PAPER – I
PHYSICS

1. A point moves in a straight line so that its displacement x metre at time t sec is given by $x^2 = 1 + t^2$. Its acceleration in m/s^2 at time t sec is

(a) $\frac{1}{x^3}$ (b) $\frac{1}{x} - \frac{1}{x^2}$ (c) $\frac{1}{x} - \frac{t^2}{x^3}$ (d) $\frac{-t}{x^2}$

2. A projectile is thrown with an initial velocity of $(x\hat{i} + y\hat{j})$ m/s. If the range of the projectile is double the maximum height reached by it then

(a) $x = 2y$ (b) $y = 2x$ (c) $x = y$ (d) $y = 4x$

3. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25 then the maximum fraction of length of chain that can overhang on edge of table is

(a) 20 % (b) 35 % (c) 25 % (d) 15 %

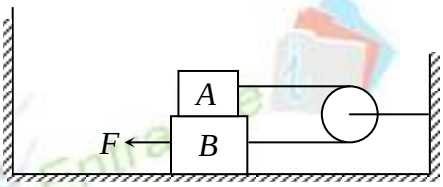
4. A body of mass M is situated in a potential field $u(x) = u_0(1 - \cos\alpha x)$, where u_0 and α are constants. The time period of small oscillations of body will be

(a) $2\pi\sqrt{\frac{M}{u_0\alpha^2}}$ (b) $2\pi\sqrt{\frac{u_0}{M\alpha^2}}$ (c) $2\pi\sqrt{\frac{u_0\alpha^2}{M}}$ (d) $2\pi\sqrt{Mu_0\alpha^2}$

5. 1000 drops of a liquid of surface tension σ and radius r join together to form a big single drop. The energy released raises the temperature of the drop. If ρ be the density of the liquid and S be the specific heat, the rise in temperature of the drop would be (J = Joule's equivalent of heat)

(a) $\frac{\sigma}{JrS\rho}$ (b) $\frac{10\sigma}{JrS\rho}$ (c) $\frac{100\sigma}{JrS\rho}$ (d) $\frac{27\sigma}{10JrS\rho}$

6. The masses of the blocks A and B are 0.5 kg and 1 kg respectively. These are arranged as shown in the figure and are connected by a massless string. The coefficient of friction between all contact surfaces is 0.4. The force needed to move the block B with constant velocity will be (g = 10 m/s^2)



(a) 5 N (b) 10 N (c) 15 N (d) 20 N

7. A pendulum consists of a wooden bob of mass m and length l. A bullet of mass m_1 is fired towards the pendulum with a speed v_1. The bullet emerges out of the bob with a speed $v_1/3$ and the bob just completes motion along a vertical circle. Then v_1 is

(a) $\left(\frac{m}{m_1}\right)\sqrt{5gl}$ (b) $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$ (c) $\frac{2}{3}\left(\frac{m_1}{m}\right)\sqrt{5gl}$ (d) $\left(\frac{m_1}{m}\right)\sqrt{gl}$

8. A metal wire of length L and radius r is clamped rigidly at one end. A force F is applied at another end so that its length increases by L. The increase in length of another metal wire of length $2L$ and radius $2r$, when stretched by a force $2F$, will be

(a) $2L$ (b) L (c) $L/2$ (d) $L/4$

9. An incompressible liquid is continuously flowing through a cylindrical pipe whose radius is $2R$ at point A. The radius at point B, in the direction of flow, is R. If the velocity of liquid at point A is v then its velocity at point B will be

(a) v (b) $4v$ (c) $2v$ (d) $v/2$

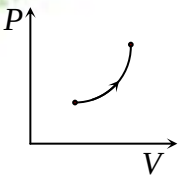
10. A sphere of density ρ, specific heat capacity c and radius r, is hung by a thermally insulated thread in an enclosure which is kept constant at a lower temperature than the sphere. The temperature of the sphere starts to drop at a rate which depends upon the temperature difference between the sphere and the enclosure and the nature of the surface of the sphere, and is proportional to

(a) $\frac{c}{r^3\rho}$ (b) $\frac{1}{r^3\rho c}$ (c) $3r^3\rho c$ (d) $\frac{1}{r\rho c}$

11. A steel tape gives correct measurement at 20°C. A piece of wood is being measured with the steel tape at 0°C. The reading is 25 cm on the tape. The real length of the given piece of wood must be

(a) 25 cm (b) less than 25cm (c) more than 25 cm (d) none of these

12. The figure shows a process on a gas in which pressure and volume both changes. The molar heat capacity for this process is C. Then



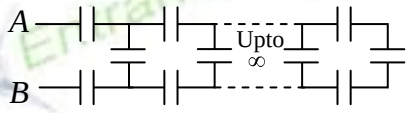
(a) $C = 0$ (b) $C = C_V$

(c) $C > C_V$ (d) $C < C_V$

13. Heat required to melt 1 gm of ice is 80 cal. A man melts 60 gms of ice by chewing it in 1 minute. His power is

(a) 4800 W (b) 336 W (c) 80 W (d) 0.75 W

14. The equivalent capacitance of the network (with all capacitors having the same capacitance C) is



(a) ∞ (b) zero

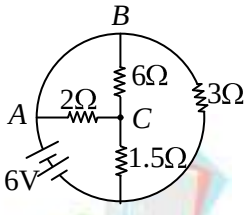
(c) $C\left(\frac{\sqrt{3}-1}{2}\right)$ (d) $C\left(\frac{\sqrt{3}+1}{2}\right)$

15. There is a current of 1.344 amp in a copper wire whose area of cross-section normal to the length of the wire is 1 mm^2. If the number of free electrons per cm^3 is 8.4×10^{22}, then the drift velocity of electrons will be

(a) 1.0 mm per sec (b) 1.0 meter per sec

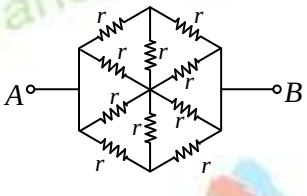
(c) 0.1 mm per sec (d) 0.01 mm per sec

16. In the circuit shown, the total current supplied by the battery is



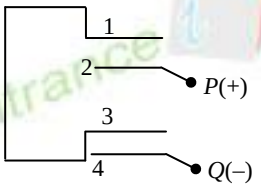
(a) 2 A (b) 4 A
(c) 1 A (d) 6 A

17. The resistance of hexagon circuit between *A* and *B* represented in figure is



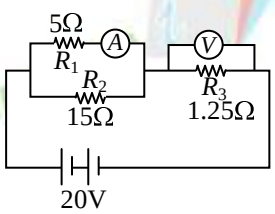
(a) *r* (b) 0.5 *r*
(c) 2*r* (d) 3*r*

18. Four metallic plates, each with surface area of one side *A*, are placed at a distance *d* from each other. The plates are connected as shown in figure. Then the capacitance of the system between *P* and *Q* is



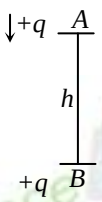
(a) $\frac{3\varepsilon_0 A}{d}$ (b) $\frac{2\varepsilon_0 A}{d}$ (c) $\frac{2\varepsilon_0 A}{3d}$ (d) $\frac{3\varepsilon_0 A}{2d}$

19. An ideal ammeter and an ideal voltmeter are connected as shown. The ammeter and voltmeter reading for $R_1 = 5\Omega$, $R_2 = 15\Omega$, $R_3 = 1.25\Omega$ and $E = 20$V are given as



(a) 6.25 A, 3.75 V (b) 3.00 A, 5 V
(c) 3.75 A, 3.75 V (d) 3.75 A; 6.25 V

20. A point charge + *q* is fixed at point *B*. Another point charge + *q* at *A* of mass *m* vertically above *B* at height *h* is dropped from rest. Choose the correct statement

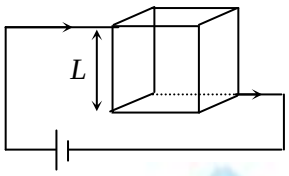


(a) It will collide with *B*
(b) It will execute S.H.M
(c) It will go down only if $\frac{q^2}{4\pi\varepsilon_0} < mgh^2$
(d) go down up to a point and then come up.

21. The temperature of cold junction of a thermocouple is –20°C and the temperature of inversion is 560°C. The neutral temperature is

(a) 270°C (b) 560°C (c) 1120°C (d) 290°C

22. A cube made of wires of equal length is connected to a battery as shown in figure. The side of cube is L. The magnetic field at the centre of cube will be



(a) $\frac{12}{\sqrt{2}}\frac{\mu_0 I}{\pi L}$ (b) $\frac{6}{\sqrt{2}}\frac{\mu_0 I}{\pi L}$ (c) $6\frac{\mu_0 I}{\pi L}$ (d) zero

23. Two straight long conductors AOB and COD are perpendicular to each other and carry currents I_1 and I_2 respectively. The magnitude of the magnetic induction at a point P at a distance a from the point O in a direction perpendicular to the plane $ABCD$ is

(a) $\frac{\mu_0}{2\pi a}(I_1 + I_2)$ (b) $\frac{\mu_0}{2\pi a}(I_1 - I_2)$ (c) $\frac{\mu_0}{2\pi a}(I_1^2 + I_2^2)^{1/2}$ (d) $\frac{\mu_0}{2\pi a}\left(\frac{I_1 I_2}{I_1 + I_2}\right)$

24. An e.m.f. of 15 V is applied in a circuit containing 5 H inductance and 10 ohm resistance. The ratio of the currents at time $t = \infty$ and $t = 1$ second is

(a) $\frac{\sqrt{e}}{(\sqrt{e}-1)}$ (b) $\frac{e^2}{(e^2-1)}$ (c) $1-e$ (d) e^{-1}

25. Earth's magnetic induction at a certain point is 7×10^{-5} Wb/m^2. This field is to be annulled by the magnetic induction at the centre of a circular conducing loop 5.0 cm in radius. The required current is

(a) 0.056 A (b) 6.5A (c) 5.6 A (d) 12.8 A

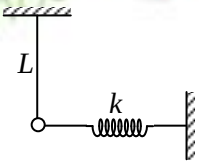
26. The intensity of sound after passing through a slab decreases by 20%. On passing through two such slabs, the intensity will decrease by

(a) 50 % (b) 40 % (c) 36 % (d) 30%

27. The electric field intensity at a point at a distance 2 m from a charge q is E. The amount of work done in bringing a charge of 2 coulomb from infinity to this point will be

(a) $2E$ joules (b) $4E$ joules (c) $\frac{E}{2}$ joules (d) $\frac{E}{4}$ joules

28. The bob of a pendulum, is attached to a horizontal spring of spring constant k. The pendulum will undergo simple harmonic motion with period (T)



(a) $2\pi\sqrt{\frac{L}{g}}$ (b) $2\pi\sqrt{\frac{m}{k}}$

(c) $2\pi\left(\frac{1}{\sqrt{(g/L)+(k/m)}}\right)$ (d) $\frac{1}{2}2\pi\sqrt{\left(\frac{L}{g}\right)+\frac{2\pi}{\sqrt{m/k}}}$

29. Transverse waves are generated in two uniform wires A and B of the same material by attaching their free ends to a vibrating source of frequency 200 Hz. The cross-section of A is

half that of *B* while the tension on *A* is twice that on *B*. The ratio of wavelengths of the transverse waves in *A* and *B* is

(a) $1:\sqrt{2}$ (b) $\sqrt{2}:1$ (c) 1 : 2 (d) 2 : 1

30. A thin sheet of glass (μ=1.5) of thickness 6 microns introduced in the path of one of interfering beams of a double slit experiment shifts the central fringes to a position previously occupied by fifth bright fringe. Then the wavelength of the light used is

(a) 6000 Å (b) 3000 Å (c) 4500 Å (d) 7500 Å

31. A concave lens of focal length *F* produces an image equal to 1/*n* of size of object, the distance of the image, from the lens is

(a) $(n+1)F$ (b) $(n-1)F$ (c) $\left(\frac{n+1}{n}\right)F$ (d) $\left(\frac{n-1}{n}\right)F$

32. A convex lens *A* of focal length 20 cm and a concave lens *B* of focal length 5 cm are kept along the same axis with a distance *d* between them. If a parallel beam of light falling on *A* leaves *B* as a parallel beam, then the distance *d* in cm will be

(a) 25 (b) 15 (c) 30 (d) 50

33. The magnifying power of an astronomical telescope in normal adjustment is 8 and the distance between the two lenses is 54 cm. The focal length of eye lens and objective lens will be respectively.

(a) 6 cm and 48 cm (b) 48 cm and 6 cm (c) 8 cm and 64 cm (d) 64 cm and 8 cm

34. Two electrons of kinetic energy 2.5 eV fall on a metal plate, which has work function of 4.0 eV. Number of electrons ejected from the metal surface is

(a) one (b) two (c) zero (d) more than two

35. The binding energies of the atoms of elements *A* and *B* are E_a and E_b respectively. Three atoms of the element *B* fuse to give one atom of element *A*. This fusion process is accompanied by release of energy *e*. Then E_a, E_b and *e* are related to each other as

(a) $E_a + e = 3E_b$ (b) $E_a = 3E_b$ (c) $E_a - e = 3E_b$ (d) $E_a + 3E_b + e = 0$

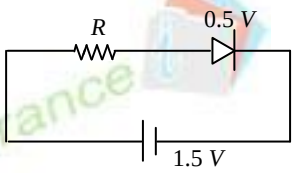
36. What is the ratio of the circumference of the first Bohr orbit for the electron in the hydrogen atom to the de-Broglie wavelength of electrons having the same velocity as the electron in the first Bohr orbit of the hydrogen atom?

(a) 1 : 1 (b) 1 : 2 (c) 1 : 4 (d) 2 : 1

37. In the X-ray tube before striking the target we accelerate the electrons through a potential difference of V volt. For which of the following value of V, we will have X-rays of largest wavelength?

(a) 10 kV (b) 20 kV (c) 30 kV (d) 40 kV

38. A diode used in the circuit shown has constant voltage drop of 0.5 V at all currents and a maximum power rating of 100 milli-watts. What should be the value of the resistor R, connected in series with the diode to obtain maximum current ?

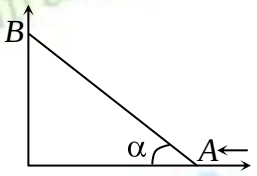


(a) 5 Ω (b) 5.6 Ω (c) 6.76 Ω (d) 20 Ω

39. The dimensional formula of magnetic flux is

(a) $[ML^2T^{-2}A^{-1}]$ (b) $[ML^0T^{-2}A^{-2}]$ (c) $[M^0L^{-2}T^{-2}A^{-2}]$ (d) $[ML^2T^{-1}A^3]$

40. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the left is 10 m/s. What is the velocity of B when angle $\alpha = 30°$?



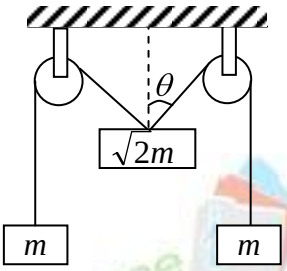
(a) 9.8 m/s (b) 10 m/s (c) 5.8 m/s (d) 17.3 m/s

41. If the thrust acting on a rocket moving with a velocity of 300 m/s is 210 N, then the rate of combustion of fuel is

(a) 0.7 kg/s (b) 1.4 kg/s (c) 0.07 kg/s (d) 10.7 kg/s.

42. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be

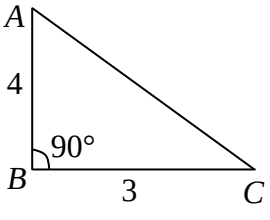
(a) 0° (b) 30°
(c) 45° (d) 60°



43. If a sphere is rolling, the ratio of the translational energy to total kinetic energy is given by

(a) 7 : 10 (b) 2 : 5 (c) 10 : 7 (d) 5 : 7

44. There is a flat uniform triangular plate ABC such that AB = 4 cm, BC = 3 cm and $\angle ABC$ = 90°, figure. The moment of inertia of the plate about AB, BC and CA as axis is respectively I_1, I_2 and I_3. The incorrect statement is



(a) $I_3 < I_2$ (b) $I_2 > I_1$

(c) $I_3 < I_1$ (d) $I_3 > I_2$

45. The period of revolution of planet *A* around the sun is 8 times that of *B*. The distance of *A* from the sun is how many times greater than that of *B* from the sun?

(a) 2 (b) 3 (c) 4 (d) 5

46. The escape velocity on the surface of the earth is 11.2 km/s. What would be the escape velocity on the surface of another planet of the same mass but 1/4 times the radius of the earth?

(a) 44.8 km/s (b) 22.4 km/s (c) 5.6 km/s (d) 11.2 km/s

47. When a 4 kg mass is hung vertically on a light spring that obeys Hook's law, the spring stretches by 2 cm. The work required to be done by an external agent in stretching this spring further 5 cm will be (g = 9.8 m/s^2)

(a) 0.245 J (b) 4.410 J (c) 2.450 J (d) 4.900 J.

48. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If two bubbles coalesce under isothermal conditions then the radius of the new bubble is

(a) 2.3 cm (b) 4.5 cm (c) 5 cm (d) 7 cm

49. A simple pendulum of length l has a bob of mass m, with a charge q on it. A vertical sheet of charge, with surface charge density σ passes through the point of suspension. At equilibrium, the string makes an angle θ with the vertical, then

(a) $\tan\theta = \dfrac{\sigma q}{2\varepsilon_0 mg}$ (b) $\tan\theta = \dfrac{\sigma q}{\varepsilon_0 mg}$ (c) $\cot\theta = \dfrac{\sigma q}{2\varepsilon_0 mg}$ (d) $\cot\theta = \dfrac{\sigma q}{\varepsilon_0 mg}$

50. The length of a sonometer wire *AB* is 110 cm. Where should the two bridges be placed from *A* to divide the wire in three segments whose fundamental frequencies are in the ratio of 1 : 2 : 3 ?

(a) 30 cm, 90 cm (b) 60 cm, 90 cm (c) 40 cm, 70 cm (d) None of these

51. The driver of a car traveling with speed 30 m/s towards a hill sound a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by the driver is

(a) 720 Hz (b) 555.5 Hz (c) 550 Hz (d) 500 Hz.

52. A semi-circular arc of radius a is charged uniformly and the charge per unit length is λ. The electric field at its centre is

(a) $\dfrac{\lambda}{4\pi\varepsilon_0 a}$ (b) $\dfrac{\lambda}{4\varepsilon_0 a}$ (c) $\dfrac{\lambda}{2\varepsilon_0 a}$ (d) $\dfrac{\lambda}{2\pi\varepsilon_0 a}$

53. A circular coil *A* has a radius *R* and the current flowing through it is *I*. Another circular coil *B* has radius 2*R* and if 2*I* is the current flowing through it, then the magnetic field at the centre of the circular coil are in the ratio of

(a) 4 : 1 (b) 2 : 1 (c) 3 : 1 (d) 1 : 1

54. A bar magnet, of magnetic moment *M*, is placed in a magnetic field of induction *B*. The torque exerted on it is

(a) $\vec{M}.\vec{B}$ (b) $\vec{B}\times\vec{M}$ (c) $\vec{M}\times\vec{B}$ (d) $-\vec{B}.\vec{M}$

55. In an A.C. circuit, the current is $i = 5\sin\left(100t - \frac{\pi}{2}\right)$ amp and the a.c. potential is $V = 200$ sin $(100\ t)$ volt. Then the power consumption is

(a) 20 watt (b) 40 watt (c) 1000 watt (d) zero

56. In a transformer, the number of turns of primary coil and secondary coil are 5 and 4 respectively. If 240 *V* is applied on the primary coil, then the ratio of current in primary and secondary coil is

(a) 4 : 5 (b) 5 : 4 (c) 5 : 9 (d) 9 : 5

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

(a) $\sqrt{\frac{\mu_0\varepsilon_0}{\mu\varepsilon}}$ (b) $\sqrt{\frac{\mu\varepsilon}{\mu_0\varepsilon_0}}$ (c) $\sqrt{\frac{\varepsilon}{\mu_0\varepsilon_0}}$ (d) $\sqrt{\frac{\mu_0\varepsilon_0}{\mu}}$.

58. The electron emitted in beta radiation originates from

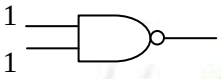
(a) inner orbits of atoms (b) free electrons existing in nuclei

(c) decay of neutron in a nucleus (d) photon escaping from the nucleus

59. A *p*-type semiconductor has acceptor level 57 meV above the valence band. The maximum wavelength of light required to create a hole is

(a) 57 Å (b) 57×10^{-3} Å (c) 217100 Å (d) 11.61×10^{-33} Å.

60. Which of the following gates will have an output of 1 ?

(a) 

(b) 

(c) 

(d) 

CHEMISTRY

Atomic masses: H = 1, C = 12, N = 14, O = 16
Avogadro's number (N_{AV}): 6.023×10^{23}
Atomic numbers: V = 23, Cr = 24, Fe = 26

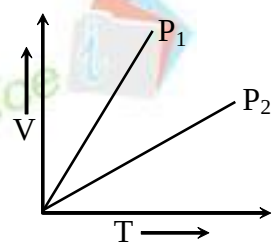
61. One litre of 0.1 M $CuSO_4$ solution is electrolysed till the whole of copper is deposited at cathode. During the electrolysis a gas is released at anode. The volume of the gas evolved at anode at STP is
(a) 112 mL (b) 254 mL (c) 1120 mL (d) 2240 mL

62. An element (X) having equivalent mass E forms a general oxide X_mO_n, its atomic mass should be
(a) $\frac{2En}{m}$ (b) 2mEn (c) $\frac{E}{n}$ (d) $\frac{mE}{2n}$

63. A vessel contains equal masses of three gases A, B and C. The total pressure exerted by the mixture of gases is 3.5 bar at 25°C. The molecular mass of C is twice that of B and molecular mass of A is half of that of B. The partial pressure of B in the vessel is
(a) 1 bar (b) 2 bar (c) 1.5 bar (d) 2.5 bar

64. At relatively high pressure, van der Waal's equation reduces to
(a) PV = RT (b) PV = RT – a/V (c) PV = RT + Pb (d) $PV = RT - a/V^2$

65. The volume (V) of an ideal gas is plotted against its temperature (T) at constant pressures P_1 and P_2. The plots are shown in the figure. So the correct relation between P_1 and P_2 is
(a) $P_1 > P_2$ (b) $P_1 < P_2$
(c) $P_1 = P_2$ (d) $\frac{P_2}{P_1} = \frac{1}{2}$



66. 2 g of hydrogen diffuses out from a container in 10 min. What mass of chlorine will diffuse out in the same time from the same container under similar conditions?
(a) $\sqrt{2\times 71}$ g (b) $\sqrt{\frac{2}{71}}$ g (c) $\sqrt{\frac{71}{2}}$ g (d) $\sqrt{71}$ g

67. An element A has face centred cubic structure with edge length equal to 361 pm. The apparent radius of atom A is
(a) 127.6 pm (b) 180.5 pm (c) 160.5 pm (d)64 pm

68. When electrons are trapped in the crystal lattice in place of anion vacancy, the defect in the crystal is called
(a) F-centre (b) dislocation (c) electronic defect (d)G-centre

69. If the speed of an electron in the Bohr's first orbit of hydrogen atom be x, then the speed of the electron in second orbit of He^+ is

(a) $\frac{x}{2}$ (b) $2x$ (c) x (d) $4x$

70. Which one of the following statements is incorrect?

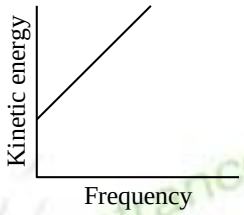
(a) Isotones are atoms of different elements having same number of neutrons.

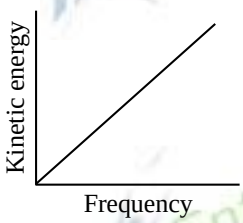
(b) Isotopes are atoms of different elements having same number of protons.

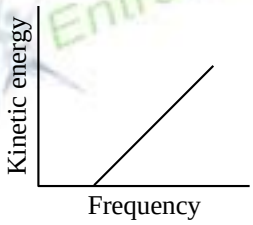
(c) Isobars are atoms of different elements having same number of nucleons.

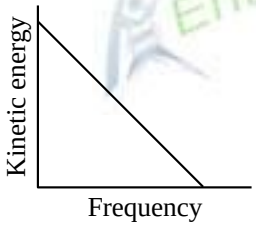
(d) Isotones and isobars are atoms of different elements.

71. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

(a) 

(b) 

(c) 

(d) 

72. The kinetic energy of an electron in n^{th} orbit of hydrogen atom is given by the relation

(a) $K^2 \frac{4\pi^2 me^4}{n^2h^2}$ (b) $-K^2 \frac{2\pi^2 me^4}{n^2h^2}$

(c) $K^2 \frac{2\pi^2 me^4}{n^2h^2}$ (d) none of these

where K is constant, h is planck's constant, m is the mass and e is the charge of an electron.

73. The basic character of oxides MgO, SrO, K_2O, NiO, Cs_2O increase in the order

(a) $MgO > SrO > K_2O > NiO > Cs_2O$ (b) $Cs_2O < K_2O < MgO < SrO < NiO$

(c) $NiO < MgO < SrO < K_2O < Cs_2O$ (d) $K_2O < NiO < MgO < SrO < Cs_2O$

74. The rate of disintegration of a radioactive element changes from initial value of 10,000 dpm to 2500 dpm in 50 days. The decay constant is

(a) $\frac{2500}{10000} d^{-1}$ (b) $1.386 \times 10^{-2}\ d^{-1}$

(c) $\frac{0.693}{2.303} \times 50\ d^{-1}$ (d) $2.772 \times 10^{-2}\ d^{-1}$

75. How many moles of butane must be burnt to increase the temperature of 10 dm^3 of water from 30ºC to 100ºC? Given that $\Delta H^\circ_{comb.}$ of butane, density of H_2O and specific heat of water are -2.879×10^3 kJ mol^{-1}, 1.0 g cm^{-3}, 4.184 JK^{-1} g^{-1} respectively.

(a) 1.017 mol (b) 2.1 mol (c) 1.5 mol (d)0.8 mol

76. A system X undergoes following changes ; $\underset{(P_1V_1T_1)}{\mathbf{X}} \longrightarrow \underset{(P_2V_2T_1)}{\mathbf{W}} \longrightarrow \underset{(P_3V_2T_2)}{\mathbf{Z}} \longrightarrow \underset{(P_1V_1T_1)}{\mathbf{X}}$

The overall process may be called

(a) reversible process (b) cyclic process

(c) cyclic as well as reversible (d) isochoric process

77. Examine the two spontaneous reactions and mark the correct statement

(i) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$; $\Delta H = -890$ kJ

(ii) $2HgO(s) \longrightarrow 2Hg(l) + O_2(g) - 181.6$ kJ

(a) both the reactions are exothermic (b) both the reactions are endothermic

(c) sign of ΔS for both is negative (d) sign of ΔG for both is negative

78. $\Delta H^{o}_{Combustion}$ of NH_3 and H_2 gases at 298 K are 9.06 kcal and 68.9 kcal respectively. $\Delta H^{o}_{formation}$ of ammonia at 298 K in kcal mol^{-1} is

(a) + 94.3 (b) + 112.3

(c) – 112.3 (d) – 94.3

79. Pure ammonia is placed in a vessel at a temperature when its dissociation is appreciable. At equilibrium

(a) α does not change with pressure.

(b) concentration of ammonia does not change with pressure.

(c) concentration of hydrogen is less than that of nitrogen.

(d) K_p does not change significantly with pressure.

80. If *x* is the degree of dissociation of PCl_5 at a given temperature in the equilibrium $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$. 2 moles of PCl_5 are taken in a vessel, then at equilibrium the total number of moles of various species would be

(a) 4 (b) 2 + x

(c) 2(1 – x) (d) 2(1 + x)

81. The conjugate acid of NH_2^- is

(a) NH_3 (b) NH_4^+

(c) N_2H_4 (d) NH_2OH

82. The correct order of increasing $[H_3O^+]$ in the following aqueous solutions is

(a) 0.01 M H_2S < 0.01 M H_2SO_4 < 0.01 M NaCl < 0.01 M $NaNO_2$

(b) 0.01 M NaCl < 0.01 M $NaNO_2$ < 0.01 M H_2S < 0.01 M H_2SO_4

(c) 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2S < 0.01 M H_2SO_4

(d) 0.01 M H_2S < 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2SO_4

83. For preparing a buffer solution of pH 5 by mixing sodium acetate and acetic acid, the ratio of the concentration of salt and acid should be ($K_a = 10^{-5}$)

(a) 1 : 10 (b) 1 : 1

(c) 10 : 1 (d) 1 : 100

84. A hypothetical reaction, $X_2 + Y_2 \rightarrow 2XY$ follows the mechanism as given below

$X_2 \longrightarrow X + X$ ..... (Fast)

$X + Y_2 \longrightarrow XY + Y$ ..... (Slow)

$X + Y \longrightarrow XY$ ..... (Fast)

The order of the overall reaction is

(a) 2 (b) 1 (c) 1.5 (d) zero

85. If order of reaction $A + B \xrightarrow{hv} AB$ is zero. It means that

(a) rate of reaction is independent of temperature

(b) rate of reaction is independent of the concentration of the reacting species

(c) the rate of formation of activated complex is zero

(d) rate of decomposition of activated complex is zero

86. Two liquids A and B have $p^\circ_A > p^\circ_B$. They constitute an ideal binary solution. Which one of the following relations between mole fraction of A in liquid phase (x_A) and that in vapour phase (y_A) is true?

(a) $x_A = y_A$ (b) $x_A > y_A$

(c) $x_A < y_A$ (d) no correlation between x_A and y_A

87. 4.8% solution of glucose would be isotonic with respect to ..... solution of urea

(a) 4.5% (b) 13.5% (c) 1.5% (d) 9%

88. The ratio of elevation in boiling point of aqueous solution of sodium chloride to that of an aqueous solution of glucose of same molalities is approximately

(a) 1 (b) 2 (c) 0.5 (d) 2.5

89. The oxidation number of Pt in $[Pt(C_2H_4)Cl_3]^{-1}$ is

(a) + 1 (b) + 2 (c) + 3 (d) + 4

90. From the following facts

(i) $2X^- + Y_2 \longrightarrow 2Y^- + X_2$ (ii) $2W^- + Y_2 \longrightarrow$ No reaction

(iii) $2Z^- + X_2 \longrightarrow 2X^- + Z_2$

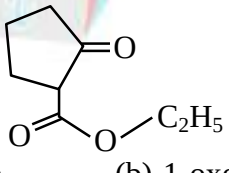
predict the correct relation among the reduction potentials of the species used in the above reactions.

(a) $E_{W_2/W^-} > E_{Y_2/Y^-} > E_{X_2/X^-} > E_{Z_2/Z^-}$ (b) $E_{W_2/W^-} > E_{Y_2/Y^-} > E_{Z_2/Z^-} > E_{X_2/X^-}$

(c) $E_{W_2/W^-} > E_{Z_2/Z^-} > E_{Y_2/Y^-} > E_{X_2/X^-}$ (d) $E_{W_2/W^-} > E_{X_2/X^-} > E_{Y_2/Y^-} > E_{Z_2/Z^-}$

91. The net charge on one gram-ion of N^{3-} has been calculated by a student as $Y \times 10^6$C. The value of Y is

(a) 2.88 (b) 8.2 (c) 6 (d) 3.49

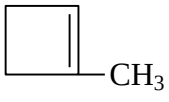
92. The IUPAC name of the compound  is

(a) 2-carbethoxy cyclopentan-1-one (b) 1-oxo-2-carbethoxy cyclopentane

(c) carbethoxy cyclo pentanone (d) none of these

93. Among the following compounds that can exist as enantiomers

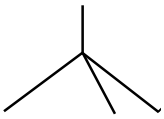
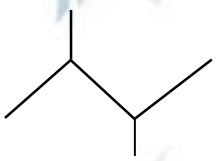
(a) $CH_3CH=C=CHCH_3$ (b) $CH_3 \cdot CH(OH) \cdot COOH$

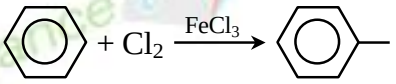
(c)  (d) Both (a) and (b)

94. Sec-butyl chloride on boiling with alcoholic KOH gives ..... as the major product.
(a) 1-butene (b) 2-butene (c) 1-butanol (d) 2-butanol

95. The compound that has the highest boiling point

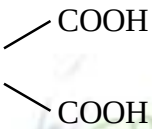
(a)  (b) 

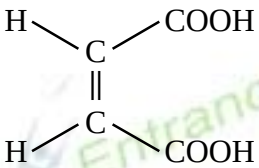
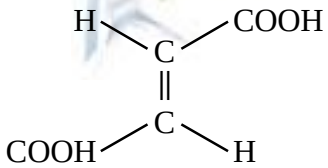
(c)  (d) 

96. In the reaction,  Cl + HCl; the attacking specie is

(a) Cl_2 (b) Cl^+
(c) Cl^- (d) $FeCl_4^-$

97. Which one of the following organic compounds readily decolourises bromine water and forms an anhydride on heating?

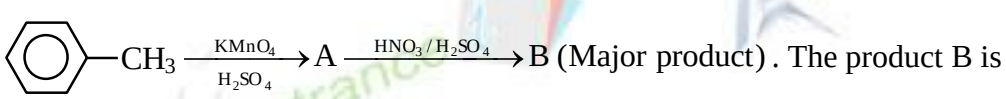
(a)  (b) 

(c)  (d) 

98. Cyclohexene on ozonolysis followed by reductive hydrolysis yields

(a) CH_3CH_2CHO (2 moles) (b) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (2 moles)

(c) $CH_3CH_2CHO + CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ (d) $OHC-(CH_2)_4-CHO$

99.  B (Major product). The product B is

(a) 4-nitrotoluene (b) 3-nitrotoluene
(c) 3-nitrobenzoic acid (d) 4-nitrobenzoic acid

100. Among following, the alkane which exists in solid state at room temperature
(a) n-heptane (b) n-octane
(c) n-decane (d) none of these

101. The compound, which will give a precipitate with $AgNO_3$ solution, is

(a) CCl_4 (b) $CH_3–CH_2–Cl$

(c) $(CH_3)_3CCl$ (d) $CHCl_3$

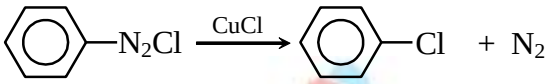
102. For the reaction $C_2H_5OH + HX \longrightarrow C_2H_5X + H_2O$ the order of reactivity is

(a) HCl > HBr > HI (b) HI > HBr > HCl

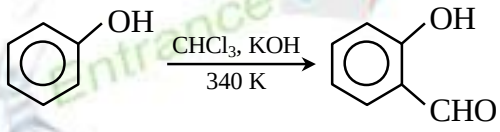
(c) HBr > HCl > HI (d) HI > HCl > HBr

103. Equation showing 'Sandmeyer's reaction' is

(a) $2CH_3CHO \xrightarrow{NaOH} CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_2 - CHO$

(b) 

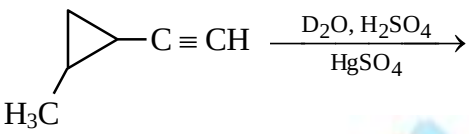
(c) 

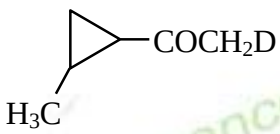
(d) 

104. On boiling with concentrated hydrobromic acid, ethyl phenyl ether will yield

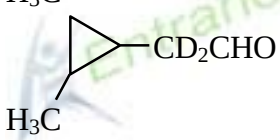
(a) phenol and ethyl bromide (b) bromobenzene and ethanol

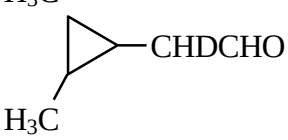
(c) phenol and ethane (d) bromobenzene and ethane

105.  Product (P). The principal organic product P is

(a) 

(b) 

(c) 

(d) 

106. Formic acid and acetic acid may be distinguished by the reaction with

(a) Sodium (b) 2,4–Dinitrophenyl hydrazine

(c) Sodium ethoxide (d) Dilute acidic permanganate

107. Schiff's reagent is

(a) magenta coloured solution of rosaniline hydrochloride decolourised with H_2SO_3.

(b) magenta solution of rosaniline hydrochloride decolourised with Cl_2.

(c) magenta solution of cobalt chloride solution.

(d) manganese sulphate solution made ammonical.

108. Order of ease of esterification of following alcohols with HCOOH

(I) CH_3CH_2OH (II) $(CH_3)_2CHOH$ (III) $(CH_3)_3COH$

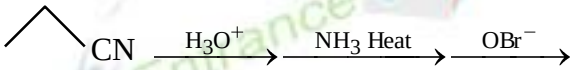
(a) I < II < III (b) III < II < I

(c) II < I < III (d) equal

109. Treatment of aniline with bromine water produces

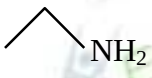
(a) 2, 4, 6-tribromoaniline (b) mixture of ortho and para bromoaniline

(c) bromobenzene (d) N-bromoaniline

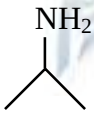
110. 

A. The product A of the reaction sequence is

(a) 

(b) 

(c) 

(d) 

111. Glucose and mannose are

(a) epimers of each other (b) homologues of each other

(c) anomers of each other (d) enantiomers of each other

112. Which one of the following compounds is paramagnetic in nature?

(a) $V(CO)_6$ (b) $Fe(CO)_5$ (c) $Fe_2(CO)_9$ (d) $Cr(CO)_6$

113. The processes in which maximum energy is released

(a) $O(g) + e^- \longrightarrow O^-(g)$ (b) $O^-(g) + e^- \longrightarrow O^{2-}(g)$

(c) $S(g) + e^- \longrightarrow S^-(g)$ (d) $S^-(g) + e^- \longrightarrow S^{2-}(g)$

114. In O_2^{-1}, O_2^0 and O_2^{-2} molecular species, the total number of antibonding electrons respectively are

(a) 7, 6, 8 (b) 1, 0, 2 (c) 6, 6, 6 (d) 8, 6, 8

115. A metal M reacts with N_2 to give a compound 'A' (M_3N). 'A' on heating at high temperature gives back 'M' and 'A' on reacting with H_2O gives a gas 'B'. 'B' turns $CuSO_4$ solution blue on passing through it. A and B can be

(a) Al and NH_3 (b) Li and NH_3 (c) Na and NH_3 (d) Ca and NH_3

116. Alkali metals can be extracted from their salts by

(a) reduction with Carbon.

(b) electrolysis of aqueous solution of their halides.

(c) electrolysis of fused halides.

(d) reduction with Aluminium.

117. From Beryllium to Barium

(a) reactivity decreases (b) density decreases

(c) metallic nature increases (d) strength of metallic bond increases

118. $BeO + C \longrightarrow CO + X$

$Be(OH)_2 + Y \xleftarrow{H_2O}$

X and Y in the above sequence are respectively

(a) Be_2C and C_2H_2 (b) Be and H_2 (c) Be_2C and CH_4 (d) Be_2C and C_2H_6

119. Ammonia can be dried over

(a) quick lime (b) slaked lime (c) $CaCl_2$ (d) PCl_5

120. Which one of the following oxides is acidic in nature?

(a) B_2O_3 (b) Al_2O_3 (c) Ga_2O_3 (d) In_2O_3