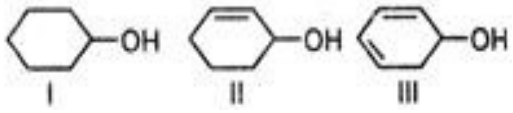
66. Which of the following is anhydride of perchloric acid ?

1) Cl_2O_7
2) Cl_2O_5
3) Cl_2O_3
4) HClO

67. Blood cells will remain as such in :

1) hypertonic solution
2) hypotonic solution
3) isotonic solution
4) none of the above

68. The correct order of ease of dehydration of following is :



1) I > II > III
2) III > II > I
3) I > III > II
4) III > I > II

69. Industrial name of $H_2S_2O_7$ is :

1) Caro's acid
2) Marshall's acid
3) oleum
4) all of these

70. Which type of isomerism is shown by propanal and propanone ?

1) Functional group
2) Metamerism
3) Tautomerism
4) Chain isomerism

71. IUPAC name of :
CH_3CH_2 C(Br) = CH - Cl is :

1) 2-bromo-1-chloro butene-1
2) 1-chloro-2-bromo butene
3) 3-chloro-2-bromo butene-2
4) none of the above

72. The solubility of Sb_2S_3 in water is 1.0×10^{-5} mol/L at 298K. What will be its solubility product ?

1) 108×10^{-25}
2) 2.0×10^{-25}
3) 256×10^{-25}
4) 121×10^{-24}

73. Iodoform test is not given by :

1) HCHO
2) CH_3CHO
3) CH_3COCH_3
4) C_2H_5OH

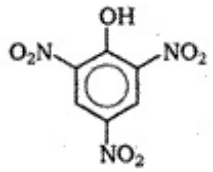
74. The vapour pressure will be lowest for :

1) 0.1 M sugar solution
2) 0.1 M KCl solution
3) 0.1 M $Cu(NO_3)_2$ solution
4) 0.1 M $AgNO_3$ solution

75. Which among the following elements have lowest value of IE_1 ?

1) Pb 2) Sn 3) Si 4) C

76. Which of the following will not react with NaOH ?

1) 

2) C_2H_5OH

3) CH_3CONH_2

4) $CH(CN)_3$

77. Which of the following is a false statement ?

1) Fluorine is more electronegative than chlorine

2) Nitrogen has greater IE_1 than oxygen

3) Lithium is amphoteric

4) Chlorine is an oxidising agent

78. Benedict's solution is not reduced by :

1) formaldehyde

2) acetaldehyde

3) glucose

4) acetic anhydride

79. The first ionisation potential is maximum for :

1) B 2) N 3) O 4) Be

80. Which of the following is a Lewis base ?

1) NaOH

2) NH_3

3) BCl_3

4) All of these

81. Distribution law was given by :

1) Henry

2) vant Hoff

3) Nernst

4) Ostwald

82. Which of the following sulphides is yellow in colour ?

1) CuS

2) CdS

3) ZnS

4) CoS

83. What is the name of element with atomic number 105 ?

1) Rutherfordium
2) Hanium
3) Nobelium
4) Holmium

84. When I_2 is passed through KCl, KF and KBr solutions :

1) Cl_2 and Br_2 are evolved
2) Cl_2 is evolved
3) Cl_2, Br_2 and F_2 are evolved
4) none of the above

85. Which of the following is not an ore of magnesium ?

1) Magnesite
2) Dolomite
3) Gypsum
4) Carnallite

86. Cetane is a compound which has very good ignition property. Chemically it is :

1) $CH_3(CH_2)_{14}\ CH_3$
2) $(CH_3)_3\ C(CH_2)_{11}\ CH_3$
3) $C_{17}\ H_{34}$
4) none of the above

87. In the reaction $H_2 + I_2 \rightleftharpoons 2HI$
In a 2 L flask 0.4 mole of each H_2 and I_2 are taken. At equilibrium 0.5 mole of HI are formed. What will be the value of equilibrium constant, K_c ?

1) 21.2
2) 35.4
3) 1.012
4) 11.1

88. The reagent used in Gatterman Koch aldehyde synthesis is :

1) $Pb/BaSO_4$
2) alkaline $KMnO_4$
3) acidic $KMnO_4$
4) CO + HCl

89. Wave nature of electrons was demonstrated by :

1) Schrodinger

2) de-Broglie
3) Davission and Germer
4) Heisenberg

90. Which of the following dissolves in hot conc. NaOH solution ?

1) Fe 2) Zn 3) Cr 4) Ag

91. KI and $CuSO_4$ solution when mixed, give :

1) $CuI_2 + K_2SO_4$
2) $Cu_2I_2 + K_2SO_4$
3) $K_2SO_4 + Cu_2I_2 + I_2$
4) $K_2SO_4 + CuI_2 + I_2$

92. Which kind of fission is favoured by sunlight ?

1) Heterolytic fission
2) Homolytic fission
3) Both (1) and (2)
4) None of the above

93. Which of the following reaction involves oxidation and reduction ?

1) $NaBr + HCl \rightarrow NaCl + HBr$
2) $HBr + AgNO_3 \rightarrow AgBr + HNO_3$
3) $H_2 + Br_2 \rightarrow 2HBr$
4) $Na_2O + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

94. Which of the following alcohol is used as beverage ?

1) Propanol
2) 2-butanol
3) Methanol
4) Ethanol

95. When acetamide reacts with Br_2 and caustic soda, then we get :

1) acetic acid
2) bromoacetic acid
3) methyl amine
4) ethyl amine

96. Quantitative measurement of nitrogen in an organic compound is done by the method :

1) Berthelot method
2) Beilstein method
3) Lassaigne test

4) Kjeldahl method

97. Which of the following salt does not get hydrolysed in water ?

1) $KClO_4$

2) NH_4Cl

3) CH_3COONa

4) None of these

98. In Mac-Arthur Forest method,silver is extracted from the solution of $Na[Ag(CN)_2]$ by the use of :

1) Fe 2) Mg 3) Cu 4) Zn

99. Brown ring in the test of NO_3^- is formed due to the formation of :

1) $[Fe(H_2O)_5 \cdot NO]\ SO_4$

2) $[Fe(SO_4)_2 \cdot NO]\ H_2O$

3) $Fe_2(SO_4)_3 \cdot NO$

4) none of the above

100. Fluorine is the best oxidising agent because it has :

1) highest electron affinity

2) highest $E°_{red}$

3) highest $E°_{oxid}$

4) lowest electron affinity

Answer Key

1) 4	2) 1	3) 2	4) 3	5) 1	6) 4	7) 1	8) 2	9) 4	10) 3
11) 1	12) 1	13) 1	14) 1	15) 2	16) 4	17) 2	18) 3	19) 2	20) 2
21) 1	22) 3	23) 4	24) 3	25) 2	26) 1	27) 2	28) 3	29) 1	30) 3
31) 1	32) 2	33) 4	34) 1	35) 4	36) 1	37) 1	38) 1	39) 1	40) 3
41) 2	42) 1	43) 1	44) 2	45) 3	46) 2	47) 2	48) 1	49) 1	50) 3
51) 1	52) 3	53) 3	54) 4	55) 3	56) 4	57) 2	58) 2	59) 2	60) 3
61) 3	62) 1	63) 4	64) 1	65) 4	66) 1	67) 3	68) 2	69) 3	70) 1
71) 1	72) 1	73) 1	74) 3	75) 2	76) 2	77) 3	78) 4	79) 2	80) 2
81) 3	82) 2	83) 2	84) 4	85) 3	86) 1	87) 4	88) 4	89) 3	90) 2
91) 3	92) 2	93) 3	94) 4	95) 3	96) 4	97) 1	98) 4	99) 1	100) 2