AIPMT - 2008

Q.1 A particle of mass m is projected with velocity v making an angle of 45º with the horizontal from level ground. When the particle lands on the level ground the magnitude of the change in its momentum will be -

(1) $mv\sqrt{2}$ (2) zero

(3) 2 mv (4) $mv/\sqrt{2}$

Q.2 A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is -

(1) 1.0 henry (2) 4.0 henry

(3) 2.5 henry (4) 2.0 henry

Q.3 A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction $\vec{B}$. After 3 seconds the kinetic energy of the particle will be -

(1) T (2) 4 T

(3) 3 T (4) 2 T

Q.4 The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}$ ms^{-2}, in the third second is -

(1) $\frac{10}{3}$ m (2) $\frac{19}{3}$ m

(3) 6m (4) 4m

Q.5 A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of 3×10^6 ms^{-1}. The velocity of the particle is :

(mass of electron = 9.1×10^{-31} kg)

(1) 3×10^{-31} ms^{-1} (2) 2.7×10^{-21} ms^{-1}

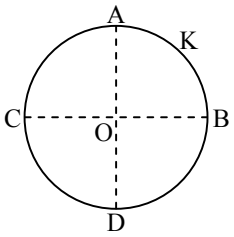
(3) 2.7×10^{-18} ms^{-1} (4) 9×10^{-2} ms^{-1}

Q.6 Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be -

(1) $\frac{Mv}{2}$ newton (2) zero

(3) Mv newton (4) 2 Mv newton

Q.7 A thin conducting ring of radius R is given a charge + Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is -



(1) E along KO (2) 3E along OK

(3) 3 E along KO (4) E along OK

Q.8 Two nuclei have their mass numbers in the ratio of 1 : 3. The ratio of their nuclear densities would be -

(1) $(3)^{1/3}$: 1 (2) 1 : 1

(3) 1 : 3 (4) 3 : 1

Q.9 If M (A, Z), M_p and M_n denote the masses of the nucleus $^{A}_{Z}X$, proton and neutron respectively in units of u (1u = 931.5 MeV/C^2) and BE represents its bonding energy in MeV, then -

(1) $M(A, Z) = ZM_p + (A - Z) M_n - BE$

(2) $M (A, Z) = ZM_p + (A - Z) M_n + BE/C^2$

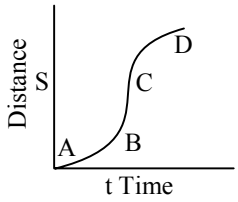
(3) $M(A, Z) = ZM_p + (A - Z) M_n - BE/C^2$

(4) $M(A, Z) = ZM_p + (A - Z) M_n + BE$

Q.10 A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in t second. The value of t is -

(1) 12 (2) 9 (3) 10 (4) 1.8

Q.11 A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point :



(1) D (2) A (3) B (4) C

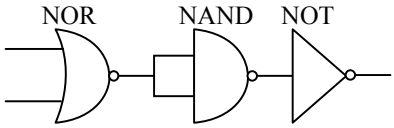
Q.12 An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20ºC ? The temperature of boiling water is 100ºC.

(1) 12.6 min (2) 4.2 min
(3) 6.3 min (4) 8.4 min

Q.13 In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of -

(1) collisions between the charged particles emitted from the cathode and the atoms of the gas
(2) collision between different electrons of the atoms of the gas
(3) excitation of electrons in the atoms
(4) collision between the atoms of the gas

Q.14 The circuit is equivalent to -



(1) NOR gate (2) OR gate
(3) AND gate (4) NAND gate

Q.15 If the error in the measurement of radius of a sphere is 2 % then the error in the determination of volume of the sphere will be -

(1) 8 % (2) 2 %
(3) 4 % (4) 6 %

Q.16 A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90º. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is -

(1) $\frac{ML^2}{6}$ (2) $\frac{\sqrt{2}ML^2}{24}$

(3) $\frac{ML^2}{24}$ (4) $\frac{ML^2}{12}$

Q.17 A p-n photodiode is made of a material with a band gap of 2.0 eV. The minimum frequency of the radiation that can be absorbed by the material is nearly :

(1) 1×10^{14} Hz (2) 20×10^{14} Hz
(3) 10×10^{14} Hz (4) 5×10^{14} Hz

Q.18 Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. the sum of the maximum and minimum intensities is -

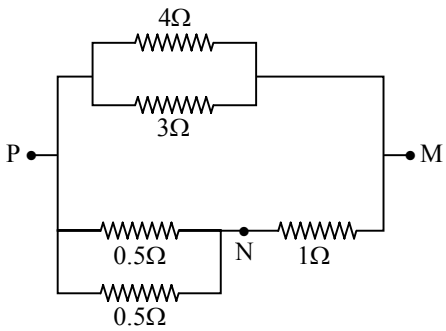
(1) $(\sqrt{I_1} - \sqrt{I_2})^2$ (2) $2(I_1 + I_2)$

(3) $I_1 + I_2$ (4) $(\sqrt{I_1} + \sqrt{I_2})^2$

Q.19 If Q, E and W denote respectively the heat added, change in internal energy and the work done by a closed cycle process, then :

(1) E = 0 (2) Q = 0
(3) W = 0 (4) Q = W = 0

Q.20 In the circuit shown, the current through the 4Ω resistor is 1 amp when the points P and M are connected to a D.C. voltage source. The potential difference between the points M and N is -



(1) 0.5 volt (2) 3.2 volt
(3) 1.5 volt (4) 1.0 volt

Q.21 On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39º W and 239º W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39ºC on the Celsius scale ?

(1) 200ºW (2) 139ºW
(3) 78ºW (4) 117ºW

Q.22 The wave described by y = 0.25 sin (10 πx – 2πf), where x and y are in metres and t in seconds, is a wave travelling along the -

(1) + ve x direction with frequency 1 Hz and wavelength λ = 0.2 m
(2) –ve x direction with amplitude 0.25 m and wavelength λ = 0.2 m
(3) – ve x direction with frequency 1 Hz
(4) + ve x direction with frequency π Hz and wavelength λ = 0.2m

Q.23 The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is -
(1) $4\pi\varepsilon_0 Q \times 10^{20}$ volt/m
(2) $12\pi\varepsilon_0 Q \times 10^{22}$ volt/m
(3) $4\pi\varepsilon_0 Q \times 10^{22}$ volt/m
(4) $12\pi\varepsilon_0 Q \times 10^{20}$ volt/m

Q.24 The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by :
(1) $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ (2) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$
(3) $\sqrt{\frac{\varepsilon_0}{\mu_0}}$ (4) $\sqrt{\mu_0\varepsilon_0}$

Q.25 Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/s. What is the phase difference between the oscillations of two points ?
(1) π (2) $\pi/6$ (3) $\pi/3$ (4) $2\pi/3$

Q.26 Two simple Harmonic Motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is -
(1) $1 : 10^3$ (2) $1 : 10^4$
(3) 1 : 10 (4) $1 : 10^2$

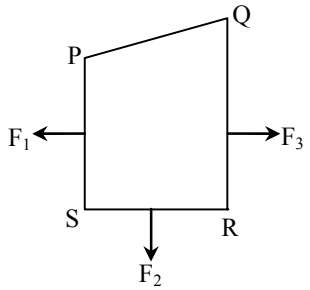
Q.27 If the lattice parameter for a crystalline structure is 3.6 Å, then the atomic radius in fcc crystal is -
(1) 2.92 Å (2) 1. 27 Å
(3) 1.81 Å (4) 2.10 Å

Q.28 Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional forces are 10 % of energy. How much power is generated by the turbine ? (g = 10 m/s^2)
(1) 12.3 kW (2) 7.0 kW
(3) 8.1 kW (4) 10.2 kW

Q.29 The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is :
(1) $\varepsilon_0 E^2$ Ad (2) $\frac{1}{2}\varepsilon_0 E^2$ Ad
(3) $\frac{1}{2}\varepsilon_0 E^2/Ad$ (4) $\varepsilon_0 E^2/Ad$

Q.30 A boy is trying to start a fire by focusing Sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the Sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m. What is the diameter of the Sun's image on the paper ?
(1) 6.5×10^{-5} m (2) 12.4×10^{-4} m
(3) 9.2×10^{-4} m (4) 6.5×10^{-4} m

Q.31 A closed loop PQRS carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments PS, SR and RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown, the force on the segment QP is :



(1) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ (2) $F_3 - F_1 - F_2$
(3) $F_3 - F_1 - F_2$ (4) $\sqrt{(F_3 - F_1)^2 + F_2^2}$

Q.32 A wire of a certain material is stretched slowly by ten percent. Its new resistance and specific resistance become respectively -
(1) both remain the same
(2) 1.1 times, 1.1 times
(3) 1.2 times, 1.1 times
(4) 1.21 times, same

Q.33 Curie temperature is the temperature above which -
(1) paramagnetic material becomes ferromagnetic material
(2) ferromagnetic material becomes diamagnetic material
(3) ferromagnetic material becomes paramagnetic material
(4) paramagnetic material becomes diamagnetic material

Q.34 Which two of the following five physical parameters have the same dimensions ?
(a) Energy density (b) Refractive index
(c) Dielectric constant (d) Young's modulus
(e) Magnetic field
(1) (a) and (d) (2) (a) and (e)
(3) (b) and (d) (4) (c) and (e)

Q.35 The ground state energy of hydrogen atom is –13.6 eV. When its electron is in the first excited state, its excitation energy is -
(1) 10.2 eV (2) zero
(3) 3.4 eV (4) 6.8 eV

Q.36 The voltage gain of an amplifier with 9 % negative feedback is 10. The voltage gain without feedback will be -
(1) 1.25 (2) 100 (3) 90 (4) 10

Q.37 A galvanometer of resistance 50 Ω is connected to a battery of 3V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be -
(1) 6050 Ω (2) 4450 Ω
(3) 5050 Ω (4) 5550 Ω

Q.38 A shell of mass 200 g is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is -
(1) 40 ms^{-1} (2) 120 ms^{-1}
(3) 100 ms^{-1} (4) 80 ms^{-1}

Q.39 In an A.C. circuit the emf (e) and the current (i) at any instant are given respectively by :

$e = E_0 \sin \omega t$

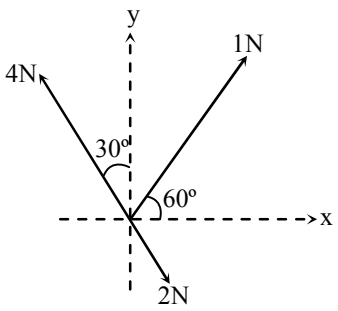
$i = I_0 \sin (\omega t - \phi)$

The average power in the circuit over one cycle of A.C. is -

(1) $\frac{E_0 I_0}{2} \cos \phi$ (2) $E_0 I_0$

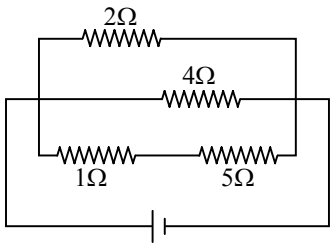
(3) $\frac{E_0 I_0}{2}$ (4) $\frac{E_0 I_0}{2} \sin \phi$

Q.40 Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is -



(1) $\frac{\sqrt{3}}{4}$ N (2) $\sqrt{3}$ N
(3) 0.5 N (4) 1.5 N

Q.41 A current of 3 amp. flows through the 2Ω resistor shown in the circuit. The power dissipated in the 5Ω resistor is -



(1) 1 watt (2) 5 watt
(3) 4 watt (4) 2 watt

Q.42 Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time -

(1) $\frac{1}{4\lambda}$ (2) $\frac{e}{\lambda}$ (3) λ (4) $\frac{1}{2}\lambda$

Q.43 The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of the incident radiation for which the stopping potential is 5 V lies in the :
(1) Infrared region (2) X-ray region
(3) Ultraviolet region (4) Visible region

Q.44 A point performs simple harmonic oscillation of period T and the equation of motion is given by $x = a \sin (\omega t + \pi/6)$. After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity ?
(1) T/3 (2) T/12
(3) T/8 (4) T/6

Q.45 Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combination is -

(1) $\frac{f_1 + f_2}{2}$ (2) $\frac{f_1 + f_2}{f_1 f_2}$

(3) $\sqrt{\frac{f_1}{f_2}}$ (4) $\sqrt{\frac{f_2}{f_1}}$

Q.46 At 10ºC the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At 110ºC this ratio is -

(1) $\frac{10}{110}$ x (2) $\frac{283}{383}$ x

(3) x (4) $\frac{383}{283}$ x

Q.47 A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20m. The speed of the car at the top of the hill is between -

(1) 16 m/s and 17 m/s (2) 13 m/s and 14 m/s

(3) 14 m/s and 15 m/s (4) 15 m/s and 16 m/s

Q.48 A circular disc of radius 0.2 metre is placed in a uniform magnetic field of induction $\frac{1}{\pi}\left(\frac{Wb}{m^2}\right)$ in such a way that its axis makes an angle of 60º with $\vec{B}$. The magnetic flux linked with the disc is -

(1) 0.08 Wb (2) 0.01 Wb

(3) 0.02 Wb (4) 0.06 Wb

Q.49 The ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and radius around their respective axes is -

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

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

Q.50 A cell can be balanced against 110 cm and 100 cm of potentiometer wire, respectively with and without being short circuited through a resistance of 10 Ω. Its internal resistance is -

(1) 2.0 ohm (2) zero

(3) 1.0 ohm (4) 0.5 ohm

Q.51 Which one of the following arrangements does not give the correct picture of the trends indicated against it ?

(1) $F_2 > Cl_2 > Br_2 > I_2$ Bond dissociation energy

(2) $F_2 > Cl_2 > Br_2 > I_2$ Electronegativity

(3) $F_2 > Cl_2 > Br_2 > I_2$ Oxidizing power

(4) $F_2 > Cl_2 > Br_2 > I_2$ Electron gain enthalpy

Q.52 If a gas expands at constant temperature, it indicates that :

(1) kinetic energy of molecules remains the same

(2) number of the molecules of gas increases

(3) kinetic energy of molecules decreases

(4) pressure of the gas increases

Q.53 The dissociation equilibrium of a gas AB_2 can be represented as :

$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$

The degree of dissociation is 'x' and is small compared to 1. The expression relating the degree of dissociation (x) with equilibrium constant K_p and total pressure P is -

(1) $(2K_p/P)^{1/2}$ (2) (K_p/P)

(3) $(2K_p/P)$ (4) $(2K_p/P)^{1/3}$

Q.54 The bromination of acetone that occurs in acid solution is represented by this equation.

$CH_3COCH_3(aq.) + Br_2(aq.) \longrightarrow$

$CH_3COCH_2Br(aq.) + H^+(aq.) + Br^-(aq.)$

These kinetic data were obtained from given reaction concentrations.

Initial concentrations, (M)		
$[CH_3COCH_3]$	$[Br_2]$	$[H^+]$
0.30	0.05	0.05
0.30	0.10	0.05
0.30	0.10	0.10
0.40	0.05	0.20

Initial rate, disappearance of Br_2, Ms^{-1}

5.7×10^{-5}

5.7×10^{-5}

1.2×10^{-4}

3.1×10^{-4}

Based on these data, the rate equation is :

(1) Rate = $k[CH_3COCH_3][Br_2][H^+]^2$

(2) Rate = $k[CH_3COCH_3][Br_2][H^+]$

(3) Rate = $k[CH_3COCH_3][H^+]$

(4) Rate = $k[CH=COCH_3][Br_2]$

Q.55 If the concentration of OH^- ions in the reaction,

$Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq.) + 3OH^-(aq.)$

is decreased by $\frac{1}{4}$ times, then equilibrium concentration of Fe^{3+} will increase by -

(1) 64 times (2) 4 times

(3) 8 times (4) 16 times

Q.56 What volume of oxygen gas (O_2) measured at 0ºC and 1 atm, is needed to burn completely one litre, of propane gas (C_3H_8) measured under the same conditions ?
(1) 5 L (2) 10 L
(3) 7 L (4) 6 L

Q.57 Equal volumes of three acid solutions of pH 3, 4 and 5 are mixed in a vessel. What will be the H^+ ion concentration in the mixture ?
(1) 3.7×10^{-3} M (2) 1.11×10^{-3} M
(3) 1.11×10^{-4} M (4) 3.7×10^{-4} M

Q.58 The relative reactivities of acyl compounds towards nucleophilic substitution are in the order of -
(1) acid anhydride > amide > ester > acyl chloride
(2) acyl chloride > ester > acid anhydride > amide
(3) acyl chloride > acid anhydride > ester > amide
(4) ester > acyl chloride > amide > acid anhydride

Q.59 In DNA, the complementary bases are -
(1) adenine and guanine, thymine and cytosine
(2) uracil and adenine, cytosine and guanine
(3) adenine and thymine, guanine and cytosine
(4) adenine and thymine, guanine and uracil

Q.60 Base strength of -
(i) $H_3C\overset{\ominus}{C}H_2$ (ii) $H_2C=\overset{\ominus}{C}H$ and
(iii) $H-C\equiv\overset{\ominus}{C}$
is in the order of -
(1) (i) > (iii) > (ii) (2) (i) > (ii) (iii)
(3) (ii) > (i) > (iii) (4) (iii) > (ii) > (i)

Q.61 Equimolar solutions of the following were prepared in water separately. Which one of the solutions will record the highest pH ?
(1) $MgCl_2$ (2) $CaCl_2$
(3) $SrCl_2$ (4) $BaCl_2$

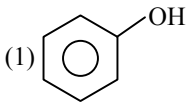
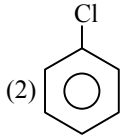
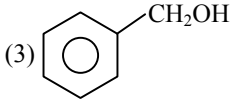
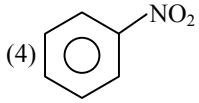
Q.62 The sequence of ionic mobility in aqueous solutions is -
(1) $Rb^+ > K^+ > Cs^+ > Na^+$
(2) $Na^+ > K^+ > Rb^+ > Cs^+$
(3) $K^+ > Na^+ > Rb^+ > Cs^+$
(4) $Cs^+ > Rb^+ > K^+ > Na^+$

Q.63 If uncertainty in position and momentum are equal, then uncertainty in velocity is -
(1) $1/m\sqrt{(h/\pi)}$ (2) $\sqrt{(h/\pi)}$
(3) $1/2m\sqrt{(h/\pi)}$ (4) $\sqrt{(h/2\pi)}$

Q.64 How many stereoisomers does this molecule have ?
$CH_3CH = CHCH_2CHBrCH_3$
(1) 8 (2) 2 (3) 4 (4) 6

Q.65 On the basis of the following Eº values, the strongest oxidizing agent is :
$[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-} + e^{-1}$, Eº = – 0.35 V
$Fe^{2+} \rightarrow Fe^{3+} + e^{-1}$, Eº = – 0.77 V
(1) Fe^{3+} (2) $[Fe(CN)_6]^{3-}$
(3) $[Fe(CN)_6]^{4-}$ (4) Fe^{2+}

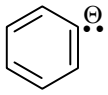
Q.66 The correct order of decreasing second ionization enthalpy of Ti = 22, V = 23, Cr = 24 and Mn = 25 is -
(1) Mn > Cr > Ti > V
(2) Ti > V > Cr > Mn
(3) Cr > Mn > V > Ti
(4) V > Mn > Cr > Ti

Q.67 Which one of the following is most reactive towards electrophilic attack ?
(1) 
(2) 
(3) 
(4) 

Q.68 Four diatomic species are listed below in different sequences. Which of these presents the correct order of their increasing bond order ?
(1) $C_2^{2-} < He_2^+ < NO < O_2^-$
(2) $He_2^+ < O_2^- < NO < C_2^{2-}$
(3) $O_2^- < NO < C_2^{2-} < He_2^+$
(4) $NO < C_2^{2-} < O_2^- < He_2^+$

Q.69 How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl ?
(1) 0.011 (2) 0.029
(3) 0.044 (4) 0.333

Q.70 The stability of carbanions in the following :

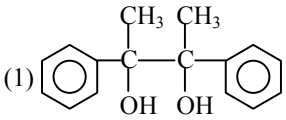
(i) $R-C\equiv\overset{\ominus}{C}$ (ii) 

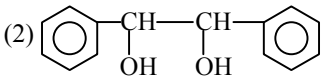
(iii) $R_2C=\overset{\ominus}{C}H$ (iv) $R_3C-\overset{\ominus}{C}H_2$

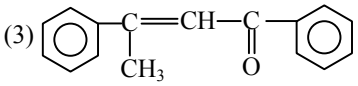
is in the order of :

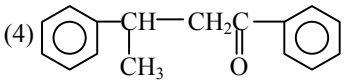
(1) (iv) > (ii) > (iii) > (i)
(2) (i) > (iii) > (ii) > (iv)
(3) (i) > (ii) > (iii) > (iv)
(4) (ii) > (iii) > (iv) > (i)

Q.71 Acetophenone when reacted with a base, C_2H_5ONa, yields a stable compound which has the structure :

(1) 

(2) 

(3) 

(4) 

Q.72 Volume occupied by one molecule of water (density = 1g cm^{-3}) is :

(1) 3.0×10^{-23} cm^3 (2) 5.5×10^{-23} cm^3
(3) 9.0×10^{-23} cm^3 (4) 6.023×10^{-23} cm^3

Q.73 Bond dissociation enthalpy of H_2, Cl_2 and HCl are 434, 242 and 431 kJ mol^{-1} respectively. Enthalpy of formation of HCl is -

(1) –93 kJ mol^{-1} (2) 245 kJ mol^{-1}
(3) 93 kJ mol^{-1} (4) –245 kJ mol^{-1}

Q.74 Which of the following complexes exhibits the highest paramagnetic behaviour ?

(1) $[Co(OX)_2\ (OH)_2]^-$
(2) $[Ti\ (NH_3)_6]^{3+}$
(3) $[V(gly)_2\ (OH)_2(NH_3)_2]^+$
(4) $[Fe\ (en)\ (bpy)\ (NH_3)_2]^{2+}$

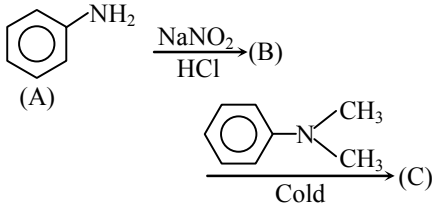
Where gly = glycine, en = ethylenediamine and bpy = bipyridyl moities

(Atomic number Ti = 22, V = 23, Fe = 26, Co = 27)

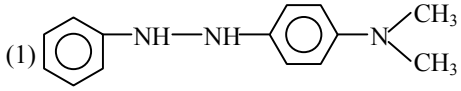
Q.75 Which one of the following statements is not true ?

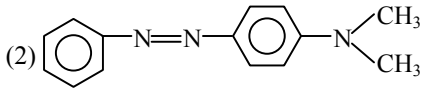
(1) Buna-S is a copolymer of butadiene and styrene
(2) Natural rubber is a 1, 4-polymer of isoprene
(3) In vulcanization, the formation of sulphur bridges between different chains make rubber harder and stronger
(4) Natural rubber has the trans-configuration at every double bond

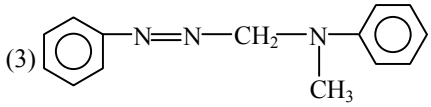
Q.76 In a reaction of aniline a coloured product (C) was obtained.

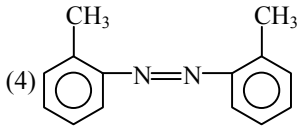


The structure of (C) would be -

(1) 

(2) 

(3) 

(4) 

Q.77 For the gas phase reaction,

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

Which of the following conditions are correct ?

(1) $\Delta H < 0$ and $\Delta S < 0$
(2) $\Delta H > 0$ and $\Delta S < 0$
(3) $\Delta H = 0$ and $\Delta S < 0$
(4) $\Delta H > 0$ and $\Delta S > 0$

Q.78 The measurement of the electron position is associated with an uncertainty in momentum, which is equal to 1×10^{-18} g cm s^{-1}. The uncertainty in electron velocity is :

(Mass of an electron is 9×10^{-28} g)

(1) 1×10^5 cm s^{-1} (2) 1×10^{11} cm s^{-1}
(3) 1×10^9 cm s^{-1} (4) 1×10^6 cm s^{-1}

Q.79 The angular shape of ozone molecule (O_3) consists of -
(1) 1 sigma and 1 pi bonds
(2) 2 sigma and 1 pi bonds
(3) 1 sigma and 2 pi bonds
(4) 2 sigma and 2 pi bonds

Q.80 Percentage of free space in a body centered cubic unit cell is -
(1) 34 % (2) 28 %
(3) 30 % (4) 32 %

Q.81 The value of equilibrium constant of the reaction,
$HI(g) \rightleftharpoons 1/2\ H_2(g) + 1/2I_2\ (g)$ is 8.0.
The equilibrium constant of the reaction,
$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ will be -
(1) 16 (2) 1/8
(3) 1/16 (4) 1/64

Q.82 The value of K_{p_1} and K_{p_2} for the reactions

$$X \rightleftharpoons Y + Z \quad ....(1) \text{ and}$$
$$A \rightleftharpoons 2B \quad ....(2)$$

are in ratio of 9 : 1. If degree of dissociation of X and A be equal, then total pressure at equilibrium (1) and (2) are in the ratio :
(1) 36 : 1 (2) 1 : 1
(3) 3 : 1 (4) 1 : 9

Q.83 Which one of the following is an amine hormone ?
(1) Insulin (2) Progesterone
(3) Thyroxine (4) Oxypurin

Q.84 Kohlrausch's Law states that at :
(1) infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte
(2) infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte whatever be the nature of the other ion of the electrolyte
(3) finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte whatever be the nature of the other ion of electrolyte
(4) infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of electrolyte

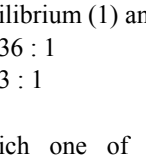
Q.85 Green chemistry means such reactions which -
(1) are related to the depletion of ozone layer
(2) study the reactions in plants
(3) produce colour during reactions
(4) reduce the use and production of hazardous chemicals

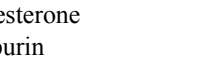
Q.86 Which of the following statements is not correct ?
(1) The number of carbon atoms in an unit cell of diamond is 4
(2) The number of Bravais lattices in which a crystal can be categorized is 14
(3) The fraction of the total volume occupied by the atoms in a primitive cell is 0.48
(4) Molecular solids are generally volatile

Q.87 In a S_N2 substitution reaction of the type

$$R\text{–}Br + Cl^- \xrightarrow{DMF} R\text{–}Cl + Br^-$$

Which one of the following has the highest relative rate ?

(1)  (2) CH_3CH_2Br

(3) $CH_3\text{–}CH_2\text{–}CH_2Br$ (4) 

Q.88 The correct order of increasing bond angles in the following triatomic species is :
(1) $NO_2^+ < NO_2 < NO_2^-$
(2) $NO_2^+ < NO_2^- < NO_2$
(3) $NO_2^- < NO_2^+ < NO_2$
(4) $NO_2^- < NO_2 < NO_2^+$

Q.89 With which one of the following elements silicon should be doped so as to give *p*-type of semiconductor?
(1) Selenium (2) Boron
(3) Germanium (4) Arsenic

Q.90 $H_3C—\underset{\underset{CH_3}{|}}{CH}—CH=CH_2+HBr \longrightarrow (X)$

Here (X) (predominantly) is :

(1) $CH_3—\underset{\underset{Br}{|}}{CH}—\underset{\underset{CH_3}{|}}{CH}—CH_3$

(2) $CH_3—\underset{\underset{CH_3}{|}}{CH}—\underset{\underset{Br}{|}}{CH}—CH_3$

(3) $CH_3—\underset{\underset{CH_3}{|}}{CH}—CH_2—CH_2\,Br$

(4) $CH_3—\underset{\underset{CH_3}{|}}{\overset{\overset{Br}{|}}{C}}—CH_2CH_3$

Q.91 An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be :

(1) CHO (2) CH_4O

(3) CH_3O (4) CH_2O

Q.92 In which of the following co-ordination entities the magnitude of Δ_O (CFSE in octahedral field) will be maximum?

(1) $[Co(CN)_6]^{3-}$ (2) $[Co(C_2O_4)_3]^{3-}$

(3) $[Co(H_2O)_6]^{3+}$ (4) $[Co(NH_3)_6]^{3+}$

(Atomic number of Co=27)

Q.93 The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders?

(1) NaH>LiH>KH>RbH>CsH

(2) LiH>NaH>KH>RbH>CsH

(3) CsH>RbH>KH>NaH>LiH

(4) KH>NaH>LiH>CsH>RbH

Q.94 Which of the following are not state functions?

(I) $q+w$ (II) q

(III) w (IV) H-TS

(1) (I), (II) and (III) (2) (II) and (III)

(3) (I) and (IV) (4) (II), (III) and (IV)

Q.95 In the hydrocarbon,

$\overset{6}{CH_3}—\overset{5}{CH}=\overset{4}{CH}—\overset{3}{CH_2}—\overset{2}{C}\equiv\overset{1}{CH}$

The state of hybridization of carbons 1, 3 and 5 are in the following sequence :

(1) sp, sp^2, sp^3 (2) sp^3, sp^2, sp

(3) sp^2, sp, sp^3 (4) sp, sp^3, sp^2

Q.96 Number of moles of MnO_4^- required to oxidize one mole of ferrous oxalate completely in acidic medium will be :

(1) 7.5 mole (2) 0.2 mole

(3) 0.6 mole (4) 0.4 mole

Q.97 The rate constants k_1 and k_2 for two different reactions are $10^{16}.e^{-2000/T}$ and $10^{15}.e^{-1000/T}$, respectively, the temperature at which $k_1=k_2$, is:

(1) 2000K (2) 1000/2.303 K

(3) 1000 K (4) 2000/2.303 K

Q.98 A strong base can abstract an α-hydrogen from:

(1) ketone (2) alkane

(3) alkene (4) amine

Q.99 Standard free energies of formation (in kJ/mol) at 298 K are -237.2, -394.4 and -8.2 for $H_2O(\ell)$, $CO_2(g)$ and pentane(g) respectively The value of E^o_{cell} for the pentane-oxygen fuel cell is:

(1) 1.0968 V (2) 0.0968 V

(3) 1.968 V (4) 2.0968 V

Q.100 If *'a'* stands for the edge length of the cubic systems : simple cubic, body centered cubic and face centered cubic, then the ratio of radii of the spheres in these systems will be respectively.

(1) $\frac{1}{2}a:\frac{\sqrt{3}}{2}a:\frac{\sqrt{2}}{2}a$ (2) $1a:\sqrt{3a}:\sqrt{2a}$

(3) $\frac{1}{2}a:\frac{\sqrt{3}}{4}a:\frac{1}{2\sqrt{2}}a$ (4) $\frac{1}{2}a:\sqrt{3}a:\frac{1}{\sqrt{2}}a$

Q.101 A competitive inhibitor of succinic dehydrogenase is :

(1) α-ketoglutarate (2) malate

(3) malonate (4) oxaloacetate

Q.102 Senescence as an active developmental cellular process in the growth and functioning of a flowering plant, is indicated in:

(1) Annual plants

(2) Floral parts

(3) Vessels and tracheid differentiation

(4) Leaf abscission

Q.103 Which one of the following statements is incorrect about menstruation?
(1) At menopause in the female, there is especially abrupt increase in gonadotropic hormones
(2) The beginning of the cycle of menstruation is called menarche
(3) During normal menstruation about 40 ml blood is lost
(4) The menstrual fluid can easily clot

Q.104 Which one of the following conditions in humans is correctly matched with its chromosomal abnormality/linkage?
(1) Erythroblastosis foetalis — X-linked
(2) Down syndrome — 44 autosomes + XO
(3) Klinfelter's syndrome — 44 autosomes + XXY
(4) Colour-blindness — Y-linked

Q.105 In leaves of C-4 plants malic acid synthesis during CO_2 fixation occurs in:
(1) bundle sheath (2) guard cells
(3) epidermal cells (4) mesophyll cells

Q.106 What is true about the isolated small tribal populations?
(1) Wrestlers who develop strong body muscles in their life time pass their character on to their progeny
(2) There is no change in population size as they have a large gene pool
(3) There is a decline in population as boys marry girls only from their own tribe
(4) Hereditary disease like colour-blindness do not spread in the isolated population

Q.107 The Replum is present in the ovary of flower of:
(1) sunflower (2) pea
(3) lemon (4) mustard

Q.108 Unisexuality of flowers prevents:
(1) geitonogamy, but not xenogamy
(2) autogamy and geitonogamy
(3) autogamy, but not geitonogamy
(4) both geitonogamy and xenogamy

Q.109 The length of different internodes in a culm of sugarcane is variable because of:
(1) size of leaf lamina at the node below each internode
(2) intercalary meristem
(3) shoot apical meristem
(4) position of axillary buds

Q.110 Which one of the following is not observed in biodiversity hotspots ?
(1) Lesser inter-specific competition
(2) Species richness
(3) Endenism
(4) Accelerated species loss

Q.111 Which one of the following is the correct percentage of the two (out of the total of 4) greenhouse gases that contribute to the total global warming ?
(1) N_2O 6%, CO_2 86%
(2) Methane 20%, N_2O 18%
(3) CFCs 14%, Methane 20%
(4) CO_2 40%, CFCs 30%

Q.112 The two subunits of ribosome remain united at a critical ion level of :
(1) magnesium (2) calcium
(3) copper (4) manganese

Q.113 Given below are four methods (A-D) and their modes of action (1-4) in achieving contraception. Select their correct matching from the four options that follow:

Method	Mode of Action
(1) The pill	(a) Prevents sperms reaching cervix
(2) Condom	(b) Prevents implantation
(3) Vasectomy	(c) Prevents ovaulation
(4) Copper-T	(d) Semen contains no sperms

Answer codes :
(1) 1 = (c), 2 = (d), 3 = (a), 4 = (b)
(2) 1 = (b), 2 = (c), 3 = (a), 4 = (d)
(3) 1 = (c), 2 = (a), 3 = (d), 4 = (b)
(4) 1 = (d), 2 = (a), 3 = (b), 4 = (c)

Q.114 The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that Adenosine Tri-Phosphate (ATP) is formed because:
(1) A proton gradient forms across the inner membrane
(2) There is a change in the permeability of the inner mitochondrial membrane toward Adenosine Di-Phosphate (ADP)
(3) High energy bonds are formed in mitochondrial proteins
(4) ADP is pumped out of the matrix into the intermembrane space

Q.115 The linking of antibiotic resistance gene with the plasmid vector became possible with:
(1) DNA polymerase (2) Exonucleases
(3) DNA ligase (4) Endonucleases

Q.116 The rupture and fractionation do not usually occur in the water column in vessel/tracheids during the ascent of sap because of :
(1) weak gravitational pull
(2) transpiration pull
(3) lignified thick walls
(4) cohesion and adhesion

Q.117 Thorn of *Bougainvillea* and tendril of *Cucurbita* are examples of:
(1) vestigial organs
(2) retrogressive evolution
(3) analogous organs
(4) homologous organs

Q.118 Consider the following four measures (1-4) that could be taken to successfully grow chickpea in an area where bacterial blight disease is common:
(i) Spray with Bordeaux mixture
(ii) Control of the insect vector of the disease pathogen
(iii) Use of only disease-free seeds
(iv) Use of varieties resistant to the disease
Which two of the above measures can control the disease?
(1) (iii) and (iv) (2) (i) and (iv)
(3) (ii) and (iii) (4) (i) and (ii)

Q.119 World Summit on Sustainable Development (2002) was held in:
(1) Argentina (2) South Africa
(3) Brazil (4) Sweden

Q.120 Darwin's Finches are an excellent examples of:
(1) brood parasitism (2) connecting links
(3) adaptive radiation (4) seasonal migration

Q.121 Polysome is formed by:
(1) a ribosome with several subunits
(2) ribosomes attached to each other in a linear arrangement
(3) several ribosomes attached to a single mRNA
(4) many ribosomes attached to a strand of endoplasmic reticulum

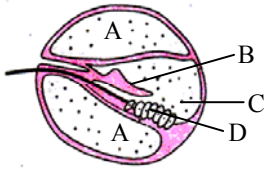
Q.122 Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?
(1) Guanine, Adenine — Purines
(2) Adenine, Thymine — Purines
(3) Thymine, Uracil — Pyrimidines
(4) Uracil, Cytosine — Pyrimidines

Q.123 The fruit is chambered, developed from inferior ovary and has seeds with succulent testa in :
(1) guava (2) cucumber
(3) pomegranate (4) orange

Q.124 Endosperm is consumed by developing embryo in the seed of:
(1) pea (2) maize
(3) coconut (4) castor

Q.125 In the DNA molecule:
(1) the proportion of adenine in relation to thymine varies with the organism
(2) there are two strands which run antiparallel one in 5'→ 3' direction and other in 3'→ 5'
(3) the total amount of purine nucleotides and pyrimidine nucleotides is not always equal
(4) there are two strands which run parallel in the 5'→ 3' direction

Q.126 Given below is a diagrammatic cross section of a single loop of human cochlea:



Which one of the following options correctly represents the names of three different parts?

(1) D:Sensory hair cells, A:Endolymph, B:Tectorial membrane
(2) A: Perilymph, B: Tectorial membrane, C: Endolymph
(3) B:Tectorial membrane, C:Perilymph, D:Secretory cells
(4) C:Endolymph, D:Sensory hair cells, A:Serum

Q.127 Which type of white blood cells are concerned with the release of histamine and the natural anti-coagulant heparin?

(1) Eosinophils (2) Monocytes
(3) Neutrophils (4) Basophils

Q.128 *Thermococcus, Methanococcus* and *Methanobacterium* exemplify:

(1) bacteria whose DNA is relaxed or positively supercoiled but which have a cytoskeleton as well as mitochondria
(2) bacteria that contain a cytoskeleton and ribosomes
(3) archaebacteria that contain protein homologous to eukaryotic core histones
(4) archaebacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled.

Q.129 Which one of the following is being tried in India as a biofuel substitute for fossil fuels?

(1) *Musa* (2) *Aegilops*
(3) *Jatropa* (4) *Azadirachta*

Q.130 Dry indehiscent single-seeded fruit formed from bicarpellary, syncarpous, inferior ovary is:

(1) berry (2) cremocarp
(3) caryopsis (4) cypsela

Q.131 Which one of the following pairs of codons is correctly matched with their function or the signal for the particular amino acid?

(1) AUG, ACG — Start/Methionine
(2) UUA, UCA — Leucine
(3) GUU, GCU — Alanine
(4) UAG, UGA — Stop

Q.132 Select one of the following pairs of important features distinguishing *Gnetum* form *Cycas* and *Pinus* and showing affinities with angiosperms:

(1) perianth and two integuments
(2) embryo development and apical meristem
(3) absensce of resin duct and leaf venation
(4) presence of vessel elements and absence of archegonia

Q.133 Earthworms have no skeleton but during burrowing the anterior end becomes turgid and acts as a hydraulic skeleton. It is due to:

(1) gut peristalsis (2) setae
(3) coelomic fluid (4) blood

Q.134 Which one of the following is the true description about an animal concerned?

(1) Rat — Left kidney is slightly higher in position than the right one
(2) Cockroach — 10 pairs of spiracles (2 pairs on thorax and 8 pairs on abdomen)
(3) Earthworm — The alimentary canal consists of a sequence of pharynx, oesophagus, stomach, gizzard and intestine
(4) Frog — Body divisible into three regions-head, neck and trunk

Q.135 Which extraembryonic membrane in humans prevents desiccation of the embryo inside the uterus?

(1) Yolk sac (2) Amnion
(3) Chorion (4) Allantois

Q.136 About 70% of total global carbon is found in:

(1) Oceans (2) Forests
(3) Grasslands (4) Agroecosystems

Q.137 Human insulin is being commercially produced from a transgenic species of:
(1) *Rhizobium* (2) *Saccharomyces*
(3) *Escherichia* (4) *Mycobacterium*

Q.138 Vacuole in a plant cell:
(1) lacks membrane and contains air
(2) Lacks membrane and contains water and excretory substances
(3) is membrane-bound and contains storage proteins and lipids
(4) is membrane-bound and contains water and excretory substances

Q.139 Quercus species are the dominant component in:
(1) Scrub forests
(2) Tropical rain forests
(3) Temperate deciduous forests
(4) Alpine forests

Q.140 Vascular tissues in flowering plants develop from:
(1) periblem (2) dermatogen
(3) phellogen (4) plerome

Q.141 Gel electrophoresis is used for:
(1) construction of recombinant DNA by joining with cloning vectors
(2) isolation of DNA molecule
(3) cutting of DNA into fragments
(4) separation of DNA fragments according to their size

Q.142 Which one of the following pairs of organs includes only the endocrine glands?
(1) Thymus and testes
(2) Adrenal and ovary
(3) Parathyroid and adrenal
(4) Pancreas and parathyroid

Q.143 Haploids are more suitable for mutation studies than the diploids. This is because:
(1) haploids are more abundant in nature than diploids
(2) all mutations, whether dominant or recessive are expressed in haploids
(3) haploids are reproductively more stable than diploids
(4) mutagens penetrate in haploids more effectively than in diploids

Q.144 Consider the following four statements (1-4) about certain desert animals such as kangaroo-rat.
(i) They have dark colour and high rate of reproduction and excrete solid urine
(ii) They do not drink water, breathe at a slow rate to conserve water and have their body covered with thick hairs
(iii) They feed on dry seeds and do not required drinking water
(iv) They excrete very concentrated urine and do not use water to regulate body temperature
Out of these four, which two are correct-
(1) (iii) and (i) (2) (i) and (ii)
(3) (iii) and (iv) (4) (ii) and (iii)

Q.145 Which one of the following is **NOT** a characteristic of phylum Annelida?
(1) Pseudocoelom
(2) Ventral nerve cord
(3) Closed circulatory system
(4) Segmentation

Q.146 In human adult females oxytocin:
(1) stimulates pituitary to secrete vasopressin
(2) causes strong uterine contractions during parturition
(3) is secreted by anterior pituitary
(4) stimulates growth of mammary glands

Q.147 The most active phagocytic white blood cells are:
(1) eosinophils and lymphocytes
(2) neutrophils and monocytes
(3) neutrophils and eosinophils
(4) lymphocytes and macrophages

Q.148 In which one of the following, male and female gametophytes do not have free-living independent existence?
(1) *Polytrichum* (2) *Cedrus*
(3) *Pteris* (4) *Funaria*

Q.149 What is vital capacity of our lungs?
(1) Inspiratory reserve volume plus expiratory reserve volume
(2) Total lung capacity minus residual volume
(3) Inspiratory reserve volume plus tidal volume
(4) Total lung capacity minus expiratory reserve volume

Q.150 Which one of the following is hetero-sporous?
(1) *Adiantum* (2) *Equisetum*
(3) *Dryoptris* (4) *Salvinia*

Q.151 The blood calcium level is lowered by the deficiency of:
(1) both calcitonin and parathormone
(2) calcitonin
(3) parathormone
(4) thyroxine

Q.152 The C_4 plants are photosynthetically more efficient than C_3 plants because:
(1) the CO_2 efflux is not prevented
(2) they have more chloroplasts
(3) the CO_2 compensation point is more
(4) CO_2 generated during photorespiration is trapped and recycled through PEP carboxylase

Q.153 Which one of the following phyla is correctly matched with its two general characteristic?
(1) Echinoderamata — Pentamerous radial symmetry and mostly internal fertilization
(2) Mollusca — Normally oviparous and development through a trochophore or veliger larva
(3) Arthropoda — Body divided into head, thorax and abdomen and respiration by tracheae
(4) Chordata — Notochord at some stage and separate anal and urinary openings to the outside

Q.154 In germinating seeds fatty acids are degraded exclusively in the:
(1) peroxisomes (2) mitochondria
(3) proplastids (4) glyoxysomes

Q.155 Which one of the following is the correct difference between **Rod cells** and **Cone cells** of our retina?

	Rod cells	**Cone cells**
(1) Overall function	Vision in poor light	Colour vision and detailed vision in bright light
(2) Distribution	More concent-rated in centre of retina	Evenly distributed all over retina
(3) Visual acuity	High	Low
(4) Visual pigment contained	lodopsin	Rhodopsin

Q.156 In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea?
(1) Archaea completely differ from both prokaryotes and eukaryotes
(2) Archaea completely differ from prokaryotes
(3) Archaea resemble eukarya in all respects
(4) Archaea have some novel features that are absent in other prokaryotes and eukaryotes

Q.157 Which one of the following proved effective for biological control of nematodal disese in plants?
(1) *Gliocladium virens*
(2) *Paecilomyces lilacinus*
(3) *Pisolithus tinctorius*
(4) *Pseudomonas cepacia*

Q.158 A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this?
(i) Lots of urea and phosphate fertilizer were used in the crops in the vicinity
(ii) the area was sprayed with DDT by an aircraft
(iii) The lake water turned green and stinky
(iv) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis
Which two of the above were the main causes of fish mortality in the lake?
(1) (i), (iii) (2) (i), (ii)
(3) (ii), (iii) (4) (iii), (iv)

Q.159 The table below gives the populations (in thousands) of ten species (A-J) in four areas (a-d) consisting of the number of habitats given within brackets against each. Study the table and answer the question which follows:

Area and Number of Habitats	Species, and their populations (in thousands) in the areas									
	A	B	C	D	E	F	G	H	I	J
a (11)	2.3	1.2	0.52	6.0	-	3.1	1.1	9.0	-	10.3
b (11)	10.2	-	0.62	-	1.5	3.0	-	8.2	1.1	11.2
c (13)	11.3	0.9	0.48	2.4	1.4	4.2	0.8	8.4	2.2	4.1
d (12)	3.2	10.2	11.1	4.8	0.4	3.3	0.8	7.3	11.3	2.1

Which area out of a to *d* shows maximum species diversity?
(1) *d* (2) *a*
(3) *b* (4) *c*

Q.160 During the propagation of a nerve impulse, the action potential results from the movement of:
(1) K^+ ions from intracellular fluid to extracellular fluid
(2) Na^+ ions from extracelluar fluid to intracellular fluid
(3) K^+ ions from extracellular fluid to intracellular fluid
(4) Na^+ ions from intracellular fluid to extracellular fluid

Q.161 Consider the following statements concerning food chains:
(i) Removal of 80% tigers from an area resulted in greatly increased growth of vegetation
(ii) Removal of most of the carnivores resulted in an increased population of deers
(iii) The length of food chains is generally limited to 3-4 trophic levels due to energy loss
(iv) The length of food chains may vary from 2 to 8 trophic levels
(1) (i), (iv) (2) (i), (ii)
(3) (ii), (iii) (4) (iii), (iv)

Q.162 Modern detergents contain enzyme preparations of:
(1) thermoacidophiles (2) thermophiles
(3) acidophiles (4) alkaliphiles

Q.163 What is antisense technology?
(1) When a piece of RNA that is complementary in sequence is used to stop expression of a specific gene
(2) RNA polymerase producing DNA
(3) A cell displaying a foreign antigen used for synthesis of antigens
(4) Production of somaclonal variants in tissue cultures

Q.164 Cornea transplant in humans is almost never rejected. This is because:
(1) It is composed of enucleated cells
(2) It is a non-living layer
(3) Its cells are least penetrable by bacteria
(4) It has no blood supply

Q.165 Which one of the following is incorrect about the characteristics of protobionts (coacervates and microspheres) as envisaged in the abiogenic origin of life?
(1) They were partially isolated from the surrounding
(2) They could maintain an internal environment
(3) They were able to reproduce
(4) They could separate combinations of molecules from the surroundings

Q.166 In humans, blood passes from the post caval to the diastolic right atrium of heart due to:
(1) stimulation of the sino auricular node
(2) pressure difference between the post caval and atrium
(3) pushing open of the venous valves
(4) suction pull

Q.167 Which one of the following is resistant to enzyme action?
(1) Pollen exine (2) Leaf cuticle
(3) Cork (4) Wood fibre

Q.168 According to Central Pollution Control Board (CPCB), which particulate size in diameter (in micrometers) of the air pollutants is responsible for greatest harm to human health?
(1) 1.0 or less (2) 5.2-2.5
(3) 2.5 or less (4) 1.5 or less

Q.169 Cellulose is the major component of cell walls of :
(1) *Pseudomonas* (2) *Saccharomyces*
(3) *Pythium* (4) *Xanthomonas*

Q.170 What does the filiform apparatus do at the entrance into ovule?
(1) It brings about opening of the pollen tube
(2) It guides pollen tube from a synergid to egg
(3) It helps in the entry of pollen tube into a synergid
(4) It prevents entry of more than one pollen tube into the embryo sac

Q.171 Match the disease in Column I with the appropriate items (pathogen/ prevention/ treatment) in Column II.

Column I	Column II
(A) Amoebiasis	(i) *Treponema pallidium*
(B) Diphtheria	(ii) Use only sterilized food and water
(C) Cholera	(iii) DPT Vaccine
(D) Syphilis	(iv) Use oval rehydration therapy

(1) A = (ii), B = (i), C = (iii), D = (iv)
(2) A = (ii), B = (iii), C = (iv), D = (i)
(3) A = (i), B = (ii), C = (iii), D = (iv)
(4) A = (ii), B = (iv), C = (i), D = (iii)

Q.172 Carbohydrates are commonly found as starch in plant storage organs. Which of the following five (1-5) properties of starch make it useful as a storage material?
(1) Easily translocated
(2) Chemically non-reactive
(3) Easily digested by animals
(4) Osmotically inactive
(5) Synthesized during photosynthesis
(1) (1), (3) and (5) (2) (1) and (5)
(3) (2) and (3) (4) (2) and (4)

Q.173 The slow rate of decomposition of fallen logs in nature is due to their:
(1) anaerobic environment around them
(2) low cellulose content
(3) low moisture content
(4) poor nitrogen content

Q.174 Cry1 endotoxins obtained from *Bacillus thuringiensis* are effective against:
(1) Nematodes (2) Boll worms
(3) Mosquitoes (4) Flies

Q.175 Consider the statements given below regarding contraception and answer as directed thereafter:
(i) Medical Termination of Pregnancy (MTP) during first trimester is generally safe
(ii) Generally chances of conception are nil until mother breast-feeds the infant upto two years
(iii) Intrauterine devices like copper-T are effective contraceptives
(iv) Contraception pills may be taken upto one week after coitus to prevent conception
Which two of the above statement are correct?
(1) (i), (iii) (2) (i), (ii)
(3) (ii), (iii) (4) (iii), (iv)

Q.176 Bacterial leaf blight of rice is caused by a species of:
(1) *Alternaria* (2) *Erwinia*
(3) *Xanthomonas* (4) *Pseudomonas*

Q.177 *Trichoderma harzianum* has proved a useful microorganism for:
(1) gene transfer in higher plants
(2) biological control of soil-borne plant pathogens
(3) bioremediation of contaminated soils
(4) reclamation of wastelands

Q.178 Which one of the following pairs of items correctly belongs to the category of organs mentioned against it?
(1) Nephridia of earthworm and malpighian tubules of cockroach — Excretory organs
(2) Wings of honeybee and wings of crow — Homologous organs
(3) Thorn of *Bougainvillea* and tendrils of *Cucurbita* — Analogous organs
(4) Nictitating membrane and blind spot in human eye — Vestigial organs

Q.179 To which type of barriers under innate immunity, do the saliva in the mouth and the tears from the eyes, belong?
(1) Physiological barriers
(2) physical barriers
(3) Cytokine barriers
(4) Cellular barriers

Q.180 Which one of the following groups of three animals each is correctly matched with their one characteristic morphological feature?

Animals	Morphological feature
(1) Scorpion, Spider, Cockroach	— Ventral solid central nervous system
(2) Cockroach, Locust, *Taenia*	— Metameric segmentation
(3) Liver fluke, Sea anemone, Sea cucumber	— Bilateral symmetry
(4) Centipede, Prawn, Sea urchin	— Jointed appendages

Q.181 A transgenic food crop which may help in solving the problem of night-blindness in developing countries is:
(1) *Bt*. Soybean
(2) Golden rice
(3) Flaver Saver tomatoes
(4) Starlink maize

Q.182 Which one of the following is the correct matching of the site of action on the given substrate, the enzyme acting upon it and the end product?
(1) Small intestine — Proteins $\xrightarrow{\text{Pepsin}}$ Amino acids
(2) Stomach — Fats $\xrightarrow{\text{Lipase}}$ Micelles
(3) Duodenum — Triglycerides $\xrightarrow{\text{Trypsin}}$ Monoglycerides
(4) Small intestine — Starch $\xrightarrow{\alpha-\text{amylase}}$ Disaccharide (Maltose)

Q.183 What will happen if the secretion of parietal cells of gastric glands is blocked with an inhibitor?
(1) In the absence of HCI secretion, inactive pepsinogen is not converted into the active enzyme pepsin
(2) Enterokinase will not be released from the duodenal mucosa and so trypsinogen is not converted to trypsin
(3) Gastric juice will be deficient in chymosin
(4) Gastric juice will be deficient in pepsinogen

Q.184 Nitrogen fixation in root nodules of *Alnus* is brought about by:
(1) *Frankia* (2) *Azorhizobium*
(3) *Bradyrhizobium* (4) *Clostridium*

Q.185 Which one of the following is the correct statement regarding the particular psychotropic drug specified?
(1) Morphine leads to delusions and disturbed emotions
(2) Barbiturates cause relaxation and temporary euphoria
(3) Hashish causes after thought perceptions and hallucinations
(4) Opium stimulates nervous system and causes hallucinations

Q.186 The energy-releasing process in which the substrate is oxidized without an external electron acceptor is called:
(1) aerobic respiration (2) glycolysis
(3) fermentation (4) photorespiration

Q.187 The haemoglobin of a human foetus:
(1) has only 2 protein subunits instead of 4
(2) has a higher affinity for oxygen than that of an adult
(3) has a lower affinity for oxygen than that of an adult
(4) its affinity for oxygen is the same as that of an adult

Q.188 Which one of the following pairs of plant structures has haploid number of chromosomes?
(1) Nucellus and antipodal cells
(2) Egg nucleus and secondary nucleus
(3) Megaspore mother cell and antipodal cells
(4) Egg cell and antipodal cells

Q.189 Which one of the following items gives its correct total number?
(1) Types of diabetes — 3
(2) Cervical vertebrae in humans — 8
(3) Floating ribs in humans — 4
(4) Amino acids found in proteins — 16

Q.190 Keeping in view the "fluid mosaic model" for the structure of cell membrane, which one of the following statements is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other (described as flip-flop movement)?
(1) While proteins can flip-flop, lipids cannot
(2) neither lipids, nor proteins can flip-flop
(3) Both lipids and proteins can flip-flop
(4) While lipids can rarely flip-flop proteins cannot

Q.191 Which one of the following is linked to the discovery of Bordeaux mixture as a popular fungicide?
(1) Loose smut of wheat
(2) Black rust of wheat
(3) Bacterial leaf blight of rice
(4) Downy mildew of grapes

Q.192 Main objective of production/use of herbicide resistant GM crops is to:
(1) encourage eco-friendly herbicides
(2) reduce herbicide accumulation in food articles for health safety
(3) eliminate weeds from the field without the use of manual labour
(4) eliminate weeds from the field without the use of herbicides

Q.193 Which one of the following in birds, indicates their reptilian ancestry?
(1) Two special chambers crop and gizzard in their digestive tract
(2) Eggs with a calcareous shell
(3) Scales on their hind limbs
(4) Four-chambered heart

Q.194 Consider the following statements about biomedical technologies,
(i) During open heart surgery blood is circulated in the heart-lung machine
(ii) Blockage in coronary arteries is removed by angiography
(iii) Computerised Axial Tomography (CAT) shows detailed internal structure as seen in a section of body.
(iv) X-ray provides clear and detailed images of organs like prostate glands and lungs
Which two of the above statements are correct?
(1) (i) and (iii) (2) (i) and (ii)
(3) (ii) and (iv) (4) (iii) and (iv)

Q.195 *Ascaris* is characterized by :
(1) presence of true coelom but absence of metamerism
(2) presence of true coelom and metamerism (metamerisation)
(3) absence of true coelom but presence of metamerism
(4) presence of neither true coelom nor metamerism

Q.196 In humans, at the end of the first meiotic division, the male germ cells differentiate into the:
(1) spermatids
(2) spermatogonia
(3) primary spermatocytes
(4) secondary spermatocytes

Q.197 Electrons from excited chlorophyll molecule of photosystem II are accepted first by:
(1) Quinone (2) Ferredoxin
(3) Cytochrome-b (4) Cytochrome-f

Q.198 Importance of day length in flowering of plants was first shown in:
(1) Cotton (2) *Petunia*
(3) *Lemna* (4) Tobacco

Q.199 The fleshy receptacle of syconus of fig encloses a number of:
(1) berries (2) mericarps
(3) achenes (4) samaras

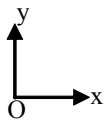
Q.200 Which one of the following scientist's name is correctly matched with the theory put fourth by him?
(1) deVries — Natural selection
(2) Mendel — Theory of pangenesis
(3) Weismann — Theory of continuity of germplasm
(4) Pasteur — Inheritance of acquired characters

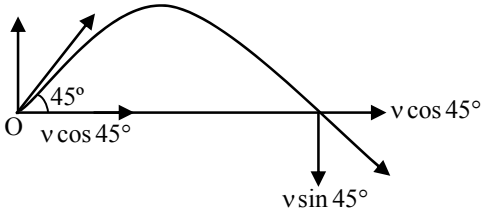
ANSWER KEY (AIPMT-2008)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans	1	1	1	1	3	3	4	2	3	2	4	3	3	1	4	4	4	2	1	2
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans	4	1	3	1	4	4	2	3	1	3	4	4	3	1	1	2	2	3	1	3
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	2	1	3	2	2	2	3	3	4	3	1	1	4	3	1	1	4	3	3	2
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans	4	4	3	3	2	3	1	2	2	3	3	1	1	1	4	2	4	3	2	4
Ques.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans	4	1	3	2	4	3	2	4	2	4	3	1	2	2	4	4	2	1	1	3
Ques.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans	3	4	4	3	4	3	4	3	2	1	3	1	3	1	3	4	4	1	2	3
Ques.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
Ans	3	2	3	1	2	2	4	3	3	4	4	4	3	2	2	1	3	4	3	4
Ques.	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
Ans	4	3	2	4	1	2	2	2	2	4	3	2	2	4	1	4	2	1	1	2
Ques.	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Ans	3	4	1	4	3	2	1	3	3	3	2	4	3	2	1	3	2	1	1	1
Ques.	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
Ans	2	4	1	1	2	3	2	4	3	4	4	3	3	1	4	4	1	4	3	3

HINTS & SOLUTIONS

1. Only vertical component of velocity changes during projectile motion so, there is change in momentum in vertical direction only.





Change in momentum = $\Delta\vec{P}$

$= \Delta P_x \hat{i} + \Delta P_y \hat{j}, \text{since } \Delta P_x = 0$

$= \Delta P_y \hat{j} = \vec{P}_{fy} - \vec{P}_{iy}$;

$P_{iy} = mv\sin 45°, P_{fy} = -mv\sin 45°$

$\Delta\vec{P} = -mv\sin 45°, -mv\sin 45°$

$= -2mv\sin 45° = -\sqrt{2}mv_j \left|\Delta\vec{P}\right|$

$= \sqrt{2}mv$

$-$ve sign shows the direction of change in momentum in $-$ve y-direction.

2. Flux linkage = Flux through each turn × number of turns

$$\phi = 500 \times 4 \times 10^{-3} = 2\text{Wb}$$

since $\phi = Li$

$$\Rightarrow L = \frac{\phi}{i} = \frac{2}{2} = 1\text{H}$$

3. $\vec{F} = q\left(\vec{v} \times \vec{B}\right)$, i.e. magnetic force is perpendicular to both velocity and magnetic field. A force $\perp_r$, to $\vec{V}$ does no work or no power delivered by force which is $\perp_r$, $\vec{V}$ hence no kinetic energy or speed will change.

since $P = \vec{F}.\vec{V} = 0$

As $\vec{F} \perp_r, \vec{V} \perp_r, \vec{dr}$.

or $dW = \vec{F}.\vec{dr} = 0$

4. Distance covered in n^{th} second,

$$S_n = u + \frac{1}{2}a(2n-1);$$

$$= 0 + \frac{1}{2}\times\frac{4}{3}(2\times3-1)$$

$$= \frac{1}{2}\times\frac{4}{3}\times5 = \frac{10}{3}\,m$$

5. de-Broglie wavelength associated with electron moving with velocity v,

$$\lambda = \frac{h}{mv}$$

So, $\lambda_e = \dfrac{h}{9.1\times10^{-31}\times3\times10^{6}}$

Wavelength of particle of mass 1 mg moving with velocity v.

$$\lambda_p = \frac{h}{10^{-3}\times v}$$

As given, $\lambda_e = \lambda_p$

$$\Rightarrow \frac{h}{10^{-3}\times v} = \frac{h}{9.1\times10^{-31}\times3\times10^{6}}$$

$$v = \frac{27.3\times10^{-25}}{10^{-3}}\,m/s = 2.73\times10^{-21}\,m/s$$

6. $F_{ext.} = \dfrac{dp}{dt} = \dfrac{d(mv)}{dt};$

m = mass of system as conveyor belt with sand drops at time t.

$$F_{ext.} = m\frac{dv}{dt} + v\frac{dm}{dt}$$

but $v \to$ constant, so, $\dfrac{dv}{dt} = 0$

$$F_{ext} = v\frac{dm}{dt} = Mv$$

$F_{ext.}$ is in direction of $\vec{v}$ of belt.

OR

Since $m.\dfrac{dv}{dt} = F_{ext} + F_{reaction}$ .....(i)

Consider belt as a system with variable mass

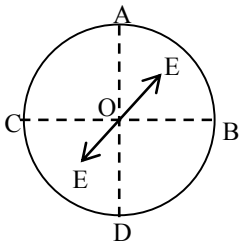
$\dfrac{dv}{dt} = 0$, m = mass of system at time t

$$F_{reaction} = v_{rec}\cdot\frac{dm}{dt} = -v\frac{dm}{dt} \qquad .....(ii)$$

$$\Rightarrow \quad F_{ext.} = v\cdot\frac{dm}{dt} = Mv.$$

$\vec{F}_{ext}$ is in direction of $\vec{v}$ to keep belt moving with constant velocity.

7. Electric field due to the given charged ring is zero at centre *'O'*. So electric field due to *AKB* is equal and opposite to electric field due to *ACDB*, from the principle of superposition.



Since $\vec{E}$ is field strength of O along $\vec{KO}$ So electric field strength due to *ACDB* along $\vec{OK}$ and it is equal to E.

8. $R = R_0\cdot A^{1/3}$

So nuclear density $= \dfrac{A\cdot m}{v}$

m = mass of each nucleon, A = mass number

$$= \frac{3m}{4\pi R_0^3} = \text{independent of A.}$$

9. Mass defect

$$\Delta m = ZM_p + (A-Z)M_n - M(A,Z)$$

Binding energy= ΔmC^2

$$BE = \left[ZM_p + (A-Z)M_n - M(A,Z)\right].C^2$$

$$M(A,Z) = ZM_p + (A-Z)M_n - \frac{BE}{C^2}$$

10. For constant acceleration

$$v^2 = u^2 + 2as$$

$$(20)^2 = (10)^2 + 2\times a\times135$$

$$a = \frac{300}{270}\,ms^{-2}$$

As $v = u + at$

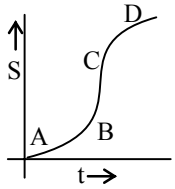
$20 = 10 + a\times t$

$10 = at$

$10 = \dfrac{300}{270}\times t$

$t = 9\,sec$

11. In distance-time graph, the speed at instant is expressed by slope at that instant. The slope is maximum at C.



12. Heat required to boil water

$Q = mc\Delta T$

$= 1 \times 1 \times (100 - 20) = 80\text{kcal}$

Heat given by supply

$H = V.i.t = 220 \times 4 \times t$

$H = Q$

$\Rightarrow 220 \times 4 \times t = 80{,}000$

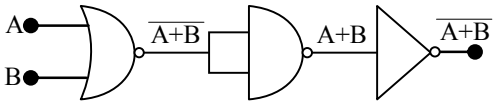
$$t = \frac{80{,}000}{220 \times 4}$$

$$= \frac{1000}{11}\text{sec}$$

$$= \frac{1000}{11 \times 60} = 1.5 \text{ min}$$

13. In the phenomenon of electric discharge tube through gases at low pressure, the coloured glow in the tube appears as a result of collisions between the charged particles emitted from cathode and the atoms of the gas.

14. The output is the output of NOR gate hence the combination will act as a NOR gate.



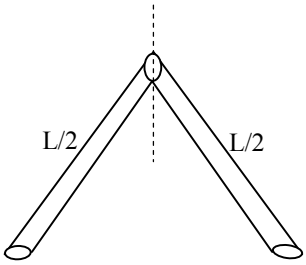
15. $V = \frac{4}{3}\pi r^3$

$$\frac{\Delta V}{V} \times 100 = 3 \times \left(\frac{\Delta r}{r} \times 100\right)$$

% error in volume = 3×% error in radius

$= 3 \times 2 = 6\%$

16.



Moment of inertia of the system

$$I = \frac{M(L/2)^2}{3} + \frac{M(L/2)^2}{3}$$

$$= \frac{ML^2}{12} + \frac{ML^2}{12} = \frac{ML^2}{6}$$

17. Frequency corresponding to 2eV is given by

$E = h\nu$

$\Rightarrow \quad 2 \times 1.6 \times 10^{-19} = 66 \times 10^{-34} \times \nu$

$$\nu = \frac{3.2 \times 10^{-19}}{6.6 \times 10^{-34}} = 5 \times 10^{14} \text{ Hz}$$

18. $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$I_{max} + I_{min}$

$= \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 + \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$= \left(I_1 + I_2 + 2\sqrt{I_1 I_2}\right) + \left(I_1 + I_2 - 2\sqrt{I_1 I_2}\right)$

$= 2(I_1 + I_2)$

19. In cyclic process since initial and final states are same internal energy is a state function therefore initial and final internal energies are also same. So change in internal energy is zero hence E = 0.

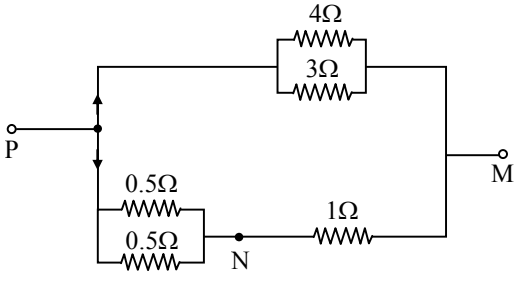
20. $i_1 = 1$ amp = current through 4Ω

i_2 = current through 3Ω and

$$\frac{i_1}{i_2} = \frac{3}{4} \Rightarrow i_2 = \frac{4}{3}\text{amp}$$

$$i_3 = i_1 + I_2 = 1 + \frac{4}{3} = \frac{7}{3}\text{amp}$$

and $\frac{i_3}{i_4} = \frac{3/4}{12/7} \Rightarrow \frac{7}{3} \times \frac{12}{7} = i_4 \times \frac{5}{4}$



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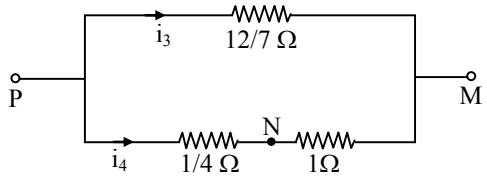


$\therefore i_4 = \frac{16}{5}$ amp = 3.2 amp

V_{NM} = P.D. across N and M = $i_4 \times 1\Omega$

= 3.2 × 1 = 3.2 volt

Second approach.

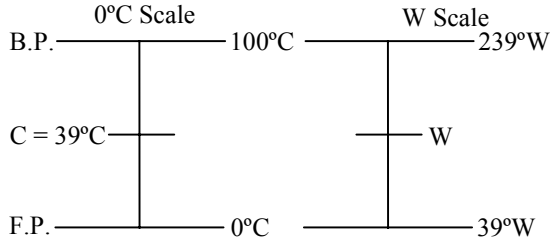
$V_{PM} = 1\ A \times 4\Omega = 4$ volt

$\frac{V_{PN}}{V_{NM}} = \frac{1}{4}$ and $V_{PN} + V_{NM} = 4$ V

$\frac{1}{4} . V_{NM} + V_{NM} = 4$

$\therefore V_{NM} = \frac{16}{5}$ V = 3.2 V

21.



W is the temperature on new scale corresponding to 39°C on °C scale.

So, $\frac{C-0}{100-0} = \frac{W-39}{239-39}$

$\Rightarrow \frac{C}{100} = \frac{W-39}{200}$

or $W = \frac{C}{100} \times 200 + 39$

$= \frac{39}{100} \times 200 + 39 = 78 + 39 = 117$

So, temperature on new scale is 117°W corresponding to 39°C.

22. Given $y = 0.25 \sin (10\pi x - 2\pi t)$

Comparing with equation of wave

$y = A \sin (kx - \omega t)$

$A = 0.25$, $k = 10\pi$, $\omega = 2\pi$

$\frac{2\pi}{\lambda} = 10\pi$ $\qquad 2\pi f = 2\pi$

$f = 1$ Hz

$\lambda = \frac{1}{5} = 0.2$ m

When sign of coefficient of t and x are opposite it means $\frac{dx}{dt} = V > 0$ i.e., wave is propagating in the direction of growing x.

23. Since

$V = \frac{Q}{4\pi\varepsilon_0 r}$ and $E = \frac{Q}{4\pi\varepsilon_0 r^2}$;

Given $V = Q \times 10^{11} = Q\, 4\pi\varepsilon_0 r$

$\Rightarrow \quad r = \frac{1}{4\pi\varepsilon_0 \times 10^{11}}$

i.e., $\quad E = \frac{V}{r}$

$\Rightarrow \quad E = \frac{QV}{r} = Q \times 10^{11} \times 4\pi\varepsilon_0 \times 10^{11}$

$= 4\pi\varepsilon_0 Q \times 10^{22}$ volt m^{-1}

24. $C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ = velocity of em wave through medium having permittivity (ε_0) and permeability (μ_0).

25. Path difference $\Delta x = x_1 - x_2 = 15 - 10 = 5$ m

$\lambda = \upsilon T = 300 \times 0.05 = 15$ m

$\Delta\phi = \frac{2\pi}{\lambda} . \Delta x = \frac{2\pi}{15} \times 5 = \frac{2\pi}{3}$

26. Maximum acceleration $a = -\omega^2 A$

$\frac{a_1}{a_2} = \frac{\omega_1^2 A}{\omega_2^2 A} = \frac{(100)^2}{(1000)^2} = \frac{1}{10^2}$

27. Lattice parameter

$a = \frac{4r}{\sqrt{2}}$

$r = \frac{\sqrt{2}a}{4} = \frac{\sqrt{2} \times 3.6}{4}$

$= 0.9 \times 1.41 = 1.27$ Å

28. Energy used per sec^{-1} to operate turbine

= mgh = 15 × 10 × 60 joule

= 9000 joule

Power supplied to turbine = 9000 joule sec^{-1}

Power loss due to friction = 900 joule sec^{-1}

Power generated by turbine

= (9000 – 900) joule sec^{-1}

= 8100 joule sec^{-1} = 8.1 kW

Second approach

$P_{generated} = P_{input} \times \frac{90}{100} = \frac{mgh}{t} \times \frac{90}{100}$

$= \frac{15 \times 10 \times 60 \times 90}{100} = 8.1$ kW

29. Energy stored in capacitor for field

$$E = \frac{1}{2}CV^2$$

$$= \frac{1}{2}\left(\frac{\varepsilon_0 A}{d}\right)(E \cdot d)^2$$

$$= \frac{1}{2}\varepsilon_0 AE^2 d$$

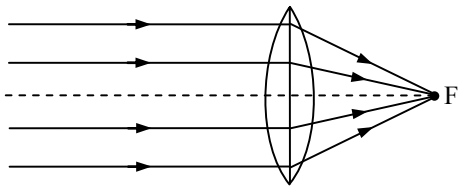
Energy stored in capacitor + Energy loss in the process of charging = Energy given by cell.

$$= \left(\frac{A\varepsilon_0}{d}\right)V^2$$

= 2 × Energy stored in capacitor

Since energy stored in capacitor = Energy loss in the process of storing the charge in capacitor.

30.



$u = 1.5 \times 10^{11}$ m

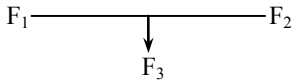
$u = f = 10$ cm $= 0.1$ m

$$\frac{\upsilon}{u} = \frac{h_i}{h_0}$$

$$\Rightarrow \quad \frac{0.1}{1.5\times10^{11}} = \frac{h_i}{1.39\times10^{9}}$$

$$h_i = \frac{1.39\times10^{8}}{1.5\times10^{11}} = 9.2 \times 10^{-4} \text{ m}$$

31. Total force on the current carrying closed loop should be zero, if placed in uniform magnetic field.



$F_{horizontal} = (F_3 - F_1)$

$F_{vertical} = F_2$

Resultant of $\vec{F_1}$, $\vec{F_2}$ and $\vec{F_3}$ is $\vec{F}$

where $F = \sqrt{(F_3 - F_1)^2 + F_2^2}$

Since total force = 0, hence force on QP is equal to $\vec{F}$ in magnitude but opposite direction.

$$F_{QP} = \sqrt{(F_3 - F_1)^2 + F_2^2}$$

32. $R = \dfrac{\rho l}{A}$

Now, $l = l + \dfrac{l}{10} = \dfrac{11l}{10}$

and therefore, $A = \dfrac{10A}{11}$

So $R' = \dfrac{P\times\left(\frac{11l}{10}\right)}{\left(\frac{10A}{11}\right)} = \dfrac{\rho l}{A} \times \dfrac{(11)^2}{(10)^2} = 1.21\ R$

Now resistance becomes 1.21 times of initial and specific resistance is the intrinsic property so remains same.

33. Curie temperature is that temperature above which a ferromagnet becomes paramagnet.

34. Energy density and Young's modulus have same dimensions and equal to $[ML^{-1}T^{-2}]$
Dielectric constant and refractive index are dimensionless.

35. Since $E_0 = -13.6$ eV ; Energy in the excited state

$$= \frac{-13.6}{4} = -3.4 \text{ eV}$$

ΔE = Excitation energy
= Energy needed to raise the electron from ground state to higher level
$= -3.4 + 13.6 = 10.2$ eV

36. Voltage gain $= \dfrac{A_V}{1+\beta.A_V}$,

where $\beta = \dfrac{9}{100} = 0.09$, voltage gain = 10

$$\Rightarrow \quad 10 = \frac{A_V}{1+\frac{9}{100}.A_V}$$

$$\Rightarrow A_V = \frac{10}{0.1} = 100$$

37. Current through galvanometer

$$I = \frac{3V}{50\Omega + 2950\Omega} = 10^{-3} \text{ A}$$

Current for 30 division $= 10^{-3}$ A

Current for 20 division $= \dfrac{20}{30} \times 10^{-3}$

$$= \frac{2}{3} \times 10^{-3} \text{ A} = \frac{3}{50+R}$$

$$\Rightarrow \quad R = 4450\ \Omega$$

38. $m_1\upsilon_1 = m_2\upsilon_2$
gun shell

$4 \times \upsilon_1 = \frac{200}{1000} \times \upsilon_2$

$\frac{\upsilon_2}{\upsilon_1} = 20$ ...(1)

$\frac{1}{2} m_1 \upsilon_1^2 + \frac{1}{2} m_2 \upsilon_2^2 = 1.05 \times 10^3$

$2\upsilon_1^2 + \frac{1}{10}\upsilon_2^2 = 1.05 \times 10^3$ ...(2)

By equation (1) and (2)

$\upsilon_2 = 100$ m/s

39. $e = E_0 \sin \omega t$

$i = I_0 \sin(\omega t - \phi)$

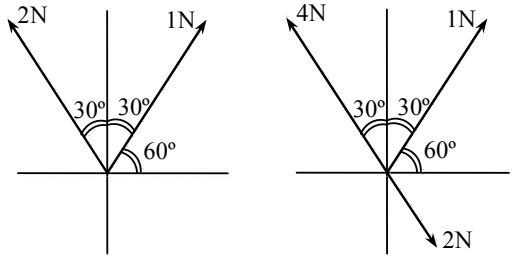
$P_{av.} = E_{rms} \cdot I_{rms} \cdot \cos\phi$

$= \frac{E_0}{\sqrt{2}} \cdot \frac{I_0}{\sqrt{2}} \cdot \cos\phi = E_0 I_0 \cos\phi$

40. 4N and 2N are opposite

So net = 4 – 2 = 2N

Now figure becomes

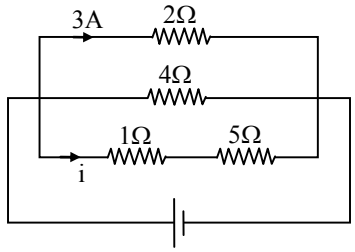


Horizontal component of 2N along –ve x-direction is $x_1 = 2 \sin 30^\circ = 1$ N

Horizontal component of 1 N along +ve x-direction is $x_2 = 1 \cos 60^\circ = \frac{1}{2}$ N

So, net horizontal force is $\frac{1}{2}$ N along –ve x-direction, hence $\frac{1}{2}$ N is required in +ve x-direction

41. Voltage across all three branches are same, i.e.,



$3 \times 2 = i \times (5 + 1)$

$i = 1$A

Power dissipated in 5Ω

$P = i^2 R$

$= (1)^2 \times 5 = 5$ watt

42. $x_1 = N_0 e^{-5\lambda t}$

$x_2 = N_0 e^{-\lambda t}$

$\frac{x_1}{x_2} = e^{-5\lambda t + \lambda t}$

$\frac{1}{e} = e^{-4\lambda t}$

$e^{-1} = e^{-4\lambda t} \Rightarrow t = \frac{1}{4\lambda}$

43. $E_{incident} = W + K_{max}$; $K_{max} = eV_0$

$hv = hv_0 + eV_0$; stopping potential $= V_0$

$\frac{hc}{\lambda} = 6.2e + 5e$

$\lambda = \frac{h \times c}{11.2 \times 1.6 \times 10^{-19}} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{11.2 \times 1.6 \times 10^{-19}}$

$= 1.1 \times 10^{-7}$ m

Hence the wavelength of ultraviolet region.

44. $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$\upsilon = \frac{dx}{dt} = a\omega \cos\left(\omega t + \frac{\pi}{6}\right)$

$\upsilon_{max} = a\omega$

$\frac{a\omega}{2} = a\omega \cos\left(\omega t + \frac{\pi}{6}\right)$

$\omega t + \frac{\pi}{6} = \frac{\pi}{3} \Rightarrow \omega t = \frac{\pi}{6}$

$t = \frac{\pi}{6\omega} = \frac{\pi \times T}{6 \times 2\pi} = \frac{T}{12}$

45. $P = P_1 + P_2 = \frac{1}{f_1} + \frac{1}{f_2}$

$P = \frac{f_1 + f_2}{f_1 . f_2}$

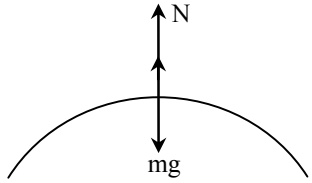
46. $PV = nRT$ or $\frac{PV}{M} = \frac{1}{M_0} RT$

or $\frac{P}{\rho} = \frac{RT}{M_0} \Rightarrow \frac{\rho}{P} \propto \frac{1}{T}$

$\Rightarrow \frac{\rho_1}{P_1} / \frac{\rho_2}{P_2} = \frac{T_2}{T_1}$ or $\frac{x}{\rho_2 / P_2} = \frac{383}{283}$

or $\frac{\rho_2}{P_2} = \frac{283}{383} x$

47. $mg - N = \frac{mv^2}{r}$



When N = 0, for weightlessness

$\frac{mv^2}{r} = mg$

$\Rightarrow \quad \upsilon^2 = rg = 20 \times 10 = 200$

$\upsilon = 14.14$

48. $A = \pi r^2 = 0.04\pi$

$\phi = BA \cos\theta$

$= \frac{1}{\pi} \times 0.04\ \pi \times \cos 60^\circ = 0.02$ Wb

49. $MK_1^2 = MR^2$

$K_1 = R$

$MK_2^2 = \frac{MR^2}{2}$

$K_2 = \frac{R}{\sqrt{2}}$

$\frac{K_2}{K_1} = \frac{\sqrt{2}}{R} = \frac{1}{\sqrt{2}}$

50. $E \propto l_1$ and $E - \frac{E}{R+r} . r \propto l_2$

$\Rightarrow \frac{r+R}{R} = \frac{l_1}{l_2}$

$\Rightarrow r = \left(\frac{l_1}{l_2} - 1\right) . R$

$= \frac{110-100}{100} \times 10 = 1\Omega$

51. In case of diatomic molecules (X_2) of halogens the bond dissociation energy decreases in the order :

$Cl_2 > Br_2 > F_2 > I_2$

The oxidizing power, electronegativity and reactivity decrease in the following order :

$F_2 > Cl_2 > Br_2 > I_2$

Electron gain enthalpy fo halogens decreases in the following order :

$Cl_2 > F_2 > Br_2 > I_2$

The low value of electron gain enthalpy of fluorine is due to small size of fluorine atom.

52. The average translational KE of one molecule of an ideal gas is as follows :

$K_t = \frac{KE}{N_A} = \frac{3/2\,RT}{N_A} = \frac{3}{2} KT$

When R/N_A = Boltzmann constant

i.e., $E_t \propto T$

Thus, at constant temperature KE of molecules remains same.

53. $2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$

2 0 0 initially

2(1 – x) 2x x at eq.

Total amount of moles at equilibrium

$= 2(1-x) + 2x + x = 2 + x$

$K_p = \frac{[P_{AB}]^2 [P_{B_2}]}{[P_{AB_2}]^2}$

$K_p = \frac{\left[\frac{2x}{2+x} \times P\right]^2 \times \left[\frac{x}{2+x} \times P\right]}{\left[\frac{2(1-x)}{2+x} \times P\right]^2}$

$K_p = \frac{\frac{4x^3}{2+x} \times P}{4(1-x)^2}$

$K_p = \frac{4x^3 \times P}{2} \times \frac{1}{4}$ (As $1 - x \simeq 1$ and $2 + x \simeq 2$)

$x = (8K_p/4P)^{1/3} = (2K_p/P)^{1/3}$

54. According to the given data, when concentration of Br_2 is doubled, the initial rate of disappearance of Br_2 remains unaffected. So order of reaction with respect to Br_2 is zero. The rate law for the reaction will be :

$k\,[CH_3COCH_3]\,[H^+]$

55. $Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq.) + 3OH^-(aq.)$

$K = \frac{[Fe^{3+}]\,[OH^-]^3}{[Fe(OH)_3]}$

$K = [Fe^{3+}]\,[OH^-]^3$

(as activity of solid is taken unity)

Concentration of OH^- ion in the reaction is decreased by 1/4 times then equilibrium concentration of Fe^{3+} will be increased by 64 times in order to keep the value of K constant.

56. $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

1 5 3 4 (Volume)

So 1 volume or 1 litre of propane requires 5 volume or 5 litre of O_2 to burn completely.

57. $pH = -\log_{10}[H^+]$

$[H+] = 10^{-pH}$

$[H+]$ of solution 1 $= 10^{-3}$

$[H+]$ of solution 2 $= 10^{-4}$

$[H+]$ of solution 3 $= 10^{-5}$

Total concentration of $[H^+]$

The volume taken in each case is 1 L

$$= 10^{-3}(1 + 1 \times 10^{-1} + 1 \times 10^{-2}$$

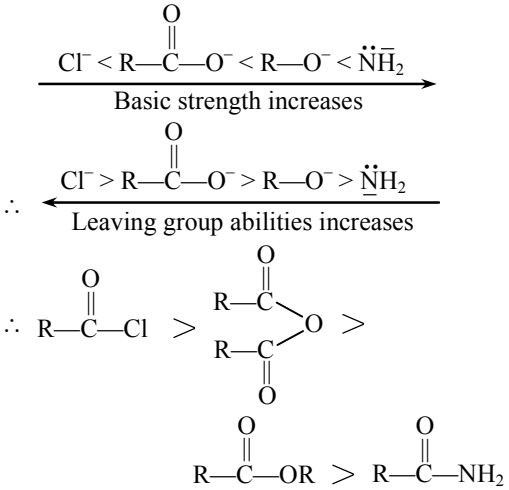
$$= 10^{-3}\left(\frac{1}{1} + \frac{1}{10} + \frac{1}{100}\right)$$

$$= 10^{-3}\left(\frac{111}{100}\right) = 1.11 \times 10^{-3}$$

Therefore, H^+ ion concentration in mixture of equal volume of these acid solutions

$$= \frac{1.11 \times 10^{-3}}{3} = 3.7 \times 10^{-4}\ M$$

58. The relative reactivities of acyl compound towards nucleophilic substitution will depend upon the nature of leaving group ability. Weak bases are good leaving group.



59. DNA contains two types of nitrogenous bases, i.e.,

Purine → Adenine (A), Guanine (G)

Pyrimidine → Cytosine (C), Thymine (T)

Adenine pairs with thymine (A : T) by two hydrogen bonds and Guanine with Cytosine (G : C) by three hydrogen bonds.

60. $\underset{sp}{H—C}\equiv\underset{sp}{C—H} > \underset{sp^2}{CH_2}=\underset{sp^2}{CH_2} > \underset{sp^3}{CH_3}—\underset{sp^3}{CH_3}$

(Acidic character)

Conjugate base of the given acid is as follows :

$C^{\ominus}C—H < {}^{\ominus}CHCH_2 < {}^{\ominus}CH_2—CH_3$

(Basic character)

So conjugate base of stronger acid is weaker and vice-versa.

61. Equimolar solutions of the given chlorides when prepared in water forms their respective hydroxides. $Be(OH)_2$ is amphoteric, but the hydroxides of other alkaline earth metals are basic. The basic strength increases down the group. Therefore higher the basic character higher will be the pH.

62. As smaller the size of cation, higher will be hydration and its effective size will increase so mobility in aqueous solution will decrease.

63. According to Heisenberg uncertainty principle

$$\Delta p \,.\, \Delta x \geq \frac{h}{4\pi}$$

$$m\Delta\upsilon.\Delta x \geq \frac{h}{4\pi}$$

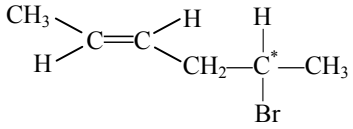
$$(m.\Delta\upsilon)^2 \geq \frac{h}{4\pi}$$

$$\Delta\upsilon \geq \frac{1}{2m}\sqrt{(h/\pi)}$$

64. Given compound,

$CH_3CH{=}CHCH_2CHBrCH_3$

may also be written as follows :



Both geometrical isomerism (cis-trans form) and optical isomerism is possible in this compound.

Number of optical isomer $= 2^n = 2^1 = 2$

(Here n = number of asymmetric carbon)

Therefore, total number of stereoisomers

$= 2 + 2 = 4$

65. $[Fe(CN)_6]^{3-} \longrightarrow [Fe(CN)_6]^{4-}$, $E^o = +0.35$ V

$Fe^{3+} \longrightarrow Fe^{2+}$, $E^o = +0.77$ V

Higher the positive reduction potential, stronger is the oxidizing agent. Oxidizing agent oxidizes other compounds and gets itself reduced easily.

66. As ionization enthalpy (both first and second) increases from left to right across the period. Only chromium is exceptional due to the stable configuration ($3d^5$) so the correct order is :

Cr > Mn > V > Ti

66. The electron density of 'phenol ring' is most among chloro benzene, benzyl alcohol and nitrobenzene.

In phenol, due to 'OH' group there will be both +M and "–I". But +M-effect of 'OH' dominates over its "–I".

68.

$$\underset{\text{Bond order}}{He_2^+} < \underset{0.5}{O_2^-} < \underset{1.5}{NO} < \underset{2.5}{C_2^{2-}} < \underset{3.0}{}$$

69.

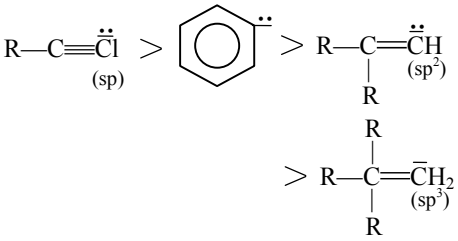
$$\underset{x\text{ mole}}{PbO} + \underset{2x\text{ moles}}{2HCl} \longrightarrow \underset{x\text{ mole}}{PbCl_2} + H_2O$$

$\frac{6.5}{224}$ mole $\quad \frac{3.2}{36.5}$ mole

= 0.029 mole = 0.087 mole

Thus, 0.029 mole of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl.

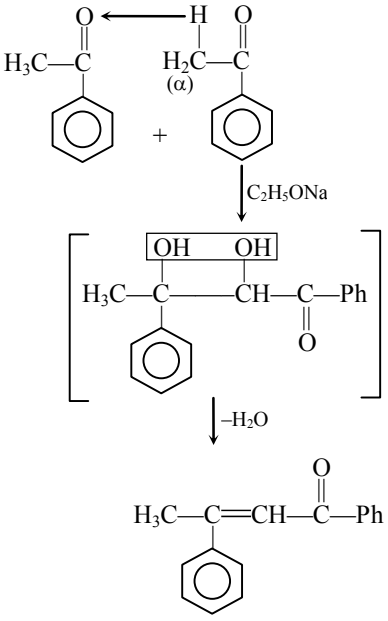
70. More is the electronegativity of hybrid atom, more will be its tendency to retain the (–)ve charge.



The electronegativity of hybrid orbitals, depends on their 's' character. It follows given order,

$$\underset{\text{electronegativity increases}}{\xleftarrow{sp > sp^2 > sp^3}}$$

71. Acetophenone when reacted with base like C_2H_5ONa, will undergo aldol condensation reaction with simultaneous loss of H_2O molecule.



72. Weight of 6.023×10^{23} molecules of water = 18 g

As volume occupied by 6.023×10^{23} molecules of water (density = 1 g cm^{-3}) will be

$$= \frac{18g}{1g\,cm^{-3}}$$

$= 18\ cm^3$ or mL

So volume occupied by one molecule of water

$$= \frac{18}{6.023 \times 10^{23}} = 2.988 \times 10^{-23}$$

$= 3.0 \times 10^{-23}\ cm^3$

73.

$$H_2 + Cl_2 \longrightarrow 2HCl$$

$\Delta H_{reaction} = \Sigma(BE)_{reactant} - \Sigma(BE)_{product}$

$= [(BE)_{H—H} + (BE)_{Cl—Cl}] - [2(BE)_{H—Cl}]$

$= 434 + 242 - (431) \times 2$

$= -186$ kJ

As $\Delta H_{reaction} = -186$ kJ

So enthalpy of formation of HCl

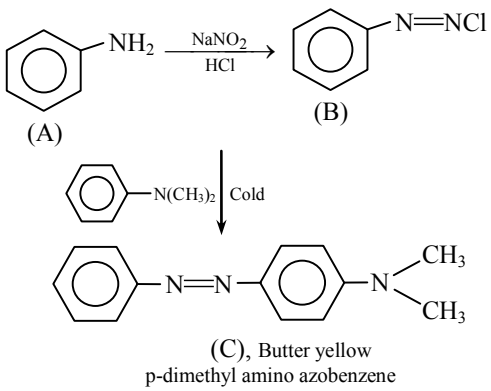
$$= \frac{-186\,kJ}{2}$$

$= -93$ kJ mol^{-1}

74. The oxidation state of Co in $[Co(OX)_2(OH)_2]^-$ is +5. This is not possible. The oxidation state of Ti in $[Ti(NH_3)_6]^{3+}$ is +3. Ti^{3+} has just one unpaired electron. O.S. of 'V' in $[V(gly)_2(OH)_2(NH_3)_2]^+$ is again +3 and it means the number of unpaired electrons is 2. Oxidation state of Fe in $[Fe(en)\ (bpy)\ (NH_3)_2]^{2+}$ is +2. So it contains 4 unpaired electron. More is the oxidation number of unpaired electron more will be the paramagnetic character.

75. Natural rubber is cis-1,3-polyisoprene and has only cis-configuration at energy double bond.

76.



(A), Butter yellow
p-dimethyl amino azobenzene

77. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

$\Delta H = \Delta E + \Delta nRT$

Here, Δn = Change in number of moles of product and reactant

As Δn = +ve, so ΔH = +ve

$\Delta S = S_{product} - S_{reactant}$

ΔS = +ve

78. Uncertainty in momentum

$(m\Delta\upsilon) = 1 \times 10^{-18}$ g cm s^{-1}

Uncertainty in velocity

$$(\Delta\upsilon) = \frac{1\times10^{-18}}{9\times10^{-28}} = 1.1 \times 10^9 \text{ cm s}^{-1}$$

79. The angular shape of ozone molecule consists of 2 sigma and 1 pi-bond.

80. For body centered cubic structure, packing fraction = 0.68, i.e., 68% of the unit cell is occupied by atoms and 32% is empty.

81. $HI(g) \rightleftharpoons 1/2H_2(g) + 1/2I_2(g)$

$$K = \frac{[H_2]^{1/2}[I_2]^{1/2}}{[HI]} = 8$$

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

$$K' = \frac{[HI]^2}{[H_2][I_2]} = (1/8)^2$$

$K' = 1/64$

82.

$X \rightleftharpoons Y + Z$ ...(1)

$A \rightleftharpoons 2B$ ...(2)

$X \rightleftharpoons Y + Z$

Initially	1	0	0
At eq.	1–α	α	α

Total no. of moles at equilibrium

$= 1 - \alpha + 2\alpha = 1 + \alpha$

$A \rightleftharpoons 2B$

Initially, when t = 0	1	0
At eq.	1 – α	2α

Total no. of moles at equilibrium

$= 1 - \alpha + 2\alpha = 1 + \alpha$

$$K_{p_1} = \frac{P_Y \times P_Z}{P_X} = \frac{[(\alpha/1+\alpha)P_1][\alpha/1+\alpha)\times P_1]}{[1-\alpha/1+\alpha]\times P_1}$$

$$K_{p_2} = \frac{(P_B)^2}{P_A} = \frac{[(2\alpha/1+\alpha)\times P_2]^2}{[1-\alpha/1+\alpha]\times P_2}$$

$$\frac{K_{p_1}}{K_{p_2}} = \frac{P_1}{4P_2}$$

$$\frac{P_1}{P_2} = \frac{36}{1} = 36:1$$

83. Thyroxine and adrenaline are amine hormone. These are water soluble hormones having amino groups.

84. According to Kohlrausch's law "At infinite dilution, each ion makes definite contribution to molar conductance of an electrolyte whatever be the nature of the other ion of the electrolyte"

$$\Lambda_m^\infty = \lambda_+^\infty + \lambda_-^\infty$$

λ_+^∞ and λ_-^∞ are molar ionic condutance at infinite dilution for cations and anions, respectively.

85. Green chemistry means such reaction which reduce the use and production of hazardous chemicals.

86. Packing fraction for a cubic unit cell is

$$f = \frac{z\times4/3\pi r^3}{d^3}$$

Here a = edge length, r = radius of cation and anion

Efficiency of packing in simple cubic or primitive cell = $\pi/6 = 0.52$

i.e., 52% of unit cell is occupied by atoms and 48% is empty.

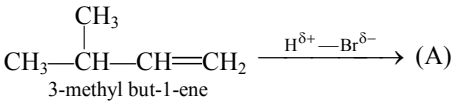
87. As primary is more reactive than secondary and tertiary alkyl halides so CH_3CH_2Br has the highest relative rate.

88. $NO_2 > NO_2^+ > NO_2^-$

132° 130° 115° (Bond angles)

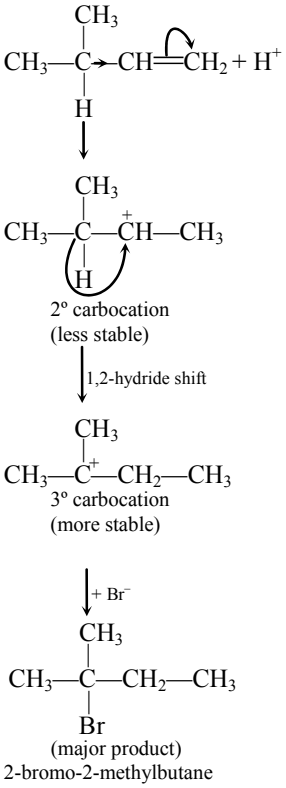
89. If silicon is doped with any of the element of group III (B, Al, Ga etc.) of the periodic table, p-type of semiconductor will be obtained.

90. The reaction occurs as follows :



3-methyl but-1-ene

Mechanism :



(major product)
2-bromo-2-methylbutane

91. Atomic mass of C = 12, H = 1 and O = 16

Element	% composition	Mole ratio	Simple ratio
C	38.71	38.71/12	3.22/3.22
		= 3.22	= 1
H	9.67	9.67/1	9.67/3.22
		= 9.67	= 3
O	51.62	51.62/16	3.22/3.22
		= 3.22	= 1

Thus empirical formula of the compound is CH_3O.

92. CFSE in octahedral field depends upon the nature of ligands. Stronger the ligands larger will be the value of Δ_{oct}.

93. The ionic character of the bonds in hydrides increase from LiH to CsH so thermal stability of these hydrides decreases as follows :

LiH > NaH > KH > RbH > CsH

94. State functions or state variables depend only on the state of the system.

Here 'w' represents work done and 'q' represents amount of heat so both of these are not state functions.

95. In the following hydrocarbon

$$\overset{6}{C}H_3\overset{(sp^3)}{}-\overset{5}{C}H=\overset{4}{C}H-\overset{3}{C}H_2-\overset{2}{C}\equiv\overset{1}{C}H$$

$(sp^3)\ (sp^2)\ (sp^2)\ (sp^3)\ (sp)\ (sp)$

The state of hybridization of carbons 1, 3 and 5 are sp, sp^3 and sp^2 respectively.

96. $[5e + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$ ...(i)] × 2

$[C_2O_4^{2-} \rightarrow 2e + 2CO_2$ ...(ii)] × 5

$$MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 10CO_2$$

As 2 moles of MnO_4^- required to oxidize 5 moles of oxalate.

So number of moles of MnO_4^- required to oxidize 1 mole of oxalate = 2/5 = 0.4.

97. $k_1 = 10^{16}\, e^{-2000/T}$

$k_2 = 10^{15}\, e^{-1000/T}$

The temperature at which $k_1 = k_2$ will be

$10^{16}\, e^{-2000/T} = 10^{15}\, e^{-1000/T}$

$$\frac{e^{-2000/T}}{e^{-1000/T}} = \frac{10^{15}}{10^{16}}$$

$$e^{-1000/T} = 10^{-1}$$

$$\log_e e^{-1000/T} = \log_e 10^{-1}$$

$$2.303 \times \log_{10} e^{-1000/T} = 2.303 \times \log_{10} 10^{-1}$$

$$\frac{-1000}{T} \times \log_{10} e = -1$$

On solving, we get

$T = 1000/2.303$ K

98. A strong base can abstract an α-hydrogen from aldehyde and ketones to form a carbanion or the enolate ion.

99. $C_5H_{12}(g) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(\ell)$

$\Delta G^o = [(-394.4 \times 5) + (-237.2 \times 6)]$
$- [(-8.2) + (8 \times 0)]$
$= -3387.5$ kJ

The standard free energy change of elementary substances is taken as zero.

For the fuel cell, the complete cell reaction is :

$C_5H_{12}(g) + 8O_2(g) \longrightarrow 5CO_2(g) + 6H_2O(\ell)$

This reaction is the combination of the following two half reactions :

$C_5H_{12}(g) + 10H_2O(\ell) \longrightarrow$
$5CO_2(g) + 32H^+ + 32e$

$8O_2(g) + 32H^+ + 32e \longrightarrow 16H_2O(\ell)$

As the number of electrons exchanged is 32 here, so n = 32

$\Delta G^o = - nFE^o$

-3387.5×10^3 J $= -32 \times 96500$ J/volt $\times E^o$

On solving, we get

$E^o = 1.09698$ V

100. For simple cubic :

$$r^+/r^- = \frac{a}{2}$$

Here a = edge length and

r^+/r^- = interatomic distance

For body centered :

$$r^+/r^- = \frac{a\sqrt{3}}{4}$$

For face centered :

$$r^+/r^- = \frac{a}{2\sqrt{2}}$$

Therefore ratio of radii of the three will be

$$\frac{a}{2} : \frac{a\sqrt{3}}{4} : \frac{a}{2\sqrt{2}}$$