# UP-CPMT_2007- Paper: 2

Physics

1. If distance between earth and sun become four times, then time period becomes
   1) 2 times
   2) 4 times
   3) 8 times
   4) 16 times

2. We wish to see inside an atom. Assuming the atom to have a diameter of 100 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about
   1) 15 eV
   2) 15 keV
   3) 150 keV
   4) 15 MeV

3. An air bubble is contained inside water. It behaves as a
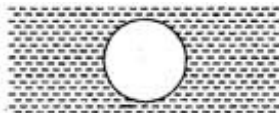
   1) concave lens
   2) convex lens
   3) neither convex nor concave
   4) cannot say

4. The earth moves in an elliptical orbit with the sun S at one of foci as shown in the figure. Its rotational kinetic energy is maximum at the point
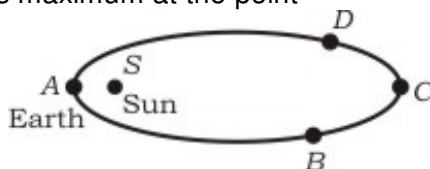
   1) A   2) B   3) C   4) D

5. The power dissipated across resistance R which is connected across a battery of potential V is P. If resistance is doubled, then the power becomes
   1) 1/2   2) 2   3) 1/8   4) 8

6. A Carnot's engine has an efficiency of 50% at sink temperature 50°C. Calculate the

temperature of source.

1) 173°C

2) 273°C

3) 100°C

4) 373°C

7. A beam of protons with velocity 4 x 10^5 m/s enters a uniform magnetic field of 0.3 T at an angle of 60° to the magnetic field. Find the radius of the helical path taken by the proton beam.

1) 0.2 cm

2) 1.2 cm

3) 2.4 cm

4) 4.8 cm

8. If acceleration of a particle at any time is given by

a = 2t + 5

calculate the velocity after 5 s, if it starts from rest.

1) 50 m/s

2) 75 m/s

3) 125 m/s

4) 5 m/s

9. During projectile motion, the horizontal velocity

1) first increases then decreases

2) first decreases then increases

3) always increases

4) always constant

10. Reverberation time does not depend upon

1) temperature

2) volume of room

3) size of window

4) carpet and curtain

11. Which of the following is true regarding beats?

1) Frequency different, amplitude same

2) Frequency same, amplitude same

3) Frequency same, amplitude different

4) None of the above

12. If k_s and k_p respectively are effective spring constant in series and parallel combination of springs as shown in figure, find (k_s/k_p).
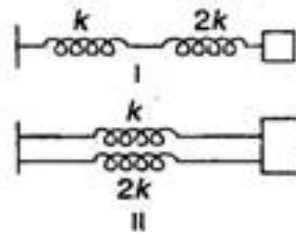
1) 9/2   2) 4/7   3) 2/9   4) 7/4

13. The inductance of a coil is L = 10 H and resistance R = 5Ω. If applied voltage of battery is 10 V and it switches off in 1 millisecond, find induced emf of inductor.

   1) 2×10^4V

   2) 4×10^4V

   3) 6×10^{-4} V

   4) None of these

14. The wavelength of K_α - line in copper is 1.54 Å. The ionisation energy of K-electron in copper in joule is

   1) 8.2×10^{-17}

   2) 9.2×10^{-16}

   3) 1.7×10^{-15}

   4) 8×10^{-16}

15. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which car can be driven round a curve of radius 40 m without skidding is (assume g = 10 ms^{-2})

   1) 50 ms^{-1}

   2) 30 ms^{-1}

   3) 15 ms^{-1}

   4) 10 ms^{-1}

16. An aluminium rod and a copper rod are taken such that their lengths are same and their resistances are also same. The specific, resistance of copper is half that of aluminium, but its density is three times that of aluminium. The ratio of the mass of aluminium rod and that of copper rod will be

   1) 1/6

   2) 2/3

   3) 1/3

   4) 6

17. 4 m^3 of water is to be pumped to a height of 20 m and forced into a reservoir at a pressure of 2×10^5 N/m^2. The work done by the motor is (external pressure = 10^5 N/m^2)

   1) 4×10^5 J

2) 8×10^5 J

3) 12×10^5 J

4) 24×10^5 J

18. Equipotential surfaces associated with an electric field which is increasing in magnitude along the x-direction are

    1) planes parallel to yz-plane

    2) planes parallel to xy-plane

    3) planes parallel to xz-plane

    4) coaxial cylinders of increasing radii around the x-axis

19. When light passes from one medium to other then which will not change?

    1) Frequency

    2) Wavelength

    3) Amplitude

    4) Velocity

20. If 200 MeV energy is released in the fission of a single nucleus of $_{92}U^{235}$, how many fissions must occur per second to produce a power of 1 kW?

    1) 3.12×10^{13}

    2) 4.12×10^3

    3) 4.1×10^{17}

    4) 5.12×10^{19}

21. A body moves with uniform acceleration, then which of the following graphs is correct?

1)

2)

3)

4) s
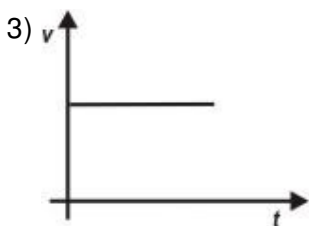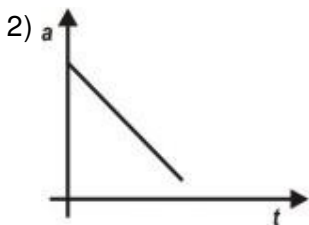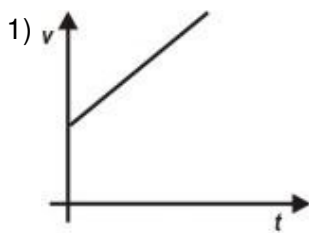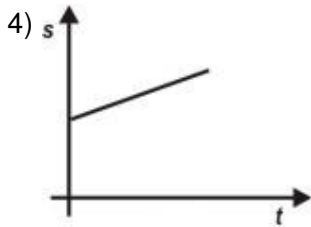
22. If coefficient of static friction is μ_s and coefficient of kinetic friction is μ_k, which is correct?

    1) $\mu_s = \mu_k$

    2) $\mu_s > \mu_k$

    3) $\mu_s < \mu_k$

    4) Cannot predict

23. Which motion does not require force to maintain it?

    1) Uniform circular motion

    2) Elliptical motion

    3) Uniform straight line motion

    4) Projectile motion

24. Two vectors are perpendicular, if

    1) $\vec{A} \cdot \vec{B} = 1$

    2) $\vec{A} \times \vec{B} = 0$

    3) $\vec{A} \cdot \vec{B} = 0$

    4) $\vec{A} \times \vec{B} = AB$

25. Find ratio of acceleration due to gravity g at depth d and at height h, where $d = 2h$.

    1) 1 : 1

    2) 1 : 2

    3) 2 : 1

    4) 1 : 8

26. Total internal reflection takes place

    1) when a ray moves from denser to rarer and incident angle is greater than critical angle

    2) when a ray moves from rarer to denser and incident angle is less than critical angle

    3) when a ray moves from rarer to denser and incident angle is equal to critical angle

    4) none of the above

27. A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is

    1) 2.14 kJ

    2) 3.14 kJ

    3) 2.4 kJ

4) 4.8 kJ

28. If in the following figure, height of object is $H_1 = + 2.5$ cm, then height of image H_2 formed is

Concave mirror
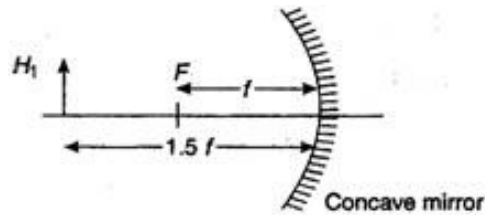
   1) - 5 cm

   2) + 5 cm

   3) + 2.5 cm

   4) - 2.5 cm

29. Moment of inertia of ring about its diameter is I. Then, moment of inertia about an axis passing through centre perpendicular to its plane is

   1) 2I   2) I/3   3) (3/2)I   4) I

30. A beam of light travelling along x-axis is described by the electric field

$E_y = (600 \text{ Vm}^{-1}) \sin \omega (t - x/c)$

then maximum magnetic force on a charge $q = 2e$, moving along y-axis with a speed of $3.0 \times 10^7 \text{ ms}^{-1}$ is ($e = 1.6 \times 10^{-19}$ C)

   1) 19.2×10^{-19} N

   2) 1.92×10^{-17} N

   3) 192 N

   4) None of these

31. Light year is used to measure

   1) distance between stars

   2) distance between atoms

   3) revolution time of earth around sun

   4) none of the above

32. Two bodies A and B having masses in the ratio of 3 : 1 possess the same kinetic energy. The ratio of linear momentum of B to A is

   1) 1 : 3

   2) 3 : 1

   3) 1 : √3

   4) √27 : 1

33. The uncertainty in the momentum of a particle is 10^{-30} kg-m/s. The minimum uncertainty in its position will be

1) 10^{-10} m

2) 10^{-15} m

3) 10^{-16} m

4) 10^{-4} m

34. BE per nucleon relation with mass number

   1) first decreases then increases

   2) first increases then decreases

   3) increases

   4) decreases

35. A 100 V, AC source of frequency 500 Hz is connected to an LCR circuit with L = 8.1 mH, C = 12.5 μF, R = 10Ω all connected in series as shown in figure. What is the quality factor of circuit?
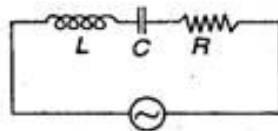
   1) 1.02

   2) 2.5434

   3) 20.54

   4) 400.54

36. What is the Q-value of the reaction p + ^{7}Li → ^{4}He + ^{4}He

   The atomic masses of ^{1}H, ^{4}He and ^{7}Li are 1.007825 u, 4.002603 u and 7.016004 u respectively.

   1) 17.35 MeV

   2) 15.06 MeV

   3) 188.35 MeV

   4) 175.35 MeV

37. Using mass (M), length (L), time (T) and current (A) as fundamental quantities, the dimensions of permeability is

   1) $[M^{-1}L^2T^{-2}A]$

   2) $[ML^{-2}T^{-2}A^{-1}]$

   3) $[MLT^{-2}A^{-2}]$

   4) $[MLT^{-1}A^{-2}]$

38. A body from height h is dropped. If the coefficient of restitution is e, then calculate the height achieved after one bounce.

   1) $h_1 = e^2h$

   2) $h_1 = e^4h$

3) $h_1 = eh$

4) $h_1 = (h/e)$

39. Which of the following is not a state function ?

   1) Work done at constant pressure

   2) Enthalpy

   3) Work done by conservative force

   4) Work done by non-conservative force

40. A bob of pendulum was filled with Hg and entire Hg is drained out, then the time period of pendulum

   1) remains unchanged

   2) decreases

   3) increases

   4) increases then decreases

41. If $B_H = (1/\sqrt{3})B_V$, find angle of dip. (where symbols have their usual meanings)

   1) $60°$ 2) $75°$ 3) $45°$ 4) $90°$

42. The minimum force required to move a body of mass m vertically upward is

   1) mg

   2) mg/2

   3) more than 2mg

   4) more than mg

43. A proton is moving in a uniform magnetic field B in a circular path of radius a in a direction perpendicular to z-axis along which field B exists. Calculate the angular momentum, if the radius is a charge on proton is e.

   1) Be/a^2

   2) eB^2a

   3) a^2eB

   4) aeB

44. If average velocity becomes 4 times then what will be the effect on rms velocity at that temperature?

   1) 1.4 times

   2) 4 times

3) 2 times

4) (1/4) times

45. In hydrogen atom spectrum, frequency of 2.7×10^{15} Hz of electromagnetic wave is emitted when transmission takes place from 2 to 1. If it moves from 3 to 1, the frequency emitted will be

1) 3.2×10^{15} Hz

2) 32×10^{15} Hz

3) 0.8×10^{15} Hz

4) 8×10^{15} Hz

46. Electromagnetic waves are produced by

1) accelerated charged particle

2) decelerated charged particle

3) charge in uniform motion

4) none of the above

47. In a potentiometer, the null point is received at 7th wire. If now we have to change the null point at 9th wire, what should we do?

1) Attach resistance in series with battery

2) Increase resistance in main circuit

3) Decrease resistance in main circuit

4) Decrease applied emf

48. When both the listener and source are moving towards each other, then which of the following is true regarding frequency and wavelength of wave observed by the observer?

1) More frequency, less wavelength

2) More frequency, more wavelength

3) Less frequency, less wavelength

4) More frequency, constant wavelength

49. Three progressive waves A, B and C are shown in the figure.
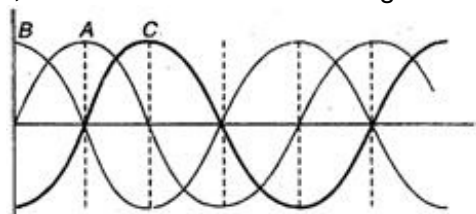
With respect to A, the progressive wave

1) B lags by ($\pi/2$) and C leads by ($\pi/2$)

2) B lags by π and C leads by π

3) B leads by ($\pi/2$) and C lags by ($\pi/2$)

4) B leads by π and C lags by π

50. Which of the following four fundamental forces has shortest range?

    1) Nuclear

    2) Gravitational

    3) Electromagnetic

    4) Weak force

Chemistry

51. Ozone is used for purifying water because

    1) it dissociates and release oxygen

    2) do not leave any foul smell like chlorine

    3) kills bacteria, cyst, fungi and acts as a biocide

    4) all of the above

52. $_{90}Th^{228} \rightarrow {_{83}}Bi^{212}$ by

    1) 4α, 1β

    2) 4α, 2β

    3) 5α, 3β

    4) 5α, 2β

53. CH_3CH_2Cl undergoes homolytic fission produces

    1) $CH_3\overset{\bullet}{C}H_2$ and $\overset{\bullet}{C}l$

    2) $CH_3\overset{\oplus}{C}H_2$ and $Cl^{\ominus}$

    3) $CH_3\overset{\oplus}{C}H_2$ and $\overset{\bullet}{C}l$

    4) $CH_3\overset{\bullet}{C}H_2$ and $Cl^{\ominus}$

54. H_2S is not a/an

    1) reducing agent

    2) acidic

    3) oxidising agent

    4) none of these

55. Difference between S and S^{2-} as S^{2-} has

    1) larger radii and large size

    2) smaller radii and large size

    3) larger radii and small size

    4) smaller radii and small size

56. Which type of bond is present in Xe molecule?

1) Covalent

2) Ion-dipole

3) van der Waals

4) Dipole-dipole

57. $AgNO_3$ does not give precipitate with $CHCl_3$ because

1) $CHCl_3$ does not ionise in water

2) $AgNO_3$ is chemically inert

3) $CHCl_3$ is chemically inert

4) none of the above

58. White lead is

1) Pb_3O_4

2) PbO

3) $2PbCO_3 . Pb(OH)_2$

4) $Pb(CH_3COO)_2 . Pb(OH)_2$

59. Which is not in accordance to Aufbau principle?

1)

2)

3)

4)

60. Graph between P and V at constant temperature is

1) straight

2) curved increasing

3) straight line with slope

4) none of the above

61. Which of the following is second most electronegative element?

1) Chlorine

2) Oxygen

3) Sulphur

4) Fluorine

62. Heavy water is

1) H_2O

2) D_2O

3) H_2O_2

4) none of these

63. If two molecules of A and B having mass 100 kg and 64 kg and rate of diffusion of A is 12 x 10^{-3}, then what will be the rate of diffusion of B?

   1) 15×10^{-3}

   2) 30×10^{-3}

   3) 45×10^{-3}

   4) 60×10^{-3}

64. Which of the following is not correct?

   1) $t_{1/2} = (0.693/k)$

   2) $N = N_0 e^{-kt}$

   3) $(1/N) - (1/N_0) = \ln kt_{1/2}$

   4) None of the above

65. Ethyl bromide is industrially prepared from

   1) ethyl alcohol + HBr

   2) ethanol + Br_2

   3) alcohol + HBr

   4) none of the above

66. Value of x in potash alum, $K_2SO_4 . Al_x (SO_4)_3 . 24H_2O$ is

   1) 4

   2) 1

   3) 2

   4) None of these

67. Aniline is prepared in presence of Fe/HCl from

   1) benzene

   2) nitrobenzene

   3) dinitrobenzene

   4) none of these

68. What is the electronic configuration of Mn^{2+}?

   1) [Ne] $3d^5 4s^0$

   2) [Ar] $3d^5 4s^2$

   3) [Ar] $3d^5 4s^0$

   4) [Ne] $3d^5 4s^2$

69. C—C bond order in benzene is

1) 1

2) 2

3) between 1 and 2

4) none of these

70. $C_6H_5{}^{14}COOH$ on heating with Na_2CO_3 releases

1) CO_2

2) $^{14}CO_2$

3) CO

4) none of these

71. During isothermal expansion of ideal gas, its

1) internal energy increases

2) enthalpy increases

3) enthalpy reduces to zero

4) enthalpy remains unchanged

72. Which one of the following is a vitamin

1) Benzoic acid

2) Ascorbic acid

3) Oxalic acid

4) Formic acid

73. $Zn^{2+} \rightarrow Zn(s)$; $E° = -0.76$ V

$Cu^{2+} \rightarrow Cu(s)$; $E° = -0.34$ V

Which of the following is spontaneous?

1) $Zn^{2+} + Cu \rightarrow Zn + Cu^{2+}$

2) $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$

3) $Zn^{2+} + Cu^{2+} \rightarrow Zn + Cu$

4) None of the above

74. Which of the following is combustion reaction?

1) $C + O_2 \rightarrow CO_2$

2) $CH_4 + O_2 \rightarrow CO_2 + H_2O$

3) $Mg + O_2 \rightarrow MgO$

4) All of the above

75. Claisen condensation is not given by

1)

2) CH_3CH_2COO

3) $-COOCH_3$

4) $-COOCH_2CH_2CH_3$

76. Internal energy is sum of

    1) kinetic energy and potential energy

    2) all types of energy of the system

    3) energy of internal system

    4) none of the above

77. Which of the following is irreversible reaction?

    1) $2NH_3 \rightarrow N_2 + 3H_2$

    2) $PCl_5 \rightarrow PCl_3 + Cl_2$

    3) $KClO_3 \rightarrow KCl + O_2$

    4) $SO_3 \rightarrow SO_2 + O_2$

78. Highest electron affinity among the following is

    1) fluorine

    2) chlorine

    3) sulphur

    4) Xe

79. What is the stoichiometric coefficient of Ca in the reaction?
$Ca + Al^{3+} \rightarrow Ca^{2+} + Al$

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

80. Which isomerism does these two show $CH_3CH_2CH_2OH$ and $CH_3CH_2OCH_3$

    1) Positional isomerism

    2) Functional isomerism

    3) Structural isomerism

    4) Chain isomerism

81. Increase in atomic size down the group is due to

    1) increase in number of electrons

    2) increase in number of protons and neutrons

3) increase in number of protons

4) increase in number of protons, neutrons and electrons

82. Blood cells do not shrink in blood because blood is

    1) hypotonic

    2) isotonic

    3) equimolar

    4) hypertonic

83. In colloid particles, range of diameters is

    1) 1 to 100 nm

    2) 1 to 1000 cm

    3) 1 to 1000 mm

    4) 1 to 1000 km

84. On hydrolysis PCl_3 gives

    1) H_3PO_3

    2) PH_3

    3) H_3PO_4

    4) $POCl_3$

85. Ionisation energy decreases down the group due to

    1) increase in charge

    2) increase in atomic size

    3) decrease in atomic size

    4) decrease in shielding effect

86. Blister copper is

    1) impure Cu

    2) Cu alloy

    3) pure Cu

    4) Cu having 1% impurity

87. Sequence of bond length of the following is

A. ethane

B. ethene

C. ethyne

    1) A > B > C

    2) B > A > C

    3) C > B > A

    4) C > A > B

88. Which is tribasic acid?

    1) H_3PO_2

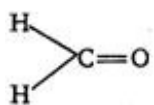   2) H_3PO_4
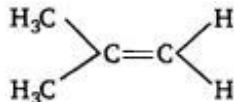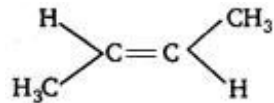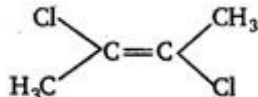
    3) $H_4P_2O_7$

    4) H_3PO_3

89. On doubling P and V with constant temperature the equilibrium constant will

    1) remain constant

    2) become double

    3) become one-fourth

    4) none of the above

90. In electrolytic cell, cathode acts as an/a

    1) oxidising agent

    2) reducing agent

    3) either of the two

    4) neither (1) nor (2)

91. Which has highest dipole moment?

    1)

    2)

    3)

    4)

92. Which of the noble gas is most reactive?

    1) He   2) Ne   3) Ar   4) Xenon

93. 1, 2-dihydroxybutane has the formula

    1) C(OH)—C(OH)—C—C

    2) C—C(OH)$_2$—C—C

    3) (OH)C—C—C—C(OH)

    4) C—C(OH)—C(OH)—C

94. Which of the following has lowest ionisation energy?

    1) Oxygen

2) Nitrogen

3) Fluorine

4) Sulphur

95. The linkage present in proteins and peptides is

1)
$$-\overset{\overset{\displaystyle O}{\|}}{C}-NH$$

2)
$$-\overset{\overset{\displaystyle O}{\|}}{C}-O$$

3)
$$-\overset{\overset{\displaystyle O}{\|}}{C}-O-\overset{\overset{\displaystyle O}{\|}}{C}-$$

4) — NH —

96. Highest ionising power is exhibited by

1) α-rays

2) β-rays

3) γ-rays

4) X-rays

97. Which of the following is most basic?

1) Benzamide

2) Butamine

3) Nitrobenzene

4) Benzene

98. Order of reaction can be

1) zero

2) fraction

3) whole number

4) integer, fraction, zero

99. Rate of diffusion of NH_3 is twice that of X. What is the molecular mass of X ?

1) 68

2) 60

3) 50

4) 45

100. +3 oxidation state is most common in

1) Ni (28)

2) Fe (26)

3) Zn (30)

4) Cu (29)

Answer Key

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