JEE Main 2025 (April)

Chapter-wise Qs Bank

Chemistry

To practice these questions digitally & track progress: Download MARKS App

Join Country's Most Relevant JEE Main Test Series: Click here

Content

Questions

Solutions

Q1. 20 mL of 2 M NaOH solution is added to 400 mL of 0.5 M NaOH solution. The final concentration of the solution is _____ $\times 10^{-2}$M. (Nearest integer)

Q2. The hydrocarbon (X) with molar mass 80 g mol^{-1} and 90% carbon has ..... degree of unsaturation.

Q3. The elemental composition of a compound is 54.2%C, 9.2%H and 36.6%O.
If the molar mass of the compound is 132 g mol^{-1}, the molecular formula of the compound is :
[Given : The relative atomic mass of C : H : O = 12 : 1 : 16]

(1) $C_4H_9O_3$

(2) $C_6H_{12}O_6$

(3) $C_4H_8O_2$

(4) $C_6H_{12}O_3$

Q4. 2.8×10^{-3} mol of CO_2 is left after removing 10^{21} molecules from its ' x ' mg sample. The mass of CO_2 taken initially is
Given: $N_A = 6.02 \times 10^{23}$ mol^{-1}

(1) 98.3 mg

(2) 48.2 mg

(3) 196.2 mg

(4) 150.4 mg

Q5. 0.01 mole of an organic compound (X) containing 10% hydrogen, on complete combustion produced 0.9 gH_2O. Molar mass of (X) is _____ gmol^{-1}.

Q6. When 81.0 g of aluminium is allowed to react with 128.0 g of oxygen gas, the mass of aluminium oxide produced in grams is_____ - (Nearest integer)
Given :
Molar mass of Al is 27.0 g mol^{-1}
Molar mass of O is 16.0 g mol^{-1}

Q7. Xg of benzoic acid on reaction with aq $NaHCO_3$ released CO_2 that occupied 11.2 L volume at STP.
X is _____ g.

Q8. Density of 3 M NaCl solution is 1.25 g/mL. The molality of the solution is :

(1) 1.79 m

(2) 2.79 m

(3) 2 m

(4) 3 m

Q9. The molarity of a 70% (mass / mass) aqueous solution of a monobasic acid (X) is _____ $\times 10^{-1}$ M(Nearest integer)

[Given: Density of aqueous solution of (X) is 1.25 g mL^{-1}

Molar mass of the acid is 70 g mol^{-1}]

Q10. Concentrated nitric acid is labelled as 75% by mass. The volume in mL of the solution which contains 30 g of nitric acid is

____.

Given : Density of nitric acid solution is 1.25 g/mL.

(1) 40

(2) 32

(3) 45

(4) 55

Q11. Consider the following reaction occurring in the blast furnace:

$Fe_3O_{4(s)} + 4CO_{(g)} \rightarrow 3Fe_{(l)} + 4CO_{2(g)}$

' x ' kg of iron is produced when 2.32×10^3 kgFe_3O_4 and 2.8×10^2 kgCO are brought together in the furnace. The value of ' x ' is _____. (nearest integer)

Given:

molar mass of $Fe_3O_4 = 232$ g mol^{-1}

molar mass of $CO = 28$ g mol^{-1}

molar mass of $Fe = 56$ g mol^{-1} }

Q12. Quantitative analysis of an organic compound (X) shows following \% composition.

C : 14.5%

Cl : 64.46 %

H: 1.8 %

(Empirical formula mass of the compound (X) is _____ $\times 10^{-1}$

(Given molar mass in gmol^{-1} of C : 12, H : 1, O : 16, Cl : 35.5)

Q13. Choose the correct statements.

(A) Weight of a substance is the amount of matter present in it.

(B) Mass is the force exerted by gravity on an object.

(C) Volume is the amount of space occupied by a substance.

(D) Temperatures below $0^\circ C$ are possible in Celsius scale, but in Kelvin scale negative temperature is not possible.

(E) Precision refers to the closeness of various measurements for the same quantity.

Choose the correct answer from the options given below :

(1) (A), (D) and (E) Only

(2) (C), (D) and (E) Only

(3) (A), (B) and (C) Only

(4) (B), (C) and (D) Only

Q1. Radius of the first excited state of Helium ion is given as :
$a_0 \rightarrow$ radius of first stationary state of hydrogen atom.

(1) $r = 4a_0$

(2) $r = 2a_0$

(3) $r = \frac{a_0}{2}$

(4) $r = \frac{a_0}{4}$

Q2. In a multielectron atom, which of the following orbitals described by three quantum numbers will have same energy in absence of electric and magnetic fields?

A. $n = 1, l = 0, m_l = 0$
B. $n = 2, l = 0, m_l = 0$
C. $n = 2, l = 1, m_l = 1$
D. $n = 3, l = 2, m_l = 1$
E. $n = 3, l = 2, m_l = 0$
Choose the correct answer from the options given below:

(1) B and C Only

(2) A and B Only

(3) C and D Only

(4) D and E Only

Q3. Given below are two statements about X-ray spectra of elements :
Statement (I) : A plot of $\sqrt{v}$ (v = frequency of X-rays emitted) vs atomic mass is a straight line.
Statement (II) : A plot of v(v = frequency of X-rays emitted) vs atomic number is a straight line.
In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

Q4. Given below are two statements :
Statement (**I**): The radii of isoelectronic species increases in the order.
$Mg^{2+} < Na^{+} < F^{-} < O^{2-}$
Statement (II): The magnitude of electron gain enthalpy of halogen decreases in the order.
$Cl > F > Br > I$
In the light of the above statements, choose the most appropriate answer from the options given below :

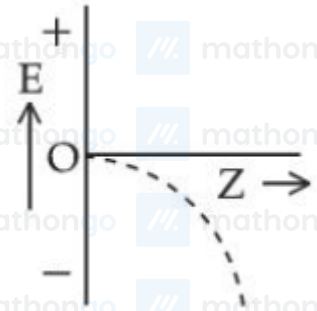
(1) Statement I is incorrect but Statement II is correct

(2) Statement I is correct but Statement II is incorrect

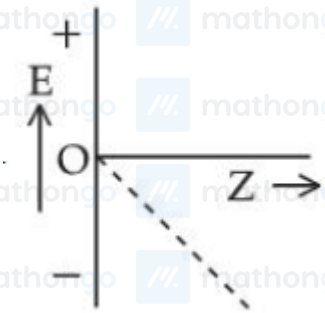
(3) Both Statement I and Statement II are incorrect

(4) Both Statement I and Statement II are correct

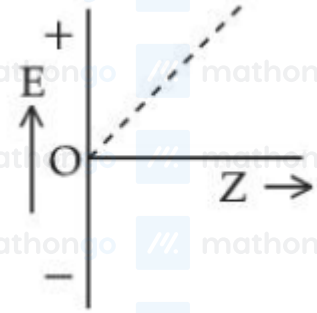
Q5. For hydrogen like species, which of the following graphs provides the most appropriate representation of E vs Z plot for a constant n ?
[E: Energy of the stationary state,
Z : atomic number, n = principal quantum number]



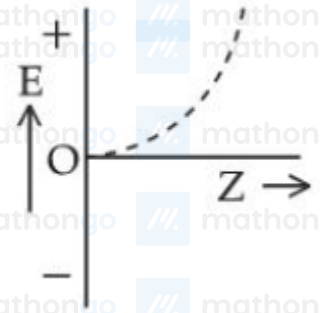
(1)



(2)



(3)



(4)

Q6. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H atom is suitable for this?
Given : Rydberg constant $R_H = 10^5\ cm^{-1},\ h = 6.6 \times 10^{-34}\ J\ s, c = 3 \times 10^8\ m/s$

(1) Balmer series, $\infty \rightarrow 2$

(2) Lyman series, $\infty \rightarrow 1$

(3) Paschen series, $\infty \rightarrow 3$

(4) Paschen series, $5 \rightarrow 3$

Q7. If a_0 is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength (λ) of the electron present in the second orbit of hydrogen atom? [n : any integer]

(1) $\frac{8\pi a_0}{n}$

(2) $\frac{2a_0}{n\pi}$

(3) $\frac{4n}{\pi a_0}$

(4) $\frac{4\pi a_0}{n}$

Q8. Given below are two statements :
Statement (I) : It is impossible to specify simultaneously with arbitrary precision, both the linear momentum and the position of a particle.
Statement (II) : If the uncertainty in the measurement of position and uncertainty in measurement of momentum are equal for an electron, then the uncertainty in the measurement of velocity is $\geqslant \sqrt{\frac{h}{\pi}} \times \frac{1}{2m}$.
In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II is false

Q9. Given below are two statements :
Statement (I) : For a given shell, the total number of allowed orbitals is given by n^2.
Statement (II) : For any subshell, the spatial orientation of the orbitals is given by $-l$ to $+l$ values including zero.
In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are false

(2) Statement I is true but Statement II is false

(3) Both Statement I and Statement II are true

(4) Statement I is false but Statement II is true

Q10. For hydrogen atom, the orbital/s with lowest energy is/are:
(A) 4 s
(B) $3p_x$
(C) $3\ d_{x^2-y^2}$
(D) $3\ d_{z^2}$
(E) $4p_z$
Choose the correct answer from the options given below :

(1) (B), (C) and (D) only

(2) (A) and (E) only

(3) (A) only

(4) (B) only

Q11. Given below are two statements :
Statement (I) : A spectral line will be observed for a $2p_x \rightarrow 2p_y$ transition.
Statement (II) : $2P_x$ and $2p_y$ are degenerate orbitals.
In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

Q12. Which of the following is/are not correct with respect to energy of atomic orbitals of hydrogen atom?
(A) $1\ s < 2p < 3\ d < 4\ s$
(B) $1\ s < 2\ s = 2p < 3\ s = 3p$
(C) $1\ s < 2\ s < 2p < 3\ s < 3p$

(D) $1\,s < 2\,s < 4\,s < 3\,d$

Choose the correct answer from the options given below :

(1) (A) and (C) only

(2) (B) and (D) only

(3) (C) and (D) only

(4) (A) and (B) only

Q1. For a reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is

(1) 5 times of initial pressure

(2) $5/2$ times of initial pressure

(3) $7/2$ times of initial pressure

(4) $7/4$ times of initial pressure

Q1. A liquid when kept inside a thermally insulated closed vessel at $25^{\circ}C$ was mechanically stirred from outside. What will be the correct option for the following thermodynamic parameters ?

(1) $\Delta U < 0, q = 0, w > 0$

(2) $\Delta U = 0, q = 0, w = 0$

(3) $\Delta U > 0, q = 0, w > 0$

(4) $\Delta U = 0, q < 0, w > 0$

Q2. Standard entropies of X_2, Y_2 and XY_5 are 70,50 and 110 J K^{-1} mol^{-1} respectively. The temperature in Kelvin at which the reaction

$\frac{1}{2}X_2 + \frac{5}{2}Y_2 \rightleftharpoons XY_5 \Delta H^{\Theta} = -35$ kJ mol^{-1}

will be at equilibrium is_____. (Nearest integer)

Q3. The effect of temperature on spontaneity of reactions are represented as :

	ΔH	ΔS	Temperature	Spontaneity
(A)	+	−	any T	Non spontaneous
(B)	+	+	low T	spontaneous
(C)	−	−	low T	Non spontaneous
(D)	−	+	any T	spontaneous

The incorrect combinations are :

(1) (B) and (C) only

(2) (B) and (D) only

(3) (A) and (D) only

(4) (A) and (C) only

Q4. If C (diamond $) \rightarrow C$ (graphite $) + XkJmol^{-1}$

$C($ diamond $) + O_2(g) \rightarrow CO_2(g) + YkJmol^{-1}$

C (graphite) $+ O_2(g) \rightarrow CO_2(g) + ZkJmol^{-1}$

at constant temperature. Then

(1) X=-Y+Z

(2) -X=Y+Z

(3) X=Y+Z

(4) X=Y-Z

Q5. Ice and water are placed in a closed container at a pressure of 1 atm and temperature 273.15 K. If pressure of the system is increased 2 times, keeping temperature constant, then identify correct observation

from following

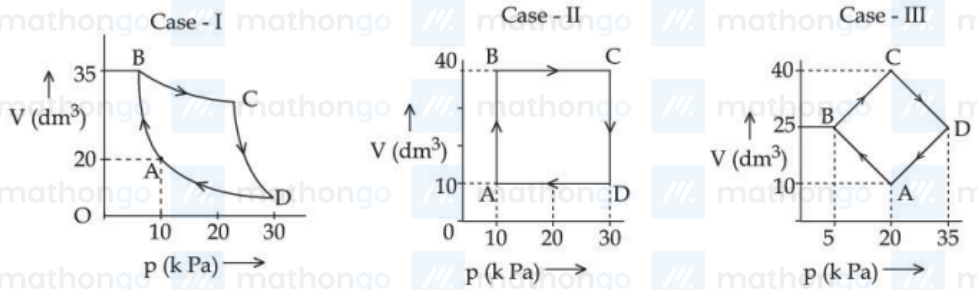
(1) Volume of system increases.

(2) The solid phase (ice) disappears completely.

(3) Liquid phase disappears completely.

(4) The amount of ice decreases.

Q6.



An ideal gas undergoes a cyclic transformation starting from the point A and coming back to the same point by tracing the path $\mathrm{A} \rightarrow \mathrm{B} \rightarrow \mathrm{C} \rightarrow \mathrm{D} \rightarrow \mathrm{A}$ as shown in the three cases above.

Choose the correct option regarding $\Delta \mathrm{U}$:

(1) $\Delta \mathrm{U}$ (Case-I) $=\Delta \mathrm{U}$ (Case-II) $=\Delta \mathrm{U}$ (Case-III)

(2) $\Delta \mathrm{U}$ (Case-I) $>\Delta \mathrm{U}$ (Case-III) $>\Delta \mathrm{U}$ (Case-II)

(3) $\Delta \mathrm{U}$ (Case-III) $>\Delta \mathrm{U}$ (Case-II) $>\Delta \mathrm{U}$ (Case-I)

(4) $\Delta \mathrm{U}$ (Case-I) $>\Delta \mathrm{U}$ (Case-II) $>\Delta \mathrm{U}$ (Case-III)

Q7. 500 J of energy is transferred as heat to 0.5 mol of Argon gas at 298 K and 1.00 atm. The final temperature and the change in internal energy respectively are:

Given : $\mathrm{R}=8.3 \mathrm{~J} \mathrm{~K}^{-1} \mathrm{~mol}^{-1}$

(1) 378 K and 500 J

(2) 368 K and 500 J

(3) 348 K and 300 J

(4) 378 K and 300 J

Q8. Match List - I with List - II.

List - I (Partial Derivatives)		List - II (Thermodynamic Quantity)	
(A)	$\left(\frac{\partial G}{\partial T}\right)_P$	(I)	C_P
(B)	$\left(\frac{\partial H}{\partial T}\right)_P$	(II)	$-S$
(C)	$\left(\frac{\partial G}{\partial P}\right)_T$	(III)	C_V
(D)	$\left(\frac{\partial U}{\partial T}\right)_V$	(IV)	V

Choose the correct answer from the options given below :

(1) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

(2) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)

(3) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

(4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Q9. Which of the following mixing of 1 M base and 1 M acid leads to the largest increase in temperature?

(1) 30 mLCH_3COOH and 30 mL NaOH

(2) 45 mLCH_3COOH and 25 mL NaOH

(3) 30 mL HCl and 30 mL NaOH

(4) 50 mL HCl and 20 mL NaOH

Q10. The standard enthalpy and standard entropy of decomposition of N_2O_4 to NO_2 are 55.0 kJ mol^{-1} and 175.0 $J/K/mol$ respectively. The standard free energy change for this reaction at $25^\circ C$ in J mol^{-1} is _____ (Nearest integer)

Q11. Let us consider an endothermic reaction which is non-spontaneous at the freezing point of water. However, the reaction is spontaneous at boiling point of water. Choose the correct option.

(1) Both ΔH and ΔS are (-ve)

(2) ΔH is (-ve) but ΔS is (+ve)

(3) ΔH is $(+ve)$ but ΔS is $(-ve)$

(4) Both ΔH and ΔS are (+ve)

Q12. Consider the following cases of standard enthalpy of reaction $\left(\Delta H_r^{\circ} \text{ in } kJmol^{-1}\right)$

$C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l);\ \Delta H_1^{\circ} = -1550$

$C\ (\text{graphite}) + O_2(g) \rightarrow CO_2\ (g);\ \Delta H_2^{\circ} = -393.5$

$H_2(g) + \frac{1}{2}O_2\ (g) \rightarrow H_2O(l);\ \Delta H_3^{\circ} = -286$

The magnitude of $\Delta H_{fC_2H_6(g)}^{\circ}$ is _____ $kJmol^{-1}$ (Nearest integer).

Q13. The bond dissociation enthalpy of $X_2\ \Delta H_{bond}$ calculated from the given data is _____ $kJmol^{-1}$. (Nearest integer)

$M^+X^-(s) \rightarrow M^+(g) + X^-(g)\ \Delta H_{lattice}^{*} = 800\ kJ\ mol^{-1}$

$M(s) \rightarrow M(g)\ \Delta H_{sub}^{\circ} = 100\ kJ\ mol^{-1}$

$M(g) \rightarrow M^+(g) + e^-(g)\ \Delta H_i = 500\ kJ\ mol^{-1}$

$X(g) + e^-(g) \rightarrow X^-(g)\ \Delta H_{eg}^{*} = -300\ kJ\ mol^{-1}$

$M(s) + \frac{1}{2}X_2(g) \rightarrow M^+X^-(s)\ \Delta H_f^{\circ} = -400\ kJ\ mol^{-1}$

[Given : M^+X^- is a pure ionic compound and X forms a diatomic molecule X_2 in gaseous state]

Q14. $S(g) + \frac{3}{2}O_2(g) \rightarrow SO_3(g) + 2x\text{kcal}$

$SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g) + y\text{kcal}$

The heat of formation of $SO_2(g)$ is given by :

(1) $x + y\text{kcal}$

(2) $y - 2x\text{kcal}$

(3) $\frac{2x}{y}\text{kcal}$

(4) $2x + y\text{kcal}$

Q15. Consider the following data :

Heat of formation of $CO_2(g) = -393.5\ kJ\ mol^{-1}$

Heat of formation of $H_2O(l) = -286.0\ kJ\ mol^{-1}$

Heat of combustion of benzene $= -3267.0\ kJ\ mol^{-1}$

The heat of formation of benzene is _ $kJmol^{-1}$. (Nearest integer)

Q16. Ice at $-5^{\circ}C$ is heated to become vapor with temperature of $110^{\circ}C$ at atmospheric pressure. The entropy change associated with this process can be obtained from

(1) $\int_{268K}^{273K} C_{p,\,m}\,dT + \frac{\Delta H_{m,\,fusion}}{T_f} + \frac{\Delta H_{m,\,vaporisation}}{T_b} + \int_{273K}^{373K} C_{p,\,m}\,dT + \int_{373K}^{383K} C_{p,\,m}\,dT$

(2) $\int_{268K}^{273K} \frac{C_{p,m}}{T} dT + \frac{\Delta H_{m,fusion}}{T_f} + \frac{\Delta H_{m,vaporisation}}{T_b} + \int_{273K}^{373K} \frac{C_{p,m}\, dT}{T} + \int_{373K}^{383K} \frac{C_{p,m}\, dT}{T}$

(3) $\int_{268K}^{383K} C_p\, dT + \frac{q_{rev}}{T}$

(4) $\int_{268K}^{383K} C_p\, dT + \frac{\Delta H_{melting}}{273} + \frac{\Delta H_{boiling}}{373}$

Q17. The formation enthalpies, $\Delta H_f \ominus$ for $H_{(g)}$ and $O_{(g)}$ are 220.0 and 250.0 kJ mol^{-1}, respectively, at 298.15 K , and $\Delta H_f^{\ominus}$ for $H_2O_{(g)}$ is -242.0 kJ mol^{-1} at the same temperature. The average bond enthalpy of the O – H bond in water at 298.15 K is _____ $kJmol^{-1}$ (nearest integer).

Q1. Consider the reaction
$X_2Y(g) = X_2(g) + \frac{1}{2}Y_2(g)$
The equation representing correct relationship between the degree of dissociation (x) of $X_2Y(g)$ with its equilibrium constant Kp is _____.
Assume x to be very very small.

(1) $x = \sqrt[3]{\frac{2Kp}{p}}$

(2) $x = \sqrt[3]{\frac{2Kp^2}{p}}$

(3) $x = \sqrt[3]{\frac{Kp}{p}}$

(4) $x = \sqrt[3]{\frac{Kp}{2p}}$

Q2. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of CO_2 is converted into CO on addition of graphite. If total pressure at equilibrium is 0.8 atm , then Kp is :

(1) 1.8 atm

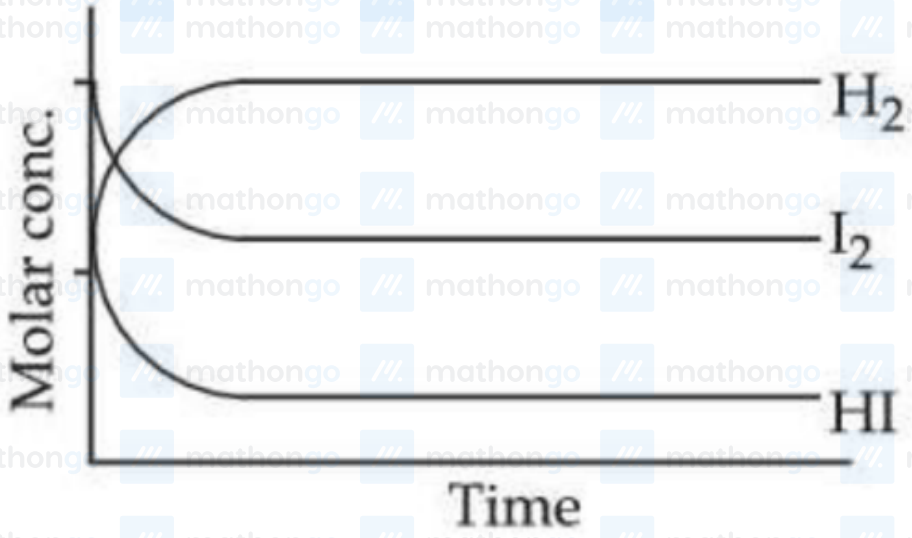
(2) 0.3 atm

(3) 3 atm

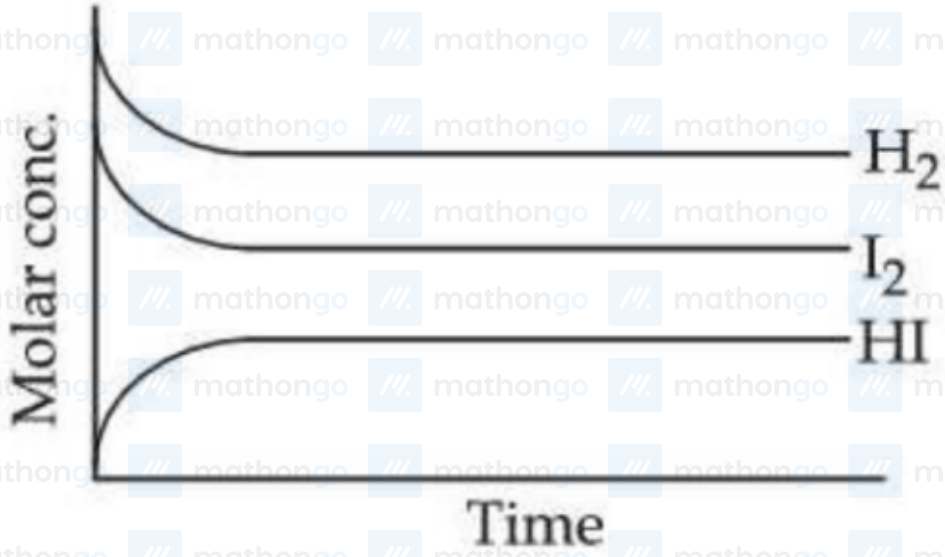
(4) 0.18 atm

Q3. 37.8 g N_2O_5 was taken in a 1 L reaction vessel and allowed to undergo the following reaction at 500 K
$2\,N_2O_{5(g)} \rightleftharpoons 2\,N_2O_{4(g)} + O_{2(g)}$
The total pressure at equilibrium was found to be 18.65 bar.
Then, $Kp = \_\_\_\_\_ \times 10^{-2}$ [nearest integer]
Assume N_2O_5 to behave ideally under these conditions.
Given: $R = 0.082$ bar $Lmol^{-1}\,K^{-1}$

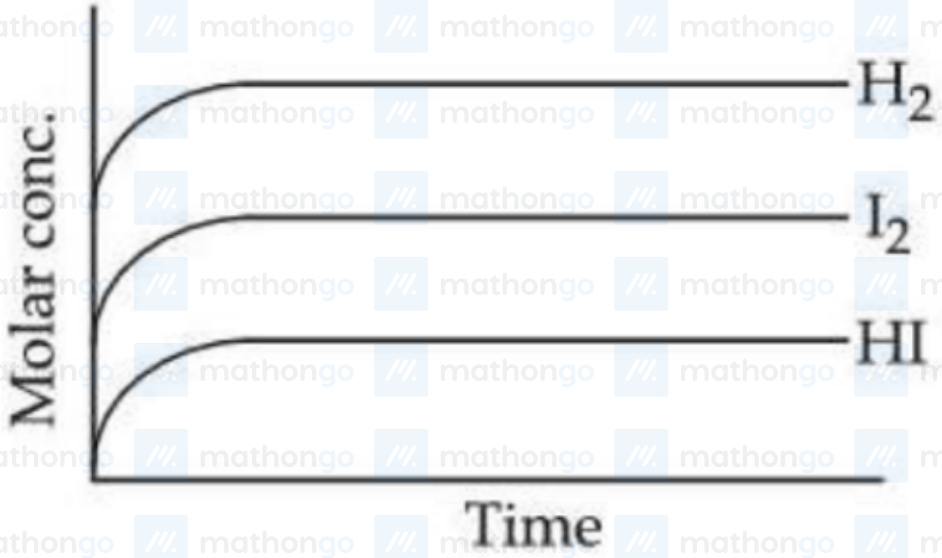
Q4. For the reaction,
$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
Attainment of equillibrium is predicted correctly by :


Molar conc.
H_2
I_2
HI
Time

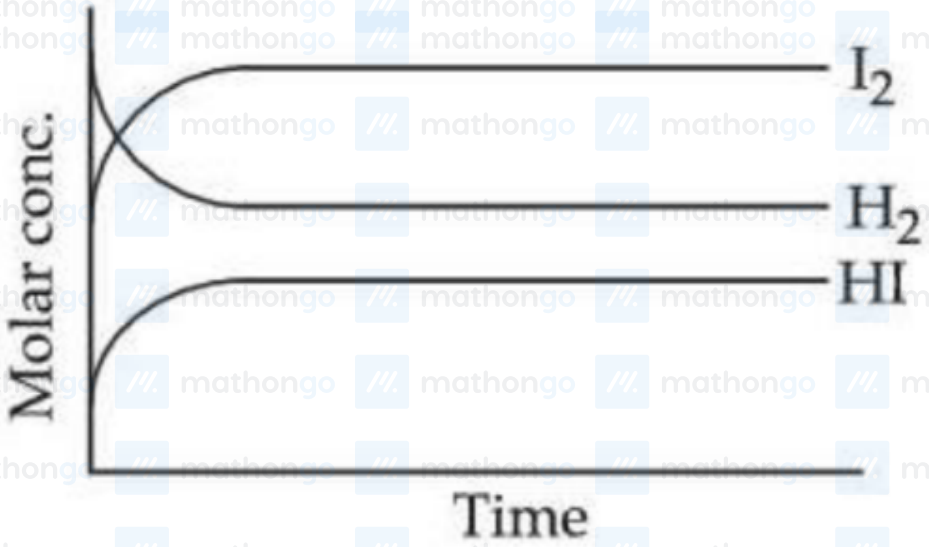
(1)


Molar conc.
H_2
I_2
HI
Time

(2)


Molar conc.
H_2
I_2
HI
Time

(3)



(4)

Q5. At temperature T, compound $AB_{2(g)}$ dissociates as $AB_{2(g)} \rightleftharpoons AB_{(g)} + \frac{1}{2} B_{2(g)}$ having degree of dissociation x (small compared to unity). The correct expression for x in terms of K_p and p is

(1) $\sqrt[4]{\frac{2K_p}{p}}$

(2) $\sqrt[3]{\frac{2K_p}{p}}$

(3) $\sqrt[3]{\frac{2K_p^2}{p}}$

(4) $\sqrt{K_p}$

Q6. Consider the equilibrium

$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$

If the pressure applied over the system increases by two fold at constant temperature then

(A) Concentration of reactants and products increases.

(B) Equilibrium will shift in forward direction.

(C) Equilibrium constant increases since concentration of products increases.

(D) Equilibrium constant remains unchanged as concentration of reactants and products remain same.

Choose the correct answer from the options given below :

(1) (A), (B) and (C) only

(2) (A) and (B) only

(3) (A), (B) and (D) only

(4) (B) and (C) only

Q1. Total number of non bonded electrons present in NO_2^- ion based on Lewis theory is _____.

Q2. A weak acid HA has degree of dissociation x. Which option gives the correct expression of (pH-pK_a)?

(1) 0

(2) $\log(1+2x)$

(3) $\log\left(\frac{1-x}{x}\right)$

(4) $\log\left(\frac{x}{1-x}\right)$

Q3. If 1 mM solution of ethylamine produces $pH = 9$, then the ionization constant (K_b) of ethylamine is 10^{-x}. The value of x is _____ (nearest integer).

[The degree of ionization of ethylamine can be neglected with respect to unity.]

Q4. pH of water is 7 at 25°C. If water is heated to 80°C., it's pH will :

(1) Decrease

(2) H^+concentration increases, OH^-concentration decreases

(3) Remains the same

(4) Increase

Q5. The molar solubility(s) of zirconium phosphate with molecular formula $\left(Zr^{4+}\right)_3\left(PO_4^{3-}\right)_4$ is given by relation :

(1) $\left(\frac{K_{sp}}{9612}\right)^{\frac{1}{3}}$

(2) $\left(\frac{K_{sp}}{6912}\right)^{\frac{1}{7}}$

(3) $\left(\frac{K_{sp}}{8435}\right)^{\frac{1}{7}}$

(4) $\left(\frac{K_{sp}}{5348}\right)^{\frac{1}{6}}$

Q6. Which of the following happens when NH_4OH is added gradually to the solution containing 1 M A^{2+} and $1MB^{3+}$ ions?

Given : $K_{sp}\,[A(OH)_2] = 9 \times 10^{-10}$ and $K_{sp}\,[B(OH)_3] = 27 \times 10^{-18}$ at 298 K.

(1) Both $A(OH)_2$ and $B(OH)_3$ do not show precipitation with NH_4OH

(2) $A(OH)_2$ will precipitate before $B(OH)_3$

(3) $B(OH)_3$ will precipitate before $A(OH)_2$

(4) $A(OH)_2$ and $B(OH)_3$ will precipitate together

Q7. K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30}. What is the molar solubility of this salt in water?

(1) $\frac{1.8\times10^{-30}}{27}$

(2) $\sqrt[5]{1.8 \times 10^{-30}}$

(3) $\sqrt[4]{\frac{1.6\times10^{-30}}{27}}$

(4) $\sqrt[2]{1.6 \times 10^{-30}}$

Q8. Arrange the following in increasing order of solubility product :

$Ca(OH)_2, AgBr, PbS, HgS$

(1) $HgS < AgBr < PbS < Ca(OH)_2$

(2) $Ca(OH)_2 < AgBr < HgS < PbS$

(3) $PbS < HgS < Ca(OH)_2 < AgBr$

(4) $HgS < PbS < AgBr < Ca(OH)_2$

Q1. Match the LIST-I with LIST-II

	LIST-I (Redox Reaction)		LIST-II (Type of Redox Reaction)
A.	$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + 2H_2O_{(l)}$	I.	Disproportionation reaction
B.	$2NaH_{(s)} \xrightarrow{\Delta} 2Na_{(s)} + H_{2(g)}$	II.	Combination reaction
C.	$V_2O_{5(s)} + 5Ca_{(s)} \xrightarrow{\Delta} 2V_{(s)} + 5CaO_{(s)}$	III.	Decomposition reaction
D.	$2H_2O_{2(aq)} \xrightarrow{\Delta} 2H_2O_{(l)} + O_{2(g)}$	IV.	Displacement reaction

Choose the correct answer from the options given below:

(1) A-II, B-III, C-I, D-IV

(2) A-III, B-IV, C-I, D-II

(3) A-IV, B-I, C-II, D-III

(4) A-II, B-III, C-IV, D-I

Q2. The species which does not undergo disproportionation reaction is :

(1) ClO_3^-

(2) ClO^-

(3) ClO_2^-

(4) ClO_4^-

Q3. Given below are two statements:

Statement I: In the oxalic acid vs $KMnO_4$ (in the presence of dil H_2SO_4) titration the solution needs to be heated initially to 60°C, but no heating is required in Ferrous ammonium sulphate (FAS) vs $KMnO_4$ titration (in the presence of dil H_2SO_4)

Statement II: In oxalic acid vs $KMnO_4$ titration, the initial formation of $MnSO_4$ takes place at high temperature, which then acts as catalyst for further reaction. In the case of FAS vs $KMnO_4$, heating oxidizes Fe^{2+} into Fe^{3+} by oxygen of air and error may be introduced in the experiment.

In the light of the above statements, choose the correct answer from the options given below

(1) Both Statement I and Statement II are false

(2) Both Statement I and Statement II are true

(3) Statement I is false but Statement II is true

(4) Statement I is true but Statement II is false

Q4. 0.1 M solution of KI reacts with excess of H_2SO_4 and KIO_3 solutions. According to equation

$5I^- + IO_3^- + 6H^+ \rightarrow 3I_2 + 3H_2O$

Identify the correct statements :

(A) 200 mL of KI solution reacts with 0.004 mol of KIO_3

(B) 200 mL of KI solution reacts with 0.006 mol of H_2SO_4

(C) 0.5 L of KI solution produced 0.005 mol of I_2

(D) Equivalent weight of KIO_3 is equal to ($\frac{\text{Molecular weight}}{5}$)

Choose the correct answer from the options given below :

(1) (A) and (D) only

(2) (C) and (D) only

(3) (B) and (C) only

(4) (A) and (B) only

Q5. Some CO_2 gas was kept in a sealed container at a pressure of 1 atm and at 273 K. This entire amount of CO_2 gas was later passed through an aqueous solution of $Ca(OH)_2$. The excess unreacted $Ca(OH)_2$ was later neutralized with 0.1 M of 40 mL HCl. If the volume of the sealed container of CO_2 was x, then x is _____ cm^3 (nearest integer).

[Given : The entire amount of $CO_2(g)$ reacted with exactly half the initial amount of $Ca(OH)_2$ present in the aqueous solution.]

Q1. The observed and normal molar masses of compound MX_2 are 65.6 and 164 respectively. The percent degree of ionisation of MX_2 is ..... %. (Nearest integer)

Q2. If $A_2\ B$ is 30% ionised in an aqueous solution, then the value of van't Hoff factor (i) is _____ $\times 10^{-1}$.

Q3. Given below are two statements :

Statement (I) : NaCl is added to the ice at $0^{\circ}C$, present in the ice cream box to prevent the melting of ice cream.

Statement (II) : On addition of NaCl to ice at $0^{\circ}C$, there is a depression in freezing point.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are false

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

Q4. Assume a living cell with $0.9\%(\omega/\omega)$ of glucose solution (aqueous). This cell is immersed in another solution having equal mole fraction of glucose and water.

(Consider the data upto first decimal place only)

The cell will :

(1) shrink since solution is $0.45\%(\omega/\omega)$ as a result of association of glucose molecules (due to hydrogen bonding)

(2) Show no change in volume since solution is $0.9\%(\omega/\omega)$

(3) swell up since solution is $1\%(\omega/\omega)$

(4) shrink since soluton is $0.5\%(\omega/\omega)$

Q5. Consider a binary solution of two volatile liquid components 1 and 2.x_1 and y_1 are the mole fractions of component 1 in liquid and vapour phase, respectively. The slope and intercept of the linear plot of $\frac{1}{x_1}$ vs $\frac{1}{y_1}$ are given respectively as:

(1) $\frac{P_2^0}{P_1^0}, \frac{P_2^0-P_1^0}{P_2^0}$

(2) $\frac{P_1^0}{P_2^0}, \frac{P_2^0-P_1^0}{P_2^0}$

(3) $\frac{P_1^0}{P_2^0}, \frac{P_1^0-P_2^0}{P_2^0}$

(4) $\frac{P_2^0}{P_1^0}, \frac{P_1^0-P_2^0}{P_2^0}$

Q6. When a non-volatile solute is added to the solvent, the vapour pressure of the solvent decreases by 10 mm of Hg. The mole fraction of the solute in the solution is 0.2. What would be the mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg ?

(1) 0.8

(2) 0.4

(3) 0.2

(4) 0.6

Q7. Arrange the following solutions in order of their increasing boiling points.

(i) 10^{-4}M NaCl

(ii) 10^{-4}M Urea

(iii) 10^{-3}M NaCl

(iv) 10^{-2}M NaCl

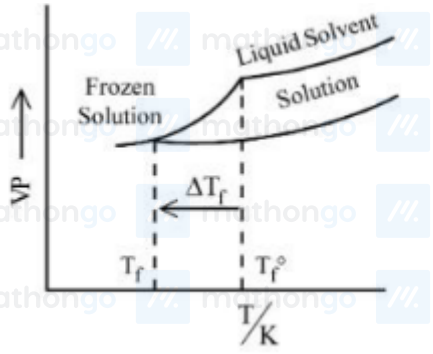
(1) (i) < (ii) < (iii) < (iv)

(2) (iv) < (iii) < (i) < (ii)

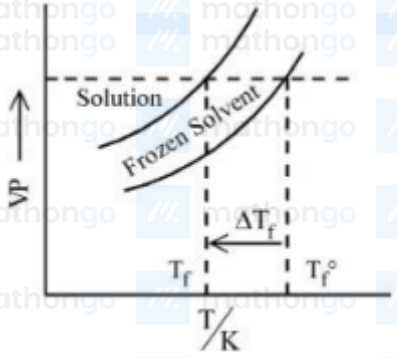
(3) (ii) < (i)≡(iii) < (iv)

(4) (ii) < (i) < (iii) < (iv)

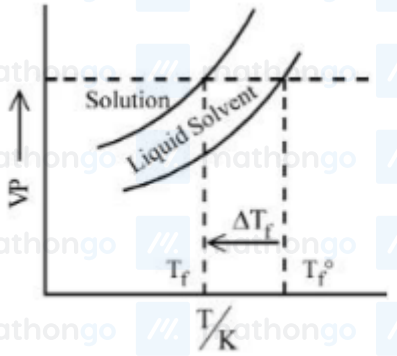
Q8. Consider the given plots of vapour pressure (VP) vs temperature(T/K). Which amongst the following options is correct graphical representation showing ΔT_f, depression in the freezing point of a solvent in a solution?



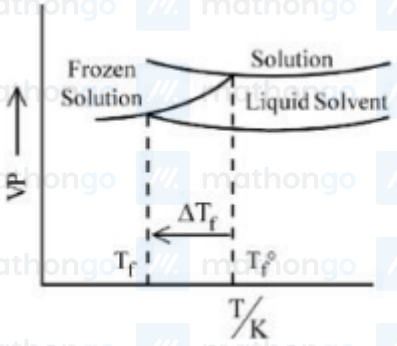
(1)



(2)



(3)



(4)

Q9. What is the freezing point depression constant of a solvent, 50 g of which contain 1 g non volatile solute (molar mass 256 g mol^{-1}) and the decrease in freezing point is 0.40 K ?

(1) 3.72 K kg mol^{-1}

(2) 1.86 K kg mol^{-1}

(3) 4.43 K kg mol^{-1}

(4) 5.12 K kg mol^{-1}

Q10. 1.24 g of AX_2 (molar mass $124\ g\ mol^{-1}$) is dissolved in 1 kg of water to form a solution with boiling point of $100.0156^\circ C$, while $25.4\ g$ of AY_2 (molar mass $250\ g\ mol^{-1}$) in 2 kg of water constitutes a solution with a boiling point of $100.0260^\circ C$.

$K_b\ (H_2O) = 0.52\ K\ kg\ mol^{-1}$

Which of the following is correct ?

(1) AX_2 is fully ionised while AY_2 is completely unionised.

(2) AX_2 is completely unionised while AY_2 is fully ionised.

(3) AX_2 and AY_2 (both) are completely unionised.

(4) AX_2 and AY_2 (both) are fully ionised.

Q1. Standard electrode potentials for a few half cells are mentioned below :

$E^{\circ}_{Cu^{2+}/Cu} = 0.34\ V, E^{\circ}_{Zn^{2+}/Zn} = -0.76\ V$

$E^{\circ}_{Ag^{+}/Ag} = 0.80\ V, E^{\circ}_{Mg^{2+}/Mg} = -2.37\ V$

Which one of the following cells gives the most negative value of ΔG° ?

(1) $Zn\left|Zn^{2+}(1M)\right|\left|Ag^{+}(1M)\right|Ag$

(2) $Zn\left|Zn^{2+}(1M)\right|\left|Mg^{2+}(1M)\right|Mg$

(3) $Ag\left|Ag^{+}(1M)\right|\left|Mg^{2+}(1M)\right|Mg$

(4) $Cu\left|Cu^{2+}(1M)\right|\left|Ag^{+}(1M)\right|Ag$

Q2. For a $Mg\left|Mg^{2+}(aq)\right|\left|Ag^{+}(aq)\right|Ag$ the correct Nernst Equation is :

(1) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Ag^{+}]}{[Mg^{2+}]}$

(2) $E_{cell} = E^{o}_{cell} + \frac{RT}{2F}\ln\frac{[Ag^{+}]^{2}}{[Mg^{2+}]}$

(3) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Ag^{+}]^{2}}{[Mg^{2+}]}$

(4) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Mg^{2+}]}{[Ag^{+}]}$

Q3. Given below are two statements :

Statement (I) : Corrosion is an electrochemical phenomenon in which pure metal acts as an anode and impure metal as a cathode.

Statement (II) : The rate of corrosion is more in alkaline medium than in acidic medium.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are false

Q4. A solution of aluminium chloride is electrolysed for 30 minutes using a current of 2 A. The amount of the aluminium deposited at the cathode is

[Given : molar mass of aluminium and chlorine are 27 g mol^{-1} and 35.5 g mol^{-1} respectively. Faraday constant $= 96500 C mol^{-1}$]

(1) 1.660 g

(2) 0.336 g

(3) 0.441 g

(4) 1.007 g

Q5. $FeO_4^{2-} \xrightarrow{+2.0v} Fe^{3+} \xrightarrow{0.8v} Fe^{2+} \xrightarrow{-0.5v} Fe^0$

In the above diagram, the standard electrode potentials are given in volts (over the arrow).

The value of $E^O_{FeO_4^{2-}/Fe^{2+}}$ is

(1) 2.1 V

(2) 1.7 V

(3) 1.4 V

(4) 1.2 V

Q6. For the given cell

$Fe^{2+}{}_{(aq)} + Ag^+{}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Ag_{(s)}$

The standard cell potential of the above reaction is Given:

$Ag^+ + e^- \rightarrow Ag \quad E^\theta = xV$

$Fe^{2+} + 2e^- \rightarrow Fe \quad E^\theta = yV$

$Fe^{3+} + 3e^- \rightarrow Fe \quad E^\theta = zV$

(1) $x + y - z$

(2) $x + 2y$

(3) $x + 2y - 3z$

(4) $y - 2x$

Q7. Based on the data given below :

$E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\ V \quad E^\circ_{Cl_2/Cl^{(-)}} = 1.36\ V$

$E^\circ_{MnO_4^-/Mn^{2+}} = 1.51\ V \quad E^\circ_{Cr^{3+}/Cr} = -0.74\ V$

the strongest reducing agent is :

(1) Cr

(2) Cl^-

(3) MnO_4^-

(4) Mn^{2+}

Q8. Electrolysis of 600 mL aqueous solution of NaCl for 5 min changes the pH of the solution to 12. The current in Amperes used for the given electrolysis is ____. (Nearest integer).

Q9. The standard reduction potential values of some of the p-block ions are given below. Predict the one with the strongest oxidising capacity.

(1) $E^{\ominus}_{Pb^{4+}/Pb^{2+}} = +1.67\ V$

(2) $E^{\ominus}_{Sn^{4+}/Sn^{2+}} = +1.15\ V$

(3) $E^{\ominus}_{Al^{3+}/Al} = -1.66\ V$

(4) $E^{o}_{Tl^{3+}/Tl} = +1.26\ V$

Q10. O_2 gas will be evolved as a product of electrolysis of :

(A) an aqueous solution of $AgNO_3$ using silver electrodes.

(B) an aqueous solution of $AgNO_3$ using platinum electrodes.

(C) a dilute solution of H_2SO_4 using platinum electrodes.

(D) a high concentration solution of H_2SO_4 using platinum electrodes.

Choose the correct answer from the options given below :

(1) (A) and (C) only

(2) (B) and (C) only

(3) (A) and (D) only

(4) (B) and (D) only

Q11. Match List - I with List - II :

	List - I Applications		**List - II** Batteries/Cell
(A)	Transistors	(I)	Anode - Zn/Hg ; Cathode - HgO + C
(B)	Hearing aids	(II)	Hydrogen fuel cell
(C)	Invertors	(III)	Anode - Zn ; Cathode - Carbon
(D)	Apollo space ship	(IV)	Anode - Pb ; Cathode - $Pb\|PbO_2$

Choose the correct answer from the options given below :

(1) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

(2) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

(3) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

(4) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

Q12. The molar conductivity of a weak electrolyte when plotted against the square root of its concentration, which of the following is expected to be observed ?

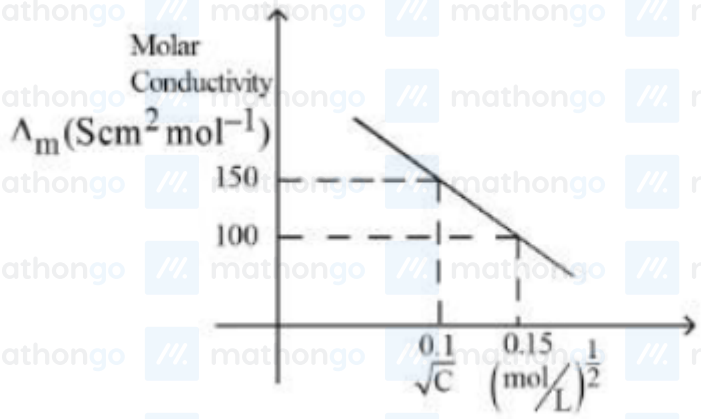
(1) A small decrease in molar conductivity is observed at infinite dilution.

(2) Molar conductivity decreases sharply with increase in concentration.

(3) A small increase in molar conductivity is observed at infinite dilution.

(4) Molar conductivity increases sharply with increase in concentration.

Q13. Given below is the plot of the molar conductivity vs $\sqrt{\text{concentration}}$ for KCl in aqueous solution.

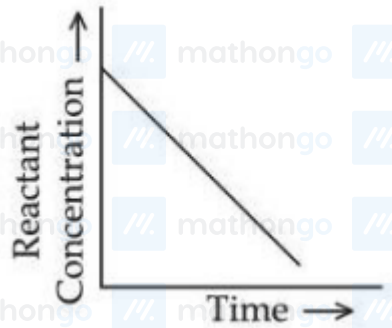


If, for the higher concentration of KCl solution, the resistance of the conductivity cell is 100Ω, then the resistance of the same cell with the dilute solution is ' x ' Ω

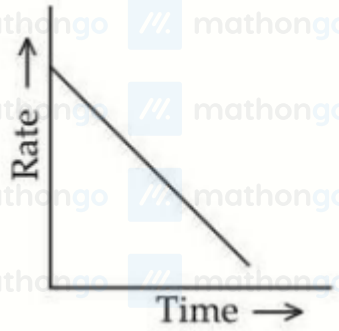
The value of x is _____ (Nearest integer)

Q1. Which of the following graphs most appropriately represents a zero order reaction ?

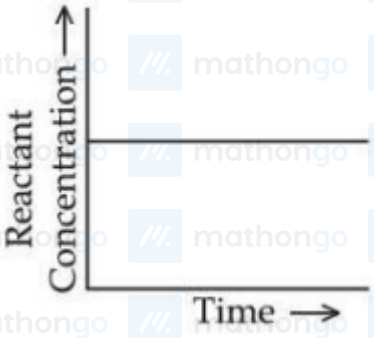
1.



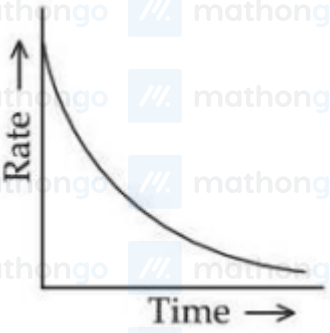
(1)



(2)



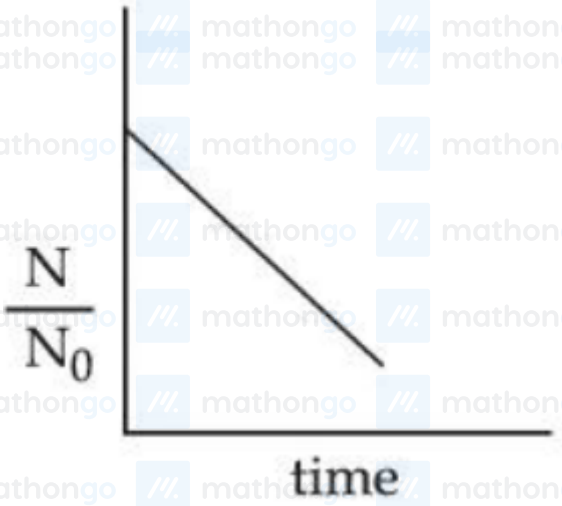
(3)



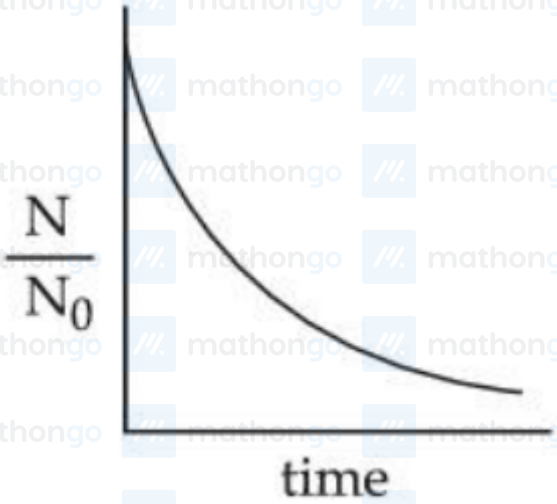
(4)

Q2. For bacterial growth in a cell culture, growth law is very similar to the law of radioactive decay. Which of the following graphs is most suitable to represent bacterial colony growth ?

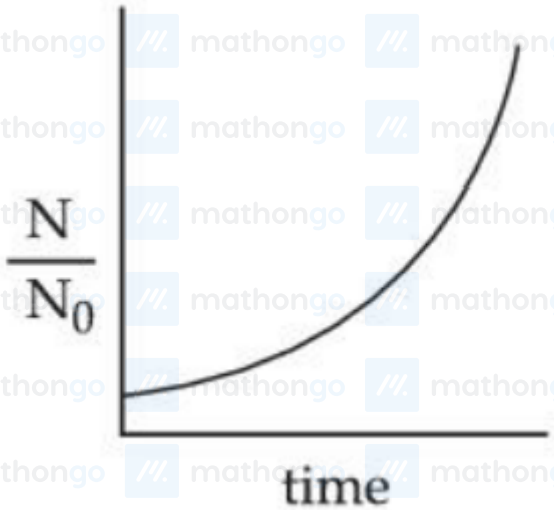
Where N - Number of Bacteria at any time, N_0 - Initial number of Bacteria.



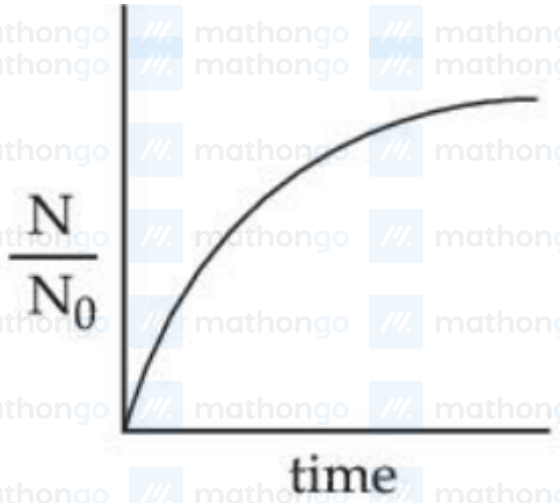
(1)



(2)



(3)



(4)

Q3. Consider an elementary reaction

$A(g) + B(g) \rightarrow C(g) + D(g)$

If the volume of reaction mixture is suddenly reduced to $\frac{1}{3}$ of its initial volume, the reaction rate will become ' x ' times of the original reaction rate. The value of x is :

(1) 3

(2) $\frac{1}{9}$

(3) 9

(4) $\frac{1}{3}$

Q4. Which of the following statement is not true for radioactive decay?

(1) Decay constant increases with increase in temperature.

(2) Amount of radioactive substance remained after three half lives is $\frac{1}{8}$ th of original amount.

(3) Decay constant does not depend upon temperature.

(4) Half life is $\ln 2$ times of $\frac{1}{\text{rate constant}}$.

Q5. $A \rightarrow B$

The molecule A changes into its isomeric form B by following a first order kinetics at a temperature of 1000 K. If the energy barrier with respect to reactant energy for such isomeric transformation is 191.48 kJ mol^{-1} and the frequency factor is 10^{20}, the time required for 50% molecules of A to become B is _____ picoseconds (nearest integer). $\left[R = 8.314 \text{ J } K^{-1} \text{ mol}^{-1}\right]$

Q6. For the thermal decomposition of $N_2O_5(g)$ at constant volume, the following table can be formed, for the reaction mentioned below.

$2\ N_2O_5(g) \rightarrow 2\ N_2O_4(g) + O_2(g)$

Sr.No	Time/s	Total pressure/(atm)
1	0	0.6
2	100	'x'

$x = \ldots \times 10^{-3}$ atm [nearest integer]

Given : Rate constant for the reaction is 4.606×10^{-2} s^{-1}.

Q7.

$[A]_0 / mol\,L^{-1}$	$t_{1/2} / min$
0.100	200
0.025	100

For a given reaction $R \rightarrow P$, $t_{1/2}$ is related to $[A]_0$ as given in table.

Given: $\log 2 = 0.30$

Which of the following is true?

A. The order of the reaction is $1/2$.

B. If $[A]_0$ is 1 M , then $t_{1/2}$ is $200\sqrt{10}$ min

C. The order of the reaction changes to 1 if the concentration of reactant changes from 0.100 M to 0.500 M.

D. $t_{1/2}$ is 800 min for $[A]_0 = 1.6M$

Choose the correct answer from the options given below:

Options

(1) A and C Only

(2) A, B and D Only

(3) C and D Only

(4) A and B Only

Q8. Drug X becomes ineffective after 50% decomposition. The original concentration of drug in a bottle was $16mg/mL$ which becomes $4mg/mL$ in 12 months. The expiry time of the drug in months is

_____

Assume that the decomposition of the drug follows first order kinetics.

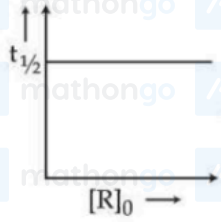
(1) 2

(2) 6

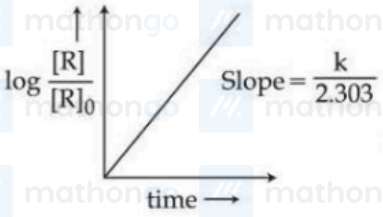
(3) 12

(4) 3

Q9. Given below are two statements :

Statement (I) : 

is valid for first order reaction.

Statement (II) : 

is valid for first order reaction.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are false

Q10. The reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism

$A_2 \underset{k_{-1}}{\overset{k_1}{\longrightarrow}} A + A$ (fast)

$A + B_2 \overset{k_2}{\longrightarrow} AB + B$ (slow)

$A + B \rightarrow AB$ (fast)

The overall order of the reaction is :

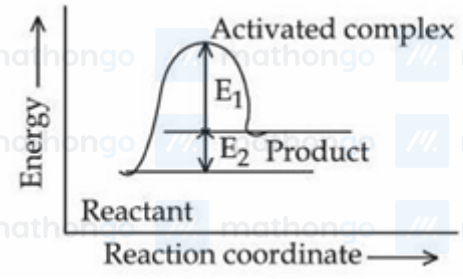
(1) 2

(2) 2.5

(3) 3

(4) 1.5

Q11. Consider the given figure and choose the correct option :



(1) Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

(2) Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.

(3) Activation energy of backward reaction is E_1 and product is more stable than reactant.

(4) Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

Q12. Consider a complex reaction taking place in three steps with rate constants k_1, k_2 and k_3 respectively. The overall rate constant k is given by the expression $k = \sqrt{\frac{k_1 k_3}{k_2}}$. If the activation energies of the three steps are 60,30 and 10 kJ mol^{-1} respectively, then the overall energy of activation in $kJmol^{-1}$ is ..... (Nearest integer)

Q1. Given below are two statements :

Statement (I) : An element in the extreme left of the periodic table forms acidic oxides.

Statement (II) : Acid is formed during the reaction between water and oxide of a reactive element present in the extreme right of the periodic table.

In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is false but Statement II is true

Q2. The incorrect decreasing order of atomic radii is

(1) $Si > P > Cl > F$

(2) $Be > Mg > Al > Si$

(3) $Al > B > N > F$

(4) $Mg > Al > C > O$

Q3. Given below are two statements :

Statement (I): According to the Law of Octaves, the elements were arranged in the increasing order of their atomic number. **Statement (II):** Meyer observed a periodically repeated pattern upon plotting physical properties of certain elements against their respective atomic numbers.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both **Statement (I)** and **Statement (II)** are false.

(2) Both **Statement (I)** and **Statement (II)** are true.

(3) **Statement (I)** is false but **Statement (II)** is true.

(4) **Statement (I)** is true but **Statement (II)** is false.

Q4. The element that does not belong to the same period of the remaining elements (modern periodic table) is:

(1) Iridium

(2) Platinum

(3) Osmium

(4) Palladium

Q5. Which of the following statements are NOT true about the periodic table?

A. The properties of elements are function of atomic weights.

B. The properties of elements are function of atomic numbers.

C. Elements having similar outer electronic configurations are arranged in same period.

D. An element's location reflects the quantum numbers of the last filled orbital.

E. The number of elements in a period is same as the number of atomic orbitals available in energy level that is being filled.

Choose the correct answer from the options given below:

(1) A, C and E Only

(2) A and E Only

(3) B, C and E Only

(4) D and E Only

Q6. Which of the following electronegativity order is incorrect?

(1) $Mg < Be < B < N$

(2) $S < Cl < O < F$

(3) $Al < Si < C < N$

(4) $Al < Mg < B < N$

Q7. Match List-I with List-II.

	List-I		List-II
(A)	$Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$	(I)	Ionisation Enthalpy
(B)	$B < C < O < N$	(II)	Metallic character
(C)	$B < Al < Mg < K$	(III)	Electronegativity
(D)	$Si < P < S < Cl$	(IV)	Ionic radii

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

(2) (A)-(IV), (B)-(I), (C)- (III), (D)-(II)

(3) (A)-(III), (B)-(IV), (C)- (II), (D)-(I)

(4) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

Q8. The successive 5 ionisation energies of an element are $800, 2427, 3658, 25024$ and $32824\ kJ/mol$, respectively. By using the above values predict the group in which the above element is present :

(1) Group 13

(2) Group 14

(3) Group 2

(4) Group 4

Q9. An element ' E' has the ionisation enthalpy value of $374\ \text{kJ mol}^{-1}$. ' E ' reacts with elements $\text{A}, \text{B}, \text{C}$ and D with electron gain enthalpy values of $-328, -349, -325$ and $-295\ \text{kJ mol}^{-1}$, respectively. The correct order of the products EA, EB, EC and ED in terms of ionic character is :

(1) $\text{ED} > \text{EC} > \text{EB} > \text{EA}$

(2) $\text{EA} > \text{EB} > \text{EC} > \text{ED}$

(3) $\text{EB} > \text{EA} > \text{EC} > \text{ED}$

(4) $\text{ED} > \text{EC} > \text{EA} > \text{EB}$

Q10. The type of oxide formed by the element among Li, Na, Be, Mg, B and Al that has the least atomic radius is :

(1) A_2O

(2) A_2O_3

(3) AO_2

(4) AO

Q11. First ionisation enthalpy values of first four group 15 elements are given below. Choose the correct value for the element that is a main component of apatite family :

(1) 1402 kJ mol^{-1}

(2) 834 kJ mol^{-1}

(3) 1012 kJ mol^{-1}

(4) 947 kJ mol^{-1}

Q1. Total number of sigma (σ) _____ and pi(π) _____ bonds respectively present in hex-1-en-4-yne are :

(1) 3 and 13

(2) 11 and 3

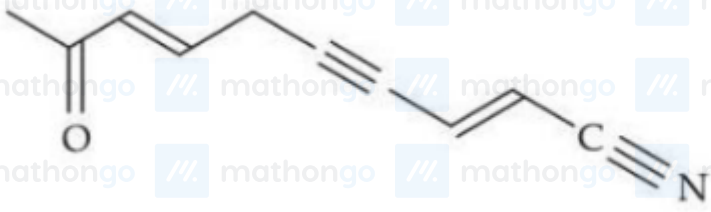
(3) 13 and 3

(4) 14 and 3

Q2. The number of molecules/ions that show linear geometry among the following is _____

$SO_2, BeCl_2, CO_2, N_3^-, NO_2, F_2O, XeF_2, NO_2^+, I_3^-, O_3$

Q3. In the given structure, number of sp and sp^2 hybridized carbon atoms present respectively are :



(1) 4 and 5

(2) 3 and 5

(3) 3 and 6

(4) 4 and 6

Q4. Match the LIST-I with LIST-II

LIST-I (Classification of molecules based on octet rule)		**LIST-II (Example)**	
A.	Molecules obeying octet rule	I.	NO, NO_2
B.	Molecules with incomplete octet	II.	$BCl_3, AlCl_3$
C.	Molecules with incomplete octet with odd electron	III.	H_2SO_4, PCl_5
D.	Molecules with expanded octet	IV.	CCl_4, CO_2

Choose the correct answer from the options given below:

(1) A-IV, B-I, C-III, D-II

(2) A-IV, B-II, C-I, D-III

(3) A-II, B-IV, C-III, D-I

(4) A-III, B-II, C-I, D-IV

Q5. The sum of sigma (σ) and pi (π) bonds in Hex-1,3-dien-5-yne is _____.

Q6. Given below are two statements :
Statement (I) : The first ionization energy of Pb is greater than that of Sn.
Statement (II) : The first ionization energy of Ge is greater than that of Si.
In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is false but Statement II is true

(2) Statement I is true but Statement II is false

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Q7. Which of the following statement is true with respect to H_2O, NH_3 and CH_4 ?
A. The central atoms of all the molecules are sp^3 hybridized.
B. The $H-O-H, H-N-H$ and $H-C-H$ angles in the above molecules are $104.5^\circ, 107.5^\circ$ and 109.5°, respectively.
C. The increasing order of dipole moment is $CH_4 < NH_3 < H_2O$.
D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.
E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.
Choose the correct answer from the options given below:

(1) A, B and C Only

(2) A, D and E Only

(3) C, D and E Only

(4) A, B, C and E Only

Q8. Given below are two statements :
Statement (I): Experimentally determined oxygen-oxygen bond lengths in the O_3 are found to be same and the bond length is greater than that of a $O=O$ (double bond) but less than that of a single $(O-O)$ bond.
Statement (II) : The strong lone pair-lone pair repulsion between oxygen atoms is solely responsible for the fact that the bond length in ozone is smaller than that of a double bond $(O=O)$ but more than that of a single bond $(O-O)$.
In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are false

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

Q9. The molecules having square pyramidal geometry are

(1) BrF_5 & PCl_5

(2) SbF_5 & PCl_5

(3) SbF_5 & $XeOF_4$

(4) BrF_5 & $XeOF_4$

Q10. Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z-direction] ?

A. $2p_z$ and $2p_x$

B. 2 s and $2p_x$

C. 3 d_{xy} and 3 $d_{x^2-y^2}$

D. 2 s and $2p_z$

E. $2p_z$ and $3d_x{}^2 - y^2$

Choose the correct answer from the options given below:

(1) A and B Only

(2) D Only

(3) E Only

(4) C and D Only

Q11. Total number of molecules/species from following which will be paramagnetic is _____

$O_2, O_2^+, O_2^-, NO, NO_2, CO, K_2[NiCl_4], [Co(NH_3)_6]Cl_3, K_2[Ni(CN)_4]$

Q12. Arrange the following compounds in increasing order of their dipole moment : HBr, H_2S, NF_3 and $CHCl_3$

(1) $H_2S < HBr < NF_3 < CHCl_3$

(2) $NF_3 < HBr < H_2S < CHCl_3$

(3) $HBr < H_2S < NF_3 < CHCl_3$

(4) $CHCl_3 < NF_3 < HBr < H_2S$

Q13. The correct option with order of melting points of the pairs (Mn, Fe), (Tc, Ru) and (Re, Os) is :

(1) $Fe < Mn, Ru < Tc$ and $Re < Os$

(2) $Mn < Fe, Tc < Ru$ and $Os < Re$

(3) $\mathrm{Mn} < \mathrm{Fe}, \mathrm{Tc} < \mathrm{Ru}$ and $\mathrm{Re} < \mathrm{Os}$

(4) $\mathrm{Fe} < \mathrm{Mn}, \mathrm{Ru} < \mathrm{Tc}$ and $\mathrm{Os} < \mathrm{Re}$

Q1. Consider the following elements In, Tl, Al, Pb, Sn and Ge.
The most stable oxidation states of elements with highest and lowest first ionisation enthalpies, respectively, are

(1) +4 and +1

(2) +1 and +4

(3) +4 and +3

(4) +2 and +3

Q2. Given below are the atomic numbers of some group 14 elements. The atomic number of the element with lowest melting point is :

(1) 6

(2) 82

(3) 14

(4) 50

Q1. The incorrect statement among the following is

(1) PH_3 shows lower proton affinity than NH_3.

(2) SO_2 can act as an oxidizing agent, but not as a reducing agent.

(3) PF_3 exists but NF_5 does not.

(4) NO_2 can dimerise easily.

Q2. A group 15 element forms $d\pi - d\pi$ bond with transition metals. It also forms hydride, which is a strongest base among the hydrides of other group members that form $d\pi - d\pi$ bond. The atomic number of the element is ____.

Q3. The maximum covalency of a non-metallic group 15 element ' E ' with weakest E – E bond is :

(1) 4

(2) 6

(3) 3

(4) 5

Q4. The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of

(1) Atomicity

(2) Electron gain enthalpy

(3) Electronegativity

(4) Atomic size

Q5. Which of the following electrolyte can be used to obtain H_2 S_2O_8 by the process of electrolysis?

(1) Dilute solution of sodium sulphate.

(2) Acidified dilute solution of sodium sulphate.

(3) Dilute solution of sulphuric acid

(4) Concentrated solution of sulphuric acid

Q1. Match List - I with List - II.

	$List-I$		$List-II$
(A)	Bronze	(I)	Cu, Ni
(B)	Brass	(II)	Fe, Cr, Ni, C
(C)	UK silver coin	(III)	Cu, Zn
(D)	Stainless steel	(IV)	Cu, Sn

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

(3) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q2. Preparation of potassium permanganate from MnO_2 involves two step process in which the 1st step is a reaction with KOH and KNO_3 to produce

(1) K_3MnO_4

(2) $K_4\left[Mn(OH)_6\right]$

(3) $KMnO_4$

(4) K_2MnO_4

Q3. Niobium (Nb) and ruthenium (Ru) have " x " and " y " number of electrons in their respective 4 d orbitals. The value of $x+y$ is _____.

Q4. The correct set of ions (aqueous solution) with same colour from the following is:

(1) $Sc^{3+}, Ti^{3+}, Cr^{2+}$

(2) V^{2+}, Cr^{3+}, Mn^{3+}

(3) Ti^{4+}, V^{4+}, Mn^{2+}

(4) Zn^{2+}, V^{3+}, Fe^{3+}

Q5. Consider ' n ' is the number of lone pair of electrons present in the equatorial position of the most stable structure of ClF_3. The ions from the following with ' n ' number of unpaired electrons are

A. V^{3+}

B. Ti^{3+}

C. Cu^{2+}

D. Ni^{2+}

E. Ti^{2+}

Choose the correct answer from the options given below:

(1) A and C Only

(2) A, D and E Only

(3) B and D Only

(4) B and C Only

Q6. The amphoteric oxide among V_2O_3, V_2O_4 and V_2O_5, upon reaction with alkali leads to formation of an oxide anion. The oxidation state of V in the oxide anion is :

(1) $+3$

(2) $+4$

(3) $+7$

(4) $+5$

Q7. The spin only magnetic moment (μ) value (B.M.) of the compound with strongest oxidising power among Mn_2O_3, TiO and VO is ____ B.M. (Nearest integer).

Q8. Consider the following reactions

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} [A] \xrightarrow[-H_2O]{H_2SO_4} [B] + K_2SO_4$$

The products $[A]$ and $[B]$, respectively are :

(1) K_2CrO_4 and CrO

(2) K_2CrO_4 and Cr_2O_3

(3) K_2CrO_4 and $K_2Cr_2O_7$

(4) $K_2Cr(OH)_6$ and Cr_2O_3

Q9. Which of the following oxidation reactions are carried out by both $K_2Cr_2O_7$ and $KMnO_4$ in acidic medium?

A. $I^- \rightarrow I_2$

B. $S^{2-} \rightarrow S$

C. $Fe^{2+} \rightarrow Fe^{3+}$

D. $I^- \rightarrow IO_3^-$

E. $S_2O_3^{2-} \rightarrow SO_4^{2-}$

Choose the correct answer from the options given below:

(1) C, D and E Only

(2) B, C and D Only

(3) A, D and E Only

(4) A, B and C Only

Q10. Identify the inorganic sulphides that are yellow in colour :

(A) $(NH_4)_2$ S

(B) Pbs

(C) Cus

(D) $As_2 S_3$

(E) $As_2 S_5$

Choose the correct answer from the options given below :

(1) (A), (D) and (E) only

(2) (D) and (E) only

(3) (A) and (B) only

(4) (A) and (C) only

Q11. The molar mass of the water insoluble product formed from the fusion of chromite ore $\left(\mathrm{FeCr_2O_4}\right)$ with $\mathrm{Na_2CO_3}$ in presence of $\mathrm{O_2}$ is _____ $\mathrm{gmol^{-1}}$.

Q12. Lanthanoid ions with $4f^7$ configuration are :

(A) Eu^{2+}

(B) Gd^{3+}

(C) Eu^{3+}

(D) Tb^{3+}

(E) Sm^{2+}

Choose the correct answer from the options given below :

(1) (A) and (D) only

(2) (B) and (C) only

(3) (A) and (B) only

(4) (B) and (E) only

Q13. Which of the following ions is the strongest oxidizing agent? (Atomic Number of $\mathrm{Ce}=58, \mathrm{Eu}=63, \mathrm{Tb}=65, \mathrm{Lu}=71$)

(1) Eu^{2+}

(2) Tb^{4+}

(3) Lu^{3+}

(4) Ce^{3+}

Q14. Find the compound ' A ' from the following reaction sequences.

$$A \xrightarrow{\text{aqua-regia}} B \xrightarrow[(2)\ AcOH]{(1)\ KNO_2|NH_4OH} \text{yellow ppt}$$

(1) CoS

(2) ZnS

(3) NiS

(4) MnS

Q1. The calculated spin-only magnetic moments of $K_3[Fe(OH)_6]$ and $K_4[Fe(OH)_6]$ respectively are :

(1) 3.87 and 4.90 B.M.

(2) 4.90 and 5.92 B.M.

(3) 4.90 and 4.90 B.M.

(4) 5.92 and 4.90 B.M.

Q2. Identify the coordination complexes in which the central metal ion has d^4 configuration.

(A) $[FeO_4]^{2-}$

(B) $[Mn(CN)_6]^{3-}$

(C) $[Fe(CN)_6]^{3-}$

(D) $Cr_2(O-\overset{\overset{O}{\|}}{C}-Me)_4(H_2O)_2$

(E) $[NiF_6]^{2-}$

Choose the correct answer from the options given below :

(1) (B), (C) and (D) only

(2) (C) and (E) only

(3) (B) and (D) only

(4) (A), (B) and (E) only

Q3. The complex of Ni^{2+} ion and dimethyl glyoxime contains _____ number of Hydrogen (H) atoms.

Q4. Identify the homoleptic complexes with odd number of d electrons in the central metal :

(A) $[FeO_4]^{2-}$

(B) $[Fe(CN)_6]^{3-}$

(C) $[Fe(CN)_5NO]^{2-}$

(D) $[CoCl_4]^{2-}$

(E) $[Co(H_2O)_3F_3]$

Choose the correct answer from the options given below :

(1) (A), (B) and (D) only

(2) (C) and (E) only

(3) (B) and (D) only

(4) (A), (C) and (E) only

Q5. The complex that shows Facial - Meridional isomerism is:

(1) $_{1.}[Co(en)_2Cl_2]^+$

(2) $[Co(en)_3]^{3+}$

(3) $\left[Co(NH_3)_3Cl_3\right]$

(4) $\left[Co(NH_3)_4Cl_2\right]^+$

Q6. From the magnetic behaviour of $[NiCl_4]^{2-}$ (paramagnetic) and $[Ni(CO)_4]$ (diamagnetic), choose the correct geometry and oxidation state.

(1) $[NiCl_4]^{2-}$: Ni^{II}, tetrahedral
$[Ni(CO)_4]$: Ni^{II}, square planar

(2) $[NiCl_4]^{2-}$: Ni^{II}, square planar
$[Ni(CO)_4]$: $Ni(0)$, square planar

(3) $[NiCl_4]^{2-}$: Ni^{II}, tetrahedral
$[Ni(CO)_4]$: $Ni(0)$, tetrahedral

(4) $[NiCl_4]^{2-}$: $Ni(0)$, tetrahedral
$[Ni(CO)_4]$: $Ni(0)$, square planar

Q7. Identify the homoleptic complex(es) that is/are low spin.
(A) $[Fe(CN)_5NO]^{2-}$
(B) $[CoF_6]^{3-}$
(C) $[Fe(CN)_6]^{4-}$
(D) $\left[Co(NH_3)_6\right]^{3+}$
(E) $\left[Cr(H_2O)_6\right]^{2+}$
Choose the correct answer from the options given below :

(1) (C) only

(2) (C) and (D) only

(3) (A) and (C) only

(4) (B) and (E) only

Q8. One mole of the octahedral complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with excess of $AgNO_3$ solution to yield two moles of $AgCl_{(s)}$. The structure of the complex is:

(1) $\left[Co(NH_3)_4Cl_2\right] \cdot Cl \cdot NH_3$

(2) $\left[Co(NH_3)_3Cl_3\right] \cdot 2NH_3$

(3) $\left[Co(NH_3)_5Cl\right] Cl_2$

(4) $\left[Co(NH_3)_4Cl\right] \cdot Cl_2 \cdot NH_3$

Q9. Match List - I with List - II.

	List - I (Transition metal ion)		**List - II (Spin only magnetic moment (B.M.))**
(A)	Ti^{3+}	(I)	3.87
(B)	V^{2+}	(II)	0.00
(C)	Ni^{2+}	(III)	1.73
(D)	Sc^{3+}	(IV)	2.84

Choose the correct answer from the options given below :

(1) (A) – (III), (B) – (I), (C) – (IV), (D) – (II)

(2) (A) – (III), (B) – (I), (C) – (II), (D) – (IV)

(3) (A) – (IV), (B) – (II), (C) – (III), (D) – (I)

(4) (A) – (II), (B) – (IV), (C) – (I), (D) – (III)

Q10. Match List - I with List - II.

	List - I (Complex)		**List - II (Hybridisation of central metal ion)**
(A)	$[CoF_6]^{3-}$	(I)	d^2sp^3
(B)	$[NiCl_4]^{2-}$	(II)	sp^3
(C)	$[Co(NH_3)_6]^{3+}$	(III)	sp^3d^2
(D)	$[Ni(CN)_4]^{2-}$	(IV)	dsp^2

Choose the correct answer from the options given below :

(1) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(2) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(4) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

Q11. Match List - I with List - II.

	List - I (Complex)		List - II (Hybridisation & Magnetic characters)
(A)	$[MnBr_4]^{2-}$	(I)	d^2sp^3 & diamagnetic
(B)	$[FeF_6]^{3-}$	(II)	$sp^3\ d^2$ & paramagnetic
(C)	$\left[Co(C_2O_4)_3\right]^{3-}$	(III)	sp^3 & diamagnetic
(D)	$[Ni(CO)_4]$	(IV)	sp^3 & paramagnetic

Choose the correct answer from the options given below :

(1) (A) $-(IV), (B) - (II), (C) - (I), (D) - (III)$

(2) $(A) - (III), (B) - (I), (C) - (II), (D) - (IV)$

(3) (A) $-(IV), (B) - (I), (C) - (II), (D) - (III)$

(4) $(A) - (III), (B) - (II), (C) - (I), (D) - (IV)$

Q12. Consider the following low-spin complexes

$K_3\left[Co(NO_2)_6\right]$, $K_4\left[Fe(CN)_6\right]$,
$K_3\left[Fe(CN)_6\right]$, $Cu_2\left[Fe(CN)_6\right]$ and $Zn_2\left[Fe(CN)_6\right]$

The sum of the spin-only magnetic moment values of complexes having yellow colour is. _____ B.M. (answer in nearest integer)

Q13. In which of the following complexes the CFSE, Δ_o will be equal to zero?

(1) $[Fe(en)_3]\ Cl_3$

(2) $K_4\left[Fe(CN)_6\right]$

(3) $\left[Fe(NH_3)_6\right]\ Br_2$

(4) $K_3\left[Fe(SCN)_6\right]$

Q14. The correct order of the following complexes in terms of their crystal field stabilization energies is :

(1) $\left[Co(NH_3)_4\right]^{2+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(en)_3\right]^{3+} < \left[Co(NH_3)_6\right]^{3+}$

(2) $\left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(NH_3)_4\right]^{2+} < \left[Co(en)_3\right]^{3+}$

(3) $\left[Co(en)_3\right]^{3+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_4\right]^{2+}$

(4) $\left[Co(NH_3)_4\right]^{2+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(en)_3\right]^{3+}$

Q15. The d- electronic configuration of an octahedral Co(II) complex having magnetic moment of 3.95 BM is:

(1) $t_{2\,g}{}^3e_g{}^0$

(2) $t_{2g}^6 e_g^1$

(3) $t_{2g}^5 e_g^2$

(4) $e^4 t_2^3$

Q16. The conditions and consequence that favours the $t_2{}^3{}^3 e_g{}^1$ configuration in a metal complex are :

(1) weak field ligand, low spin complex

(2) weak field ligand, high spin complex

(3) strong field ligand, high spin complex

(4) strong field ligand, low spin complex

Q17. The correct increasing order of stability of the complexes based on Δ_o value is :

I. $[Mn(CN)_6]^{3-}$

II. $[Co(CN)_6]^{4-}$

III. $[Fe(CN)_6]^{4-}$

IV. $[Fe(CN)_6]^{3-}$

(1) $IV < III < II < I$

(2) $I < II < IV < III$

(3) $III < II < IV < I$

(4) $II < III < I < IV$

Q18. $CrCl_3 \cdot xNH_3$ can exist as a complex. 0.1 molal aqueous solution of this complex shows a depression in freezing point of $0.558^\circ C$. Assuming 100% ionisation of this complex and coordination number of Cr is 6 , the complex will be

(Given $K_f = 1.86\ K\ kg\ mol^{-1}$)

(1) $[Cr(NH_3)_5Cl]\ Cl_2$

(2) $[Cr(NH_3)_6]\ Cl_3$

(3) $[Cr(NH_3)_3Cl_3]$

(4) $[Cr(NH_3)_4Cl_2]\ Cl$

Q19. When Ethane-1,2-diamine is added progressively to an aqueous solution of Nickel (II) chloride, the sequence of colour change observed will be :

(1) Violet $\rightarrow$ Blue $\rightarrow$ Pale Blue $\rightarrow$ Green

(2) Pale Blue → Blue → Green → Violet

(3) Green → Pale Blue → Blue → Violet

(4) Pale Blue → Blue → Violet → Green

Q1. The metal ion whose electronic configuration is not affected by the nature of the ligand and which gives a violet colour in non-luminous flame under hot condition in borax bead test is

(1) Mn^{2+}

(2) Cr^{3+}

(3) Ni^{2+}

(4) Ti^{3+}

Q2. Among the following cations, the number of cations which will give characteristic precipitate in their identification tests with $K_4[Fe(CN)_6]$ is _____.

$Cu^{2+}, Fe^{3+}, Ba^{2+}, Ca^{2+}, NH_4^+, Mg^{2+}, Zn^{2+}$

Q3. Identify A, B and C in the given below reaction sequence

$$A \xrightarrow{HNO_3} Pb(NO_3)_2 \xrightarrow{H_2SO_4} B \xrightarrow[(2)\ \text{Acetic acid}\ (3)\ K_2CrO_4]{(1)\ \text{Ammonium acetate}}$$

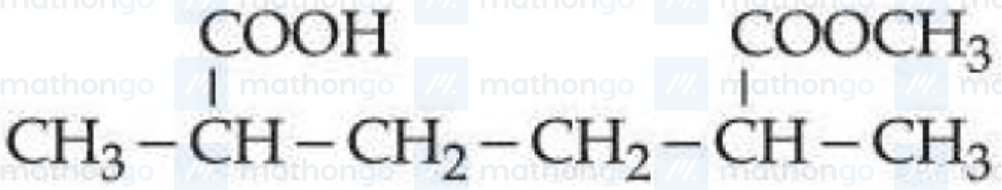
(1) $PbCl_2, PbSO_4, PbCrO_4$

(2) $PbS, PbSO_4, Pb(CH_3COO)_2$

(3) $PbCl_2, Pb(SO_4)_2, PbCrO_4$

(4) $PbS, PbSO_4, PbCrO_4$

Q1. The IUPAC name of the following compound is :



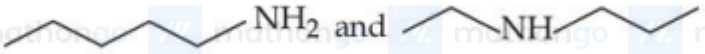
(1) Methyl-6-carboxy-2,5-dimethylhexanoate.

(2) 2-Carboxy-5-methoxycarbonylhexane.

(3) 6-Methoxycarbonyl-2,5-dimethylhexanoic acid.

(4) Methyl-5-carboxy-2-methylhexanoate.

Q2. Given below are two statements :

Statement (I) :  are isomeric compounds.**Statement (II) :**  are functional group isomers.

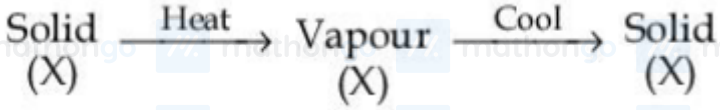
(1) Both **Statement (I)** and **Statement (II)** are false.

(2) Both **Statement (I)** and **Statement (II)** are true.

(3) **Statement (I)** is false but **Statement (II)** is true.

(4) **Statement (I)** is true but **Statement (II)** is false.

Q3. The purification method based on the following physical transformation is :



(1) Distillation

(2) Extraction

(3) Sublimation

(4) Crystallization

Q4. Given below are two statements :

Statement (I): In partition chromatography, stationary phase is thin film of liquid present in the inert support.

Statement (II) : In paper chromatography, the material of paper acts as a stationary phase.

In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is true but Statement II is false

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are false

(4) Both Statement I and Statement II are true

Q5. Given below are two statements I and II.

Statement I: Dumas method is used for estimation of "Nitrogen" in an organic compound.

Statement II: Dumas method involves the formation of ammonium sulphate by heating the organic compound with conc H_2SO_4.

In the light of the above statements, choose the correct answer from the options given below

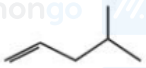
(1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are false

(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are true

Q6. Match List - I with List - II.

List - I (Structure)		List - II (IUPAC Name)
(A)	$H_3C-CH_2-\underset{\underset{C_2H_5}{\vert}}{CH}-CH_2-\underset{\underset{CH_3}{\vert}}{CH}-C_2H_5$	(I) 4-Methylpent-1-ene
(B)	$(CH_3)_2C\ (C_3H_7)_2$	(II) 3-Ethyl-5-methylheptane
(C)		(III) 4,4-Dimethylheptane
(D)		(IV) 2-Methyl-1,3-pentadiene

Choose the correct answer from the options given below :

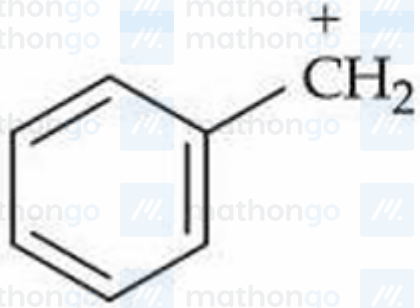
(1) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

(2) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

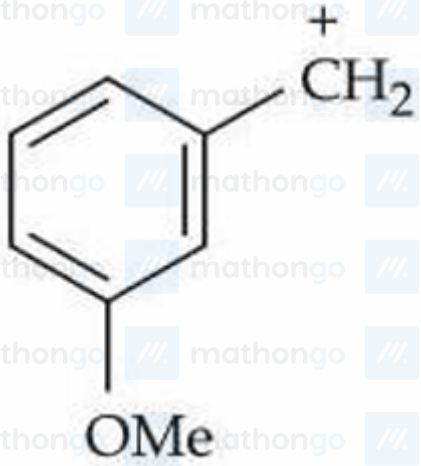
(3) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(4) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

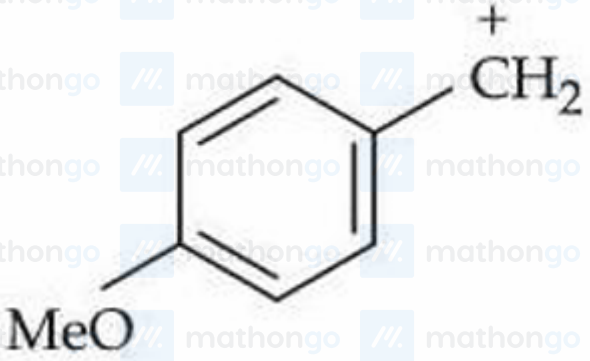
Q7. The most stable carbocation from the following is :



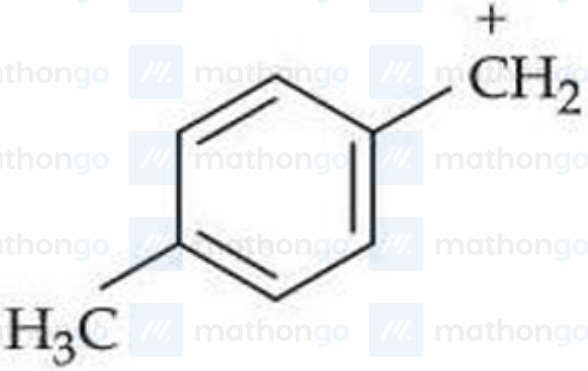
(1)



(2)

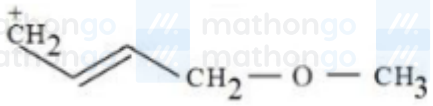


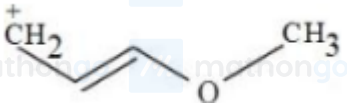
(3)

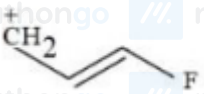


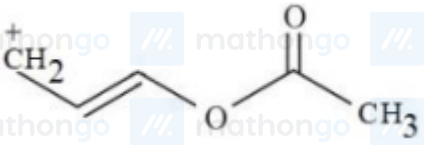
(4)

Q8. Which one of the carbocations from the following is most stable?

(1) 

(2) 

(3) 

(4) 

Q9. Identify correct statement/s :

(A) $-OCH_3$ and $-NHCOCH_3$ are activating group.

(B) -CN and -OH are meta directing group.

(C) -CN and $-SO_3H$ are meta directing group.

(D) Activating groups act as ortho - and para directing groups.

(E) Halides are activating groups.

Choose the correct answer from the options given below :

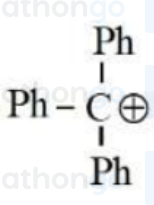
(1) (A) only

(2) (A), (B) and (E) only

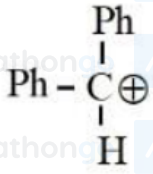
(3) (A) and (C) only

(4) (A), (C) and (D) only

Q10. The correct order of stability of following carbocations is :

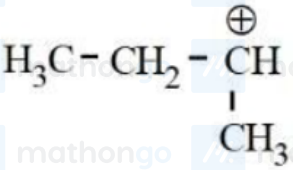


A



B

C



D

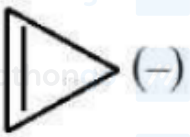
(1) C > B > A > D

(2) A > B > C > D

(3) B > C > A > D

(4) $C > A > B > D$

Q11. The correct stability order of the following species/molecules is:



p

q

r

(1) $q > r > p$

(2) $r > q > p$

(3) $q > p > r$

(4) $p > q > r$

Q12. Total number of nucleophiles from the following is :

$$NH_3, PhSH, (H_3C)_2S, H_2C=CH_2, \overset{\ominus}{O}H, H_3O^{\oplus}, (CH_3)_2CO, >=NCH_3$$

(1) 7

(2) 4

(3) 6

(4) 5

Q13. The incorrect statements regarding geometrical isomerism are :

(A) Propene shows geometrical isomerism.

(B) Trans isomer has identical atoms/groups on the opposite sides of the double bond.

(C) Cis-but-2-ene has higher dipole moment than trans-but-2-ene.

(D) 2-methylbut-2-ene shows two geometrical isomers.

(E) Trans-isomer has lower melting point than cis isomer.

Choose the correct answer from the options given below :

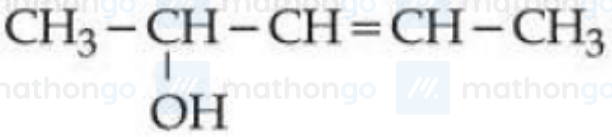
(1) (A) and (E) Only

(2) (A), (D) and (E) Only

(3) (B) and (C) Only

(4) (C), (D) and (E) Only

Q14. How many different stereoisomers are possible for the given molecule?



(1) 2

(2) 1

(3) 4

(4) 3

Q15. Propane molecule on chlorination under photochemical condition gives two di-chloro products, " x " and " y ". Amongst " x " and " y ", " x " is an optically active molecule. How many tri-chloro products (consider only structural isomers) will be obtained from " x " when it is further treated with chlorine under the photochemical condition?

(1) 2

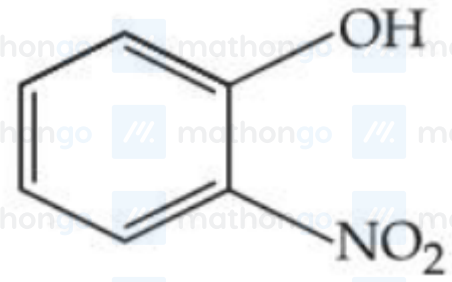
(2) 5

(3) 4

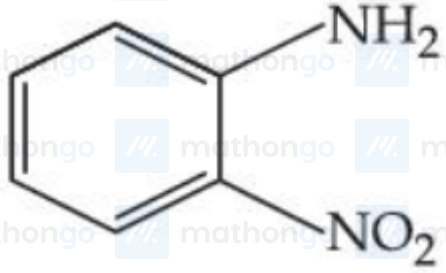
(4) 3

Q16. The possible number of stereoisomers for 5-phenylpent-4-en-2-ol is . . . . .

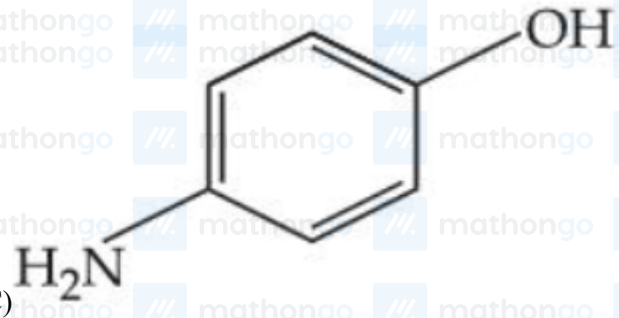
Q17. The steam volatile compounds among the following are :

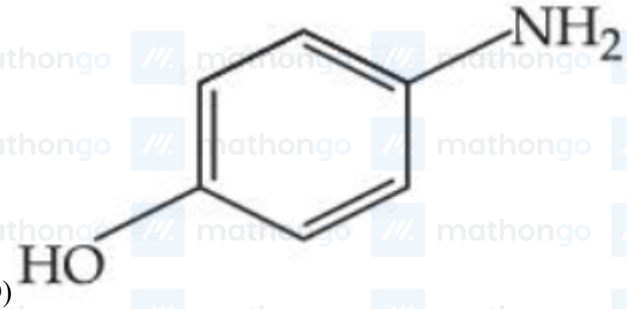


(A)



(B)

(C) 

(D) 

Choose the correct answer from the options given below :

(1) (B) and (D) Only

(2) (A) and (C) Only

(3) (A), (B) and (C) Only

(4) (A) and (B) Only

Q18. Given below are two statements :

Statement (I) : Nitrogen, sulphur, halogen and phosphorus present in an organic compound are detected by Lassaigne's Test.

Statement (II) : The elements present in the compound are converted from covalent form into ionic form by fusing the compound with Magnesium in Lassaigne's test.

In the light of the above statements, choose the correct anower from the options given below :

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

Q19. Given below are two statements:

Statement I: In Lassaigne's test, the covalent organic molecules are transformed into ionic compounds.

Statement II: The sodium fusion extract of an organic compound having N and S gives prussian blue colour with $FeSO_4$ and $Na_4\,[Fe(CN)_6]$

In the light of the above statements, choose the correct answer from the options given below.

(1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

(4) Statement I is false but Statement II is true

Q20. In Carius method for estimation of halogens, 180 mg of an organic compound produced 143.5 mg of AgCl. The percentage composition of chlorine in the compound is _____ %.
(Given : molar mass in $gmol^{-1}$ of Ag : 108, Cl : 35.5)

Q21. During " S " estimation, 160 mg of an organic compound gives 466 mg of barium sulphate. The percentage of Sulphur in the given compound is _____ %.
(Given molar mass in $gmol^{-1}$ of Ba : 137, S : 32, O : 16)

Q22. In Carius method of estimation of halogen, 0.25 g of an organic compound gave 0.15 g of silver bromide (AgBr). The percentage of Bromine in the organic compound is ..... $\times 10^{-1}$% (Nearest integer).
(Given : Molar mass of Ag is 108 and Br is 80 g mol^{-1})

Q23. In the sulphur estimation, 0.20 g of a pure organic compound gave 0.40 g of barium sulphate. The percentage of sulphur in the compound is _____ $\times 10^{-1}$%.
(Molar mass : O = 16, S = 32, Ba = 137 in $gmol^{-1}$)

Q1. The alkane from below having two secondary hydrogens is :

(1) 4 - Ethyl-3,4-dimethyloctane

(2) 2,2,4,4-Tetramethylhexane

(3) 2, 2, 3, 3-Tetramethylpentane

(4) 2, 2, 4, 5-Tetramethylheptane

Q2. Match the LIST-I with LIST-II

LIST-I Name reaction		LIST-II Product obtainable	
A.	Swarts reaction	I.	Ethyl benzene
B.	Sandmeyer's reaction	II.	Ethyl iodide
C.	Wurtz Fittig reaction	III.	Cyanobenzene
D.	Finkelstein reaction	IV.	Ethyl fluoride

Choose the correct answer from the options given below:

(1) A-II, B-I, C-III, D-IV

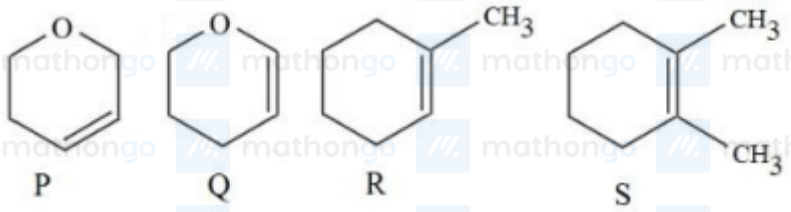
(2) A-II, B-III, C-I, D-IV

(3) A-IV, B-I, C-III, D-II

(4) A-IV, B-III, C-I, D-II

Q3. Following are the four molecules "P", "Q", "R" and "S".

Which one among the four molecules will react with $H - Br_{(aq)}$ at the fastest rate?



(1) R

(2) P

(3) Q

(4) S

Q4. Given below are two statements :

Statement (I) : On nitration of m-xylene with HNO_3, H_2SO_4 followed by oxidation, 4-nitrobenzene-1,3-dicarboxylic acid is obtained as the major product.

Statement (II) : $-CH_3$ group is o/p-directing while $-NO_2$ group is m-directing group.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are false

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

Q5. Given below are two statements :

Statement I : One mole of propyne reacts with excess of sodium to liberate half a mole of H_2 gas.

Statement II : Four g of propyne reacts with $NaNH_2$ to liberate NH_3 gas which occupies 224 mL at STP.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is incorrect but Statement II is correct

(2) Both Statement I and Statement II are correct

(3) Statement I is correct but Statement II is incorrect

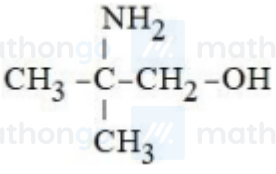
(4) Both Statement I and Statement II are incorrect

Q6. The product (A) formed in the following reaction sequence is

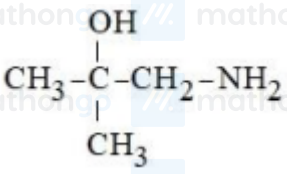
$$CH_3-C\equiv CH \xrightarrow[\text{iii) } H_2/Ni]{\text{i) } Hg^{2+}.H_2SO_4,\ \text{ii) } HCN} (A)$$

Product

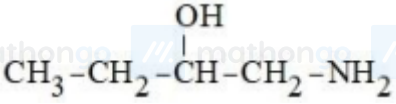
(1)



(2)



(3)



(4) $CH_3-CH_2-\underset{\displaystyle NH_2}{\underset{|}{CH}}-CH_2-OH$

Q7. Identify product $[A]$, $[B]$ and $[C]$ in the following reaction sequence.

$$CH_3-C\equiv CH \xrightarrow[H_2]{Pd/C} [A] \xrightarrow[(ii)\ Zn,\ H_2O]{(i)\ O_3} [B]+[C]$$

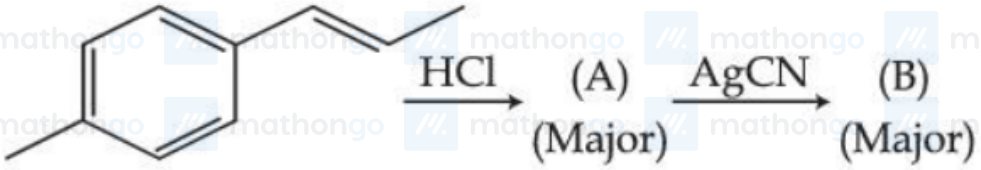
(1) $[A]: CH_2=CH_2,\ [B]: H_3C-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3,\ [C]: HCHO$

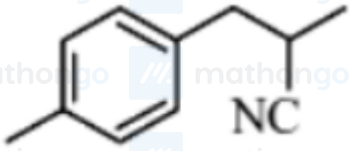
(2) $[A]: CH_3-CH=CH_2,\ [B]: CH_3CHO,\ [C]: CH_3CH_2OH$

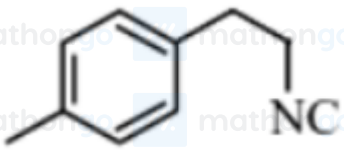
(3) $[A]: CH_3-CH=CH_2,\ [B]: CH_3CHO,\ [C]: HCHO$

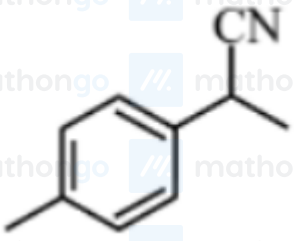
(4) $[A]: CH_3CH_2CH_3,\ [B]: CH_3CHO,\ [C]: HCHO$

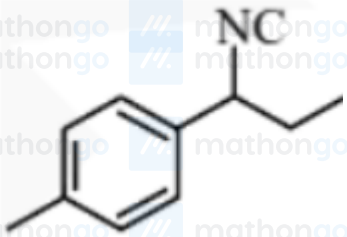
Q8. The product B formed in the following reaction sequence is :



(1) 

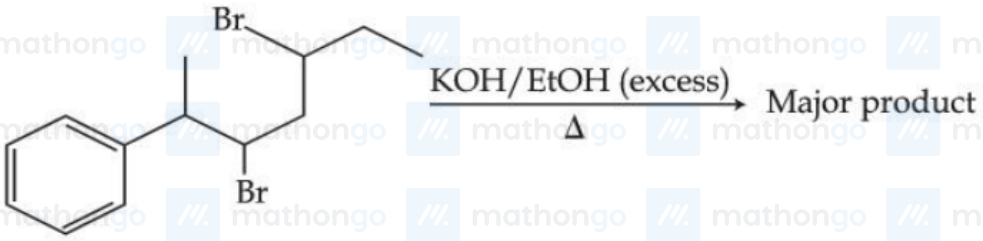
(2) 

(3) 



(4)

Q9. The major product of the following reaction is :



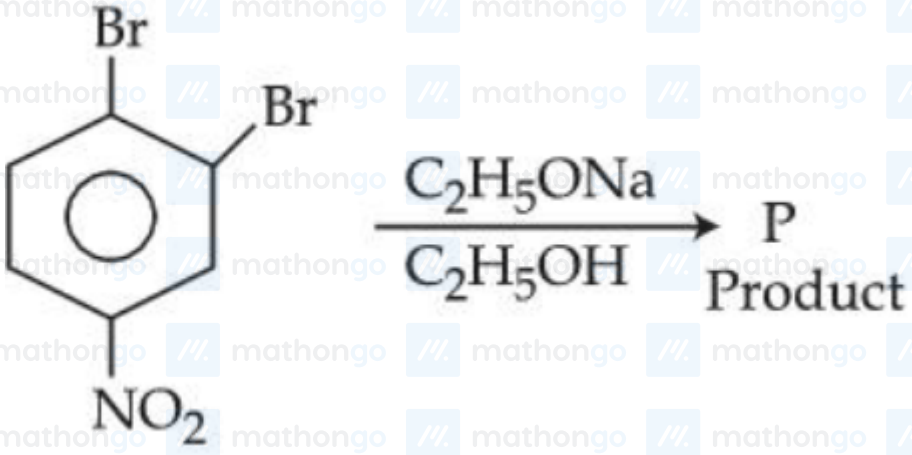
(1) 2-Phenylhepta-2,5-diene

(2) 6-Phenylhepta-2,4-diene

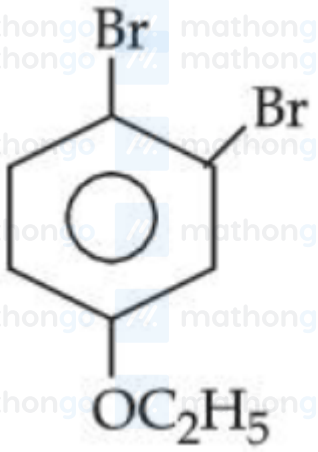
(3) 6-Phenylhepta-3,5-diene

(4) 2-Phenylhepta-2,4-diene

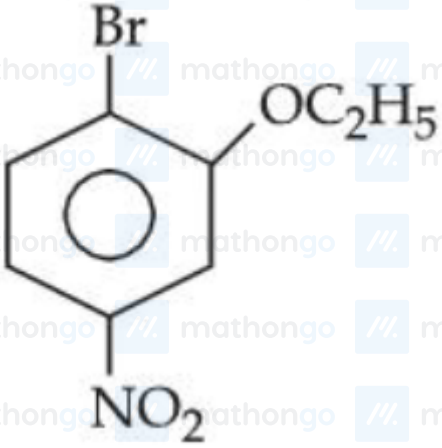
Q10. In the following substitution reaction:



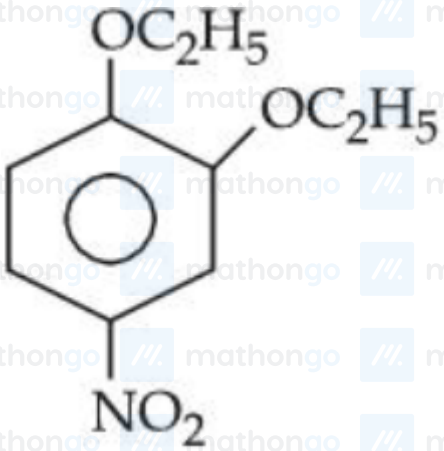
product 'P' formed is :



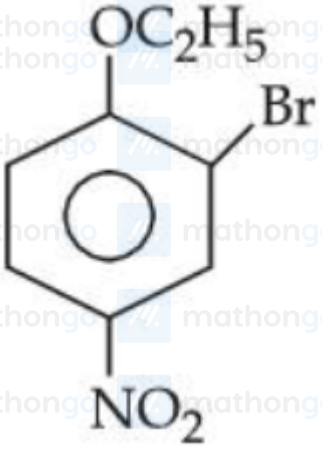
(1)



(2)

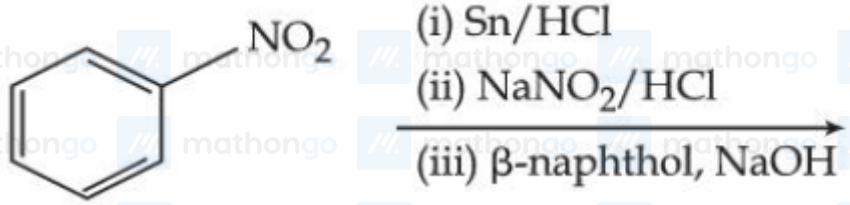


(3)

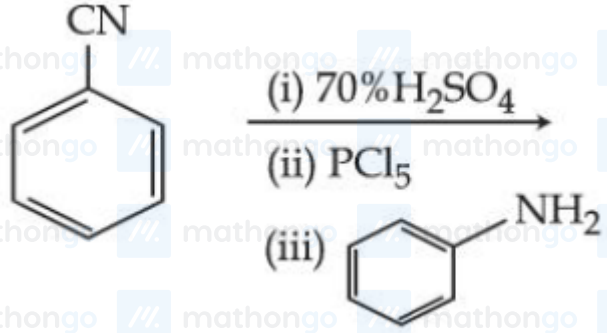


(4)

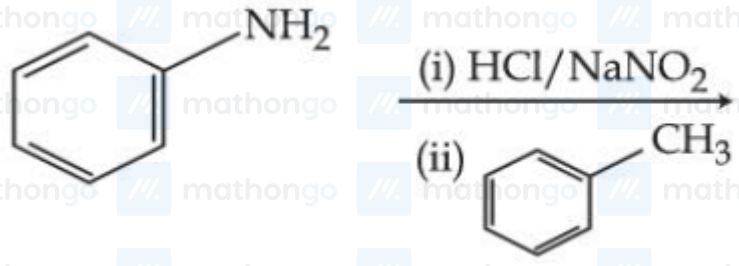
Q11. Which one of the following reaction sequences will give an azo dye?



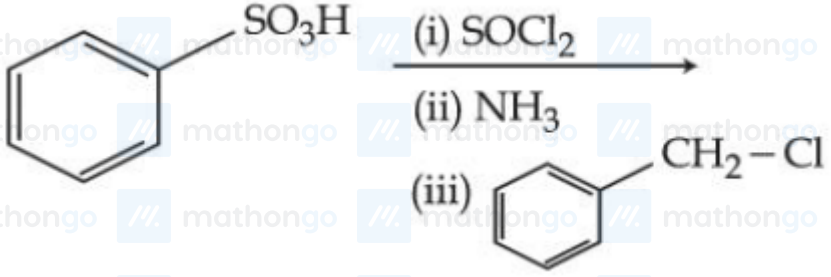
(1)



(2)



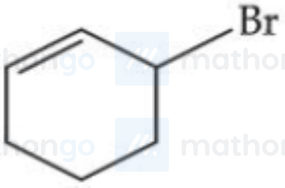
(3)

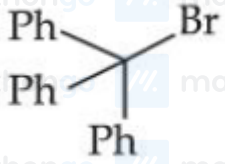


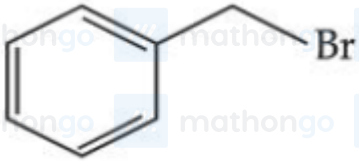
(4)

Q12. Which among the following halides will generate the most stable carbocation in the nucleophilic substitution reaction?

(1) 

(2) 

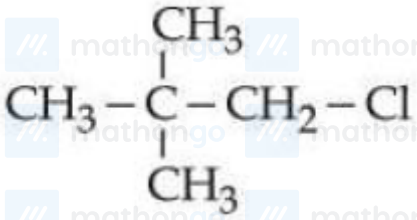
(3) 

(4) 

Q13. Isomeric hydrocarbons $\rightarrow$ negative Baeyer's test
(Molecular formula C_9H_{12})
The total number of isomers from above with four different non-aliphatic substitution sites is -

Q1. Given below are two statements :

Statement I : $CH_3 - O - CH_2 - Cl$ will undergo S_N1 reaction though it is a primary halide.



Statement II :

will not undergo S_N2 reaction very easily though it is a primary halide.

In the light of the above statements, choose the most appropriate answer from the options given below :

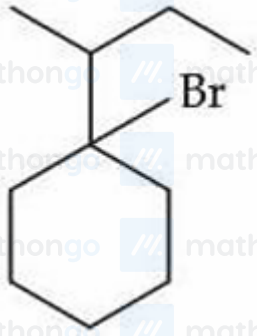
(1) Both Statement I and Statement II are incorrect

(2) Both Statement I and Statement II are correct

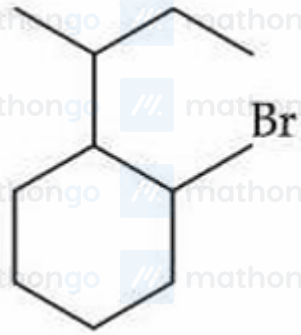
(3) Statement I is incorrect but Statement II is correct

(4) Statement I is correct but Statement II is incorrect

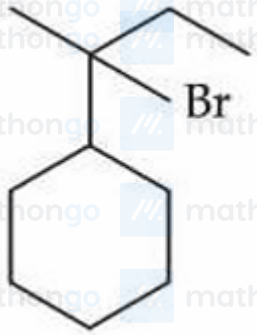
Q2. When sec-butylcyclohexane reacts with bromine in the presence of sunlight, the major product is :



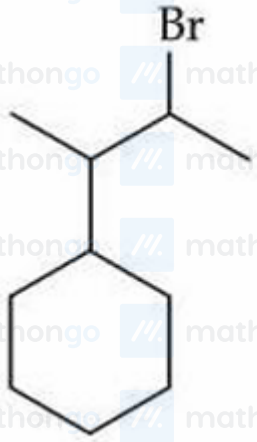
(1)



(2)



(3)



(4)

Q3. The compound with molecular formula C_6H_6, which gives only one monobromo derivative and takes up four moles of hydrogen per mole for complete hydrogenation has _____ π electrons.

Q4. Given below are two statements:

Statement I: The conversion proceeds well in the less polar medium.

$$CH_3-CH_2-CH_2-CH_2-Cl \xrightarrow{HO^-} CH_3-CH_2-CH_2-CH_2-OH + Cl^{(-)}$$

Statement II: The conversion proceeds well in the more polar medium.

$$CH_3-CH_2-CH_2-CH_2-Cl \xrightarrow{R_3\ddot{N}} CH_3-CH_2-CH_2-CH_2-\overset{R}{\underset{R}{\overset{|}{\underset{|}{N^{(+)}}}}}-R\ Cl^{(-)}$$

In the light of the above statements, choose the correct answer from the options given below

(1) Both Statement I and Statement II are true

(2) Statement I is true but Statement II is false

(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are false

Q5. The products A and B in the following reactions, respectively are

$$A \xrightleftharpoons{Ag-NO_2} CH_3-CH_2-CH_2-Br \xrightarrow{AgCN} B$$

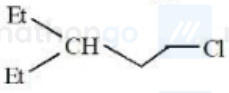
(1) $CH_3-CH_2-CH_2-NO_2$, $CH_3-CH_2-CH_2-CN$

(2) $CH_3-CH_2-CH_2-ONO$, $CH_3-CH_2-CH_2-NC$

(3) $CH_3-CH_2-CH_2-ONO$, $CH_3-CH_2-CH_2-CN$

(4) $CH_3-CH_2-CH_2-NO_2$, $CH_3-CH_2-CH_2-NC$

Q6. Given below are two statements:

Statement I:  will undergo alkaline hydrolysis at a faster rate than 

Statement II: In  , intramolecular substitution takes place first by involving lone pair of electrons on nitrogen.

In the light of the above statements, choose the most appropriate answer from the options given below

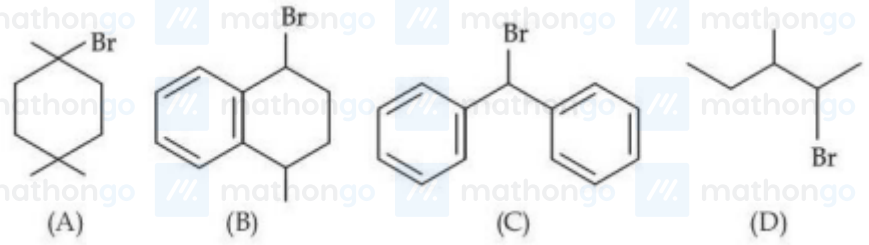
(1) Statement I is incorrect but Statement II is correct

(2) Statement I is correct but Statement II is incorrect

(3) Both Statement I and Statement II are correct

(4) Both Statement I and Statement II are incorrect

Q7. The ascending order of relative rate of solvolysis of following compounds is :



(A) (B) (C) (D)

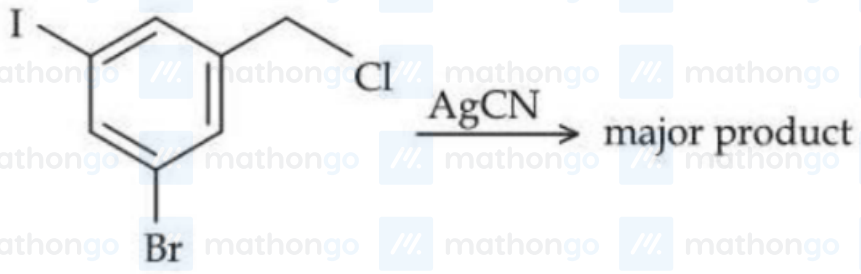
(1) (C) < (B) < (A) < (D)

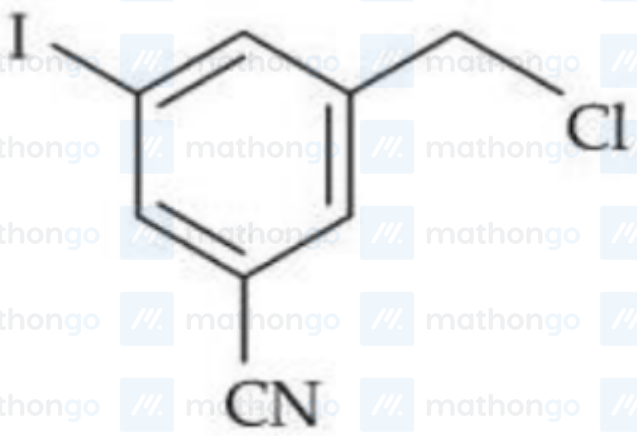
(2) (D) < (A) < (B) < (C)

(3) (D) < (B) < (A) < (C)

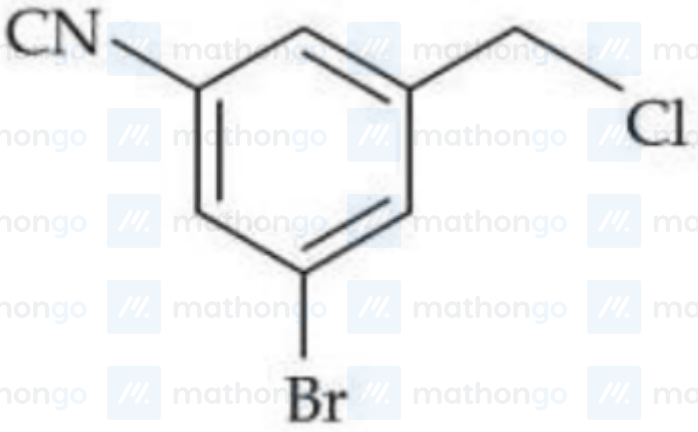
(4) (C) < (D) < (B) < (A)

Q8. The structure of the major product formed in the following reaction is :

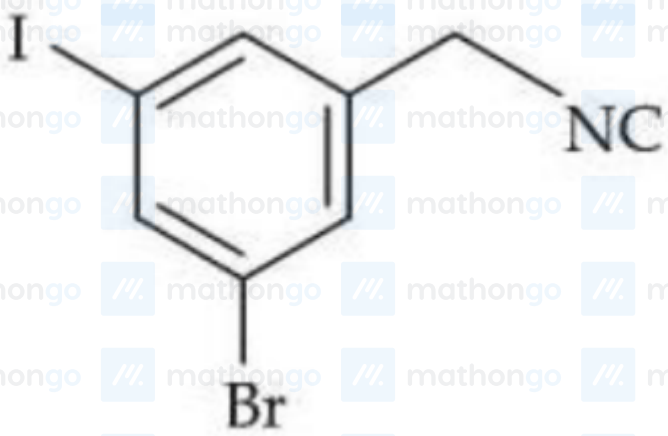




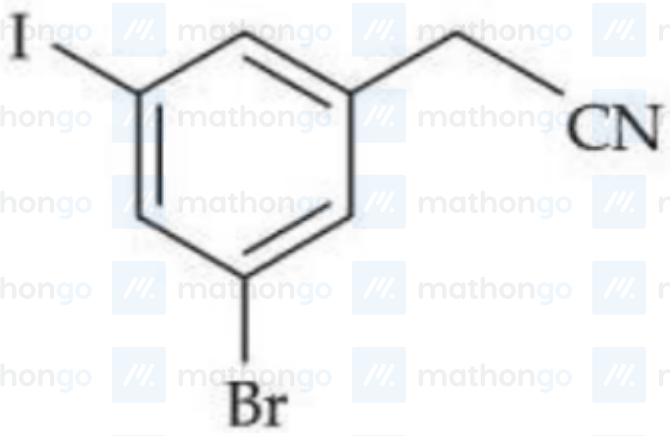
(1)



(2)

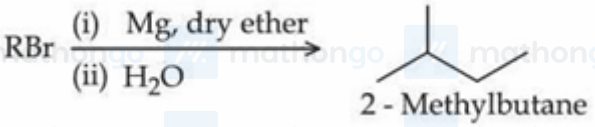


(3)



(4)

Q9.



The maximum number of RBr producing 2-methylbutane by above sequence of reactions is _____ - (Consider the structural isomers only)

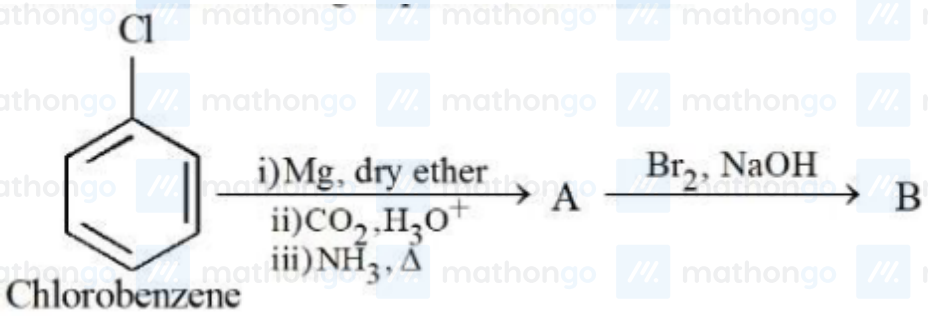
(1) 5

(2) 4

(3) 3

(4) 1

Q10. Consider the following sequence of reactions:



11.25 mg of chlorobenzene will produce _____ $\times 10^{-1}$mg of product B.
(Consider the reactions result in complete conversion.)
[Given molar mass of C, H, O, N and Cl as 12, 1, 16, 14 and 35.5 g mol^{-1} respectively]

Q1. What amount of bromine will be required to convert 2 g of phenol into 2,4,6-tribromophenol? (Given molar mass in $gmol^{-1}$ of C, H, O, Br are 12, 1, 16, 80 respectively)

(1) 20.44 g

(2) 4.0 g

(3) 6.0 g

(4) 10.22

Q2. Given below are two statements :

Statement (I) : The boiling points of alcohols and phenols increase with increase in the number of C-atoms.

Statement (II) : The boiling points of alcohols and phenols are higher in comparison to other class of compounds such as ethers, haloalkanes.

In the light of the above statements, choose the correct answer from the options given below :

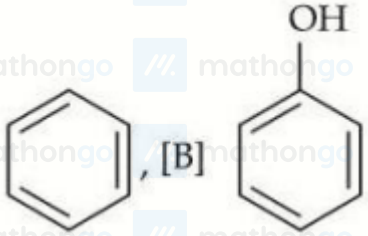
(1) Both Statement I and Statement II are false

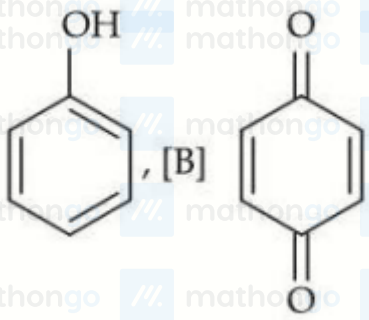
(2) Both Statement I and Statement II are true

(3) Statement I is false but Statement II is true

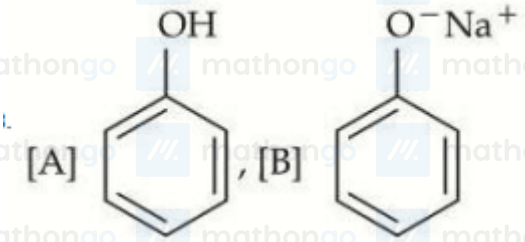
(4) Statement I is true but Statement II is false

Q3. Identify the products $[A]$ and $[B]$, respectively in the following reaction :

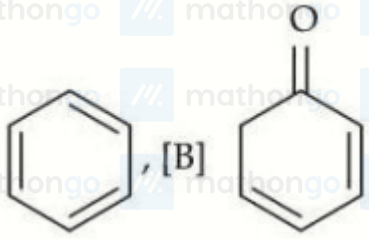
(1) 



(2)

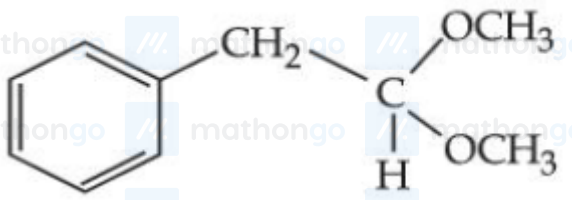


(3)

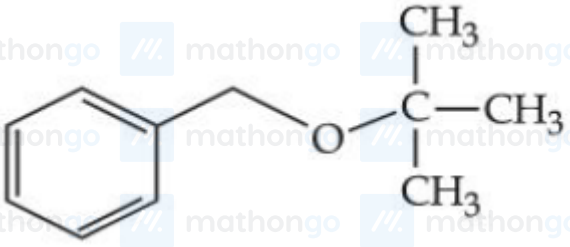


(4)

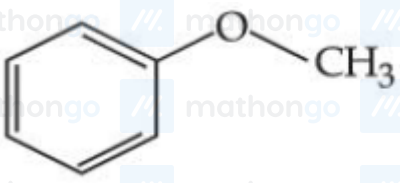
Q4. Which one of the following, with HBr will give a phenol?



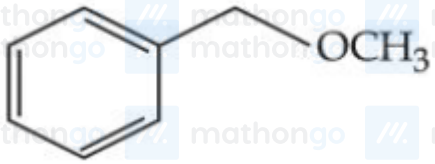
(1)



(2)



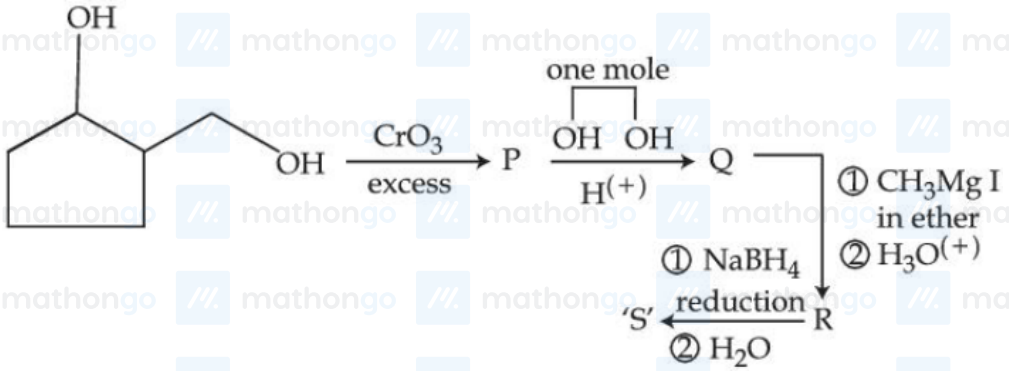
(3)



(4)

Q5. In the Claisen-Schmidt reaction to prepare, dibenzalacetone from 5.3 g of benzaldehyde, a total of 3.51 g of product was obtained. The percentage yield in this reaction was _____ %.

Q6.



0.1 mole of compound ' S ' will weigh _____ g. (Given molar mass in gmol^{-1} $\mathrm{C}:12, \mathrm{H}:1, \mathrm{O}:16$)

Q1. Which of the following arrangements with respect to their reactivity in nucleophilic addition reaction is correct?

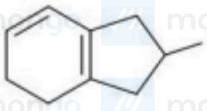
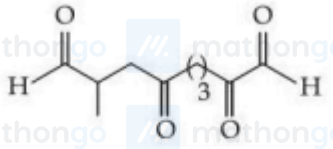
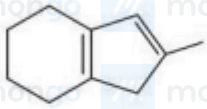
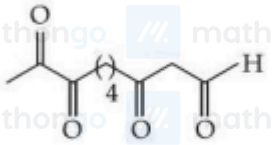
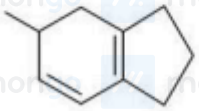
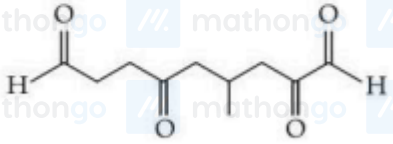
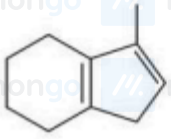
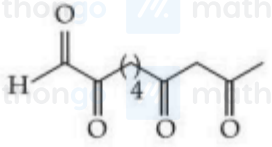
(1) acetophenone < benzaldehyde < p-tolualdehyde < p- nitrobenzaldehyde

(2) benzaldehyde < acetophenone < p- nitrobenzaldehyde < p-tolualdehyde

(3) p- nitrobenzaldehyde < benzaldehyde < p-tolualdehyde < acetophenone

(4) acetophenone < p-tolualdehyde < benzaldehyde < p- nitrobenzaldehyde

Q2. Match **List - I** with **List - II.**

List - I (Isomers of $C_{10}H_{14}$)	**List - II** (Ozonolysis product)
(A) 	(I) 
(B) 	(II) 
(C) 	(III) 
(D) 	(IV) 

Choose the correct answer from the options given below :

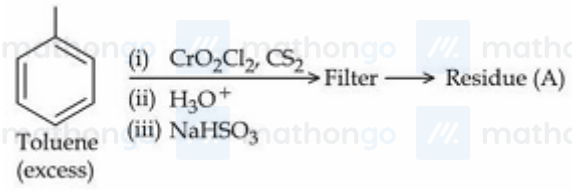
(1) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(2) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

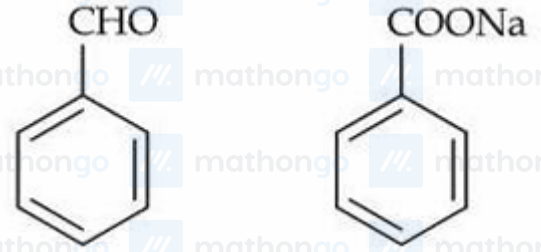
Q3.

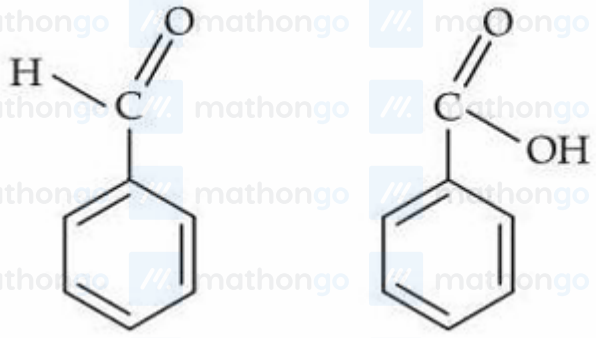


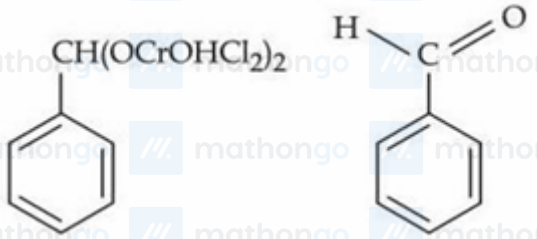
Residue (A) + HCl (dil) → Compound (B)

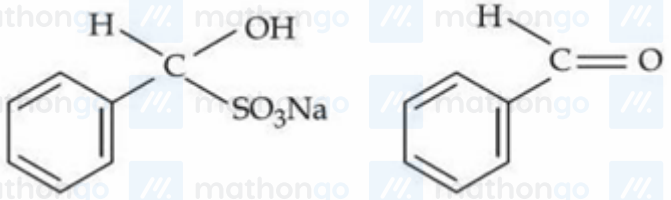
Structure of residue (A) and compound (B) formed respectively is :

[A] [B]

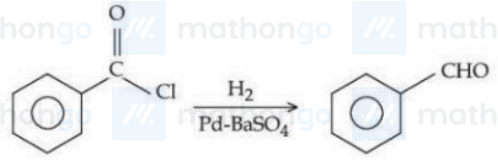
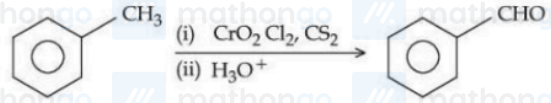
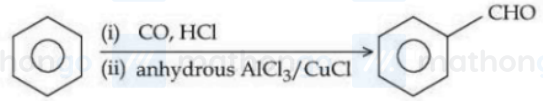
(1) 

(2) 

(3) 

(4) 

Q4. Match List - I with List - II.

List - I		List - II	
(A)	$RCN \xrightarrow[(ii)\ H_3O^+]{(i)\ SnCl_2,\ HCl} R\,CHO$	(I)	Etard reaction
(B)		(II)	Gatterman-Koch reaction
(C)		(III)	Rosenmund reduction
(D)		(IV)	Stephen reaction

Choose the correct answer from the options given below :

(1) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

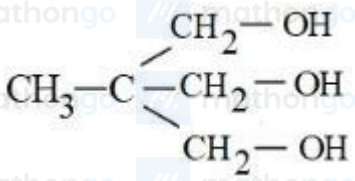
(2) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

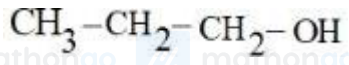
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

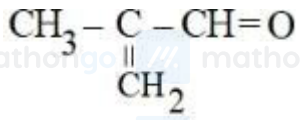
(4) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

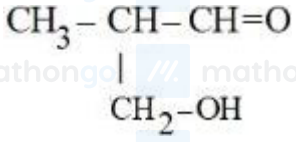
Q5. The major product of the following reaction is:

$$CH_3CH_2CH=O \xrightarrow[\text{reflux}]{\text{excess HCHO, alkali}} ?$$

(1) 

(2) 

(3) 

(4) 

Q6. Both acetaldehyde and acetone (individually) undergo which of the following reactions?

A. Iodoform Reaction

B. Cannizaro Reaction

C. Aldol Condensation

D. Tollen's Test

E. Clemmensen Reduction

Choose the correct answer from the options given below:

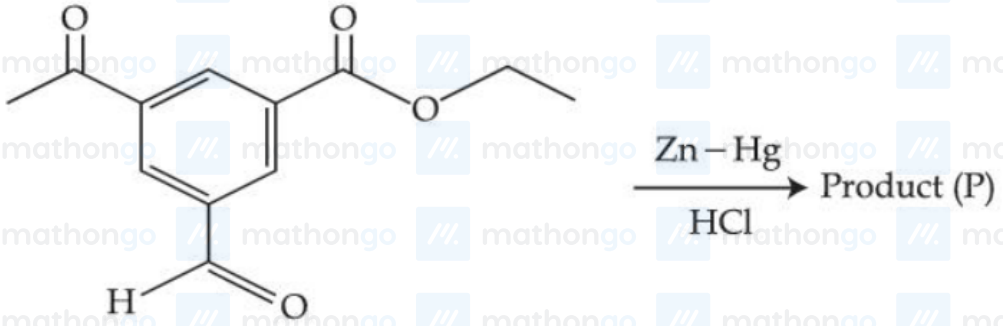
(1) A, B and D Only

(2) *C* and E Only

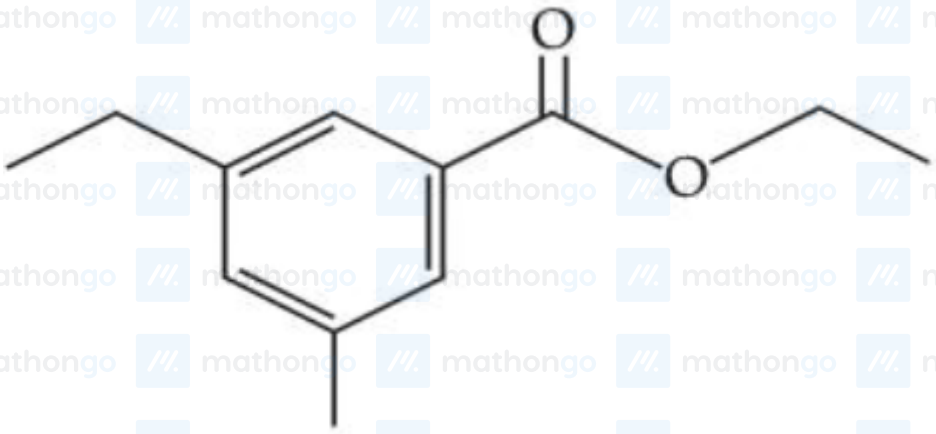
(3) A, C and E Only

(4) B, C and D Only

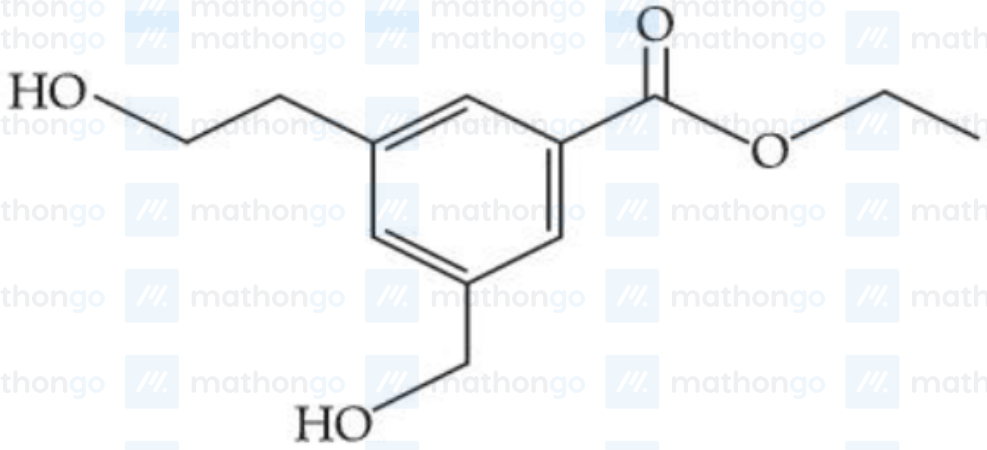
Q7. The product (P) formed in the following reaction is :



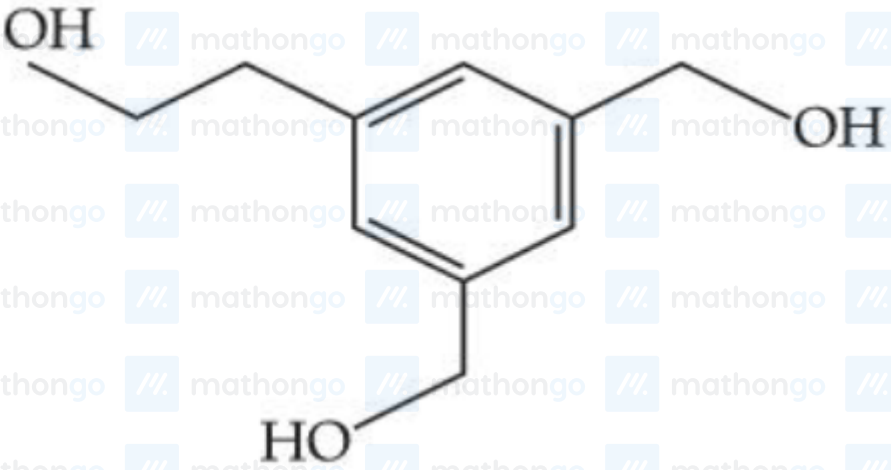
(1)



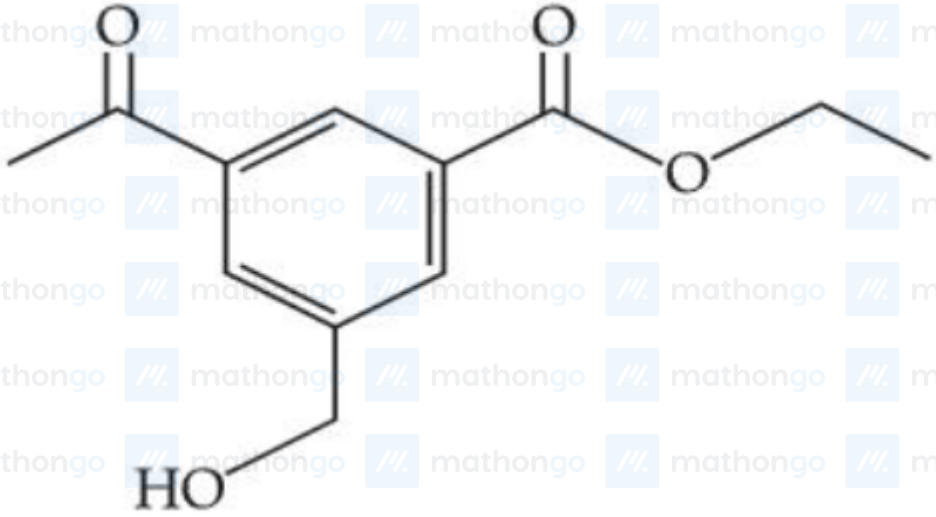
(2)



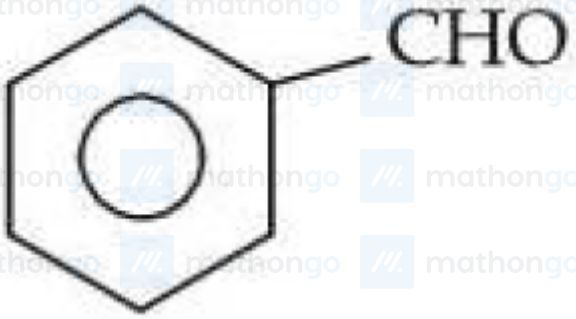
(3)



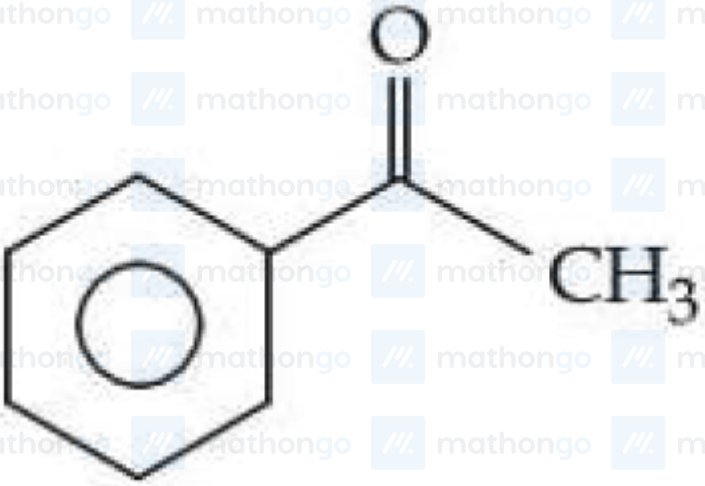
(4)



Q8. The compounds which give positive Fehling's test are :

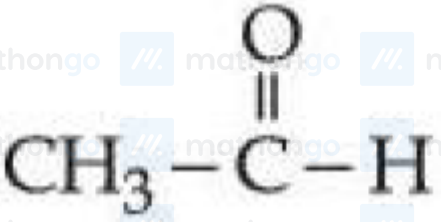


(A)



(B)

(C)$HOCH_2 - CO - (CHOH)_3 - CH_2 - OH$



(D)

(E)

Choose the correct answer from the options given below :

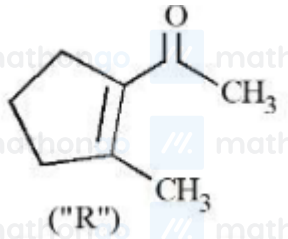
(1) (A), (D) and (E) Only

(2) (C), (D) and (E) Only

(3) (A), (C) and (D) Only

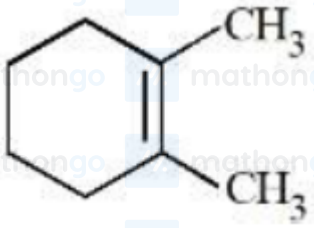
(4) (A), (B) and (C) Only

Q9. A molecule (" P ") on treatment with acid undergoes rearrangement and gives ("Q"). ("Q") on ozonolysis followed by reflux under alkaline condition gives (" R "). The structure of (" R ") is given below.



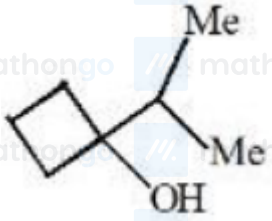
("R")

The structure of (" **P**″) is

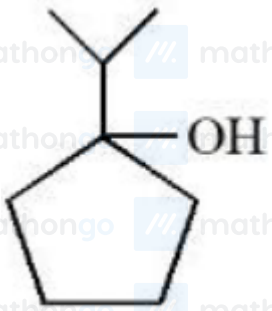


(1)

(2)



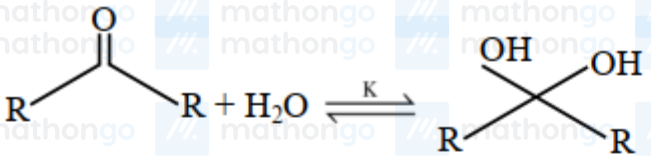
(3)



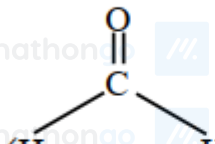
(4)

Q10. Given below are two statements :

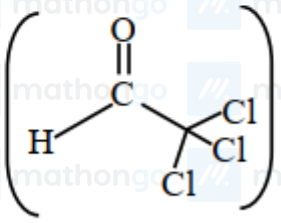
Consider the following reaction



Statement (I) : In the case of formaldehyde



(H H), K is about 2280, due to small substituents, hydration is faster.

Statement (II) : In the case of trichloro acetaldehyde  , K is about 2000 due to – I effect of – Cl.

In the light of the above statements, choose the **correct** answer from the options given below:

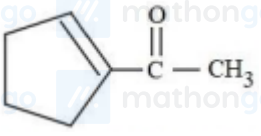
(1) Both Statement I and Statement II are false

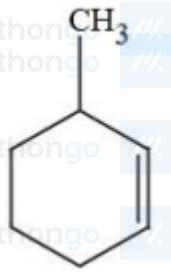
(2) Statement I is true but Statement II is false

(3) Statement I is false but Statement II is true

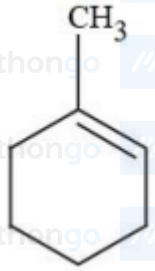
(4) Both Statement I and Statement II are true

Q11.

Aman has been asked to synthesise the molecule  (x).He thought of preparing the molecule using an aldol condensation reaction. He found a few cyclic alkenes in his laboratory. He thought of performing ozonolysis reaction on alkene to produce a dicarbonyl compound followed by aldol reaction to prepare " x ". Predict the suitable alkene that can lead to the formation of " x ".

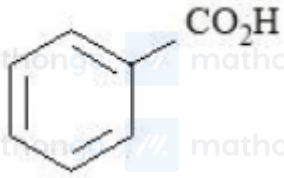
(1) 

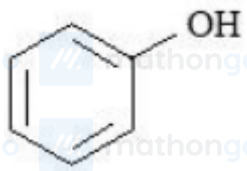
(2) 

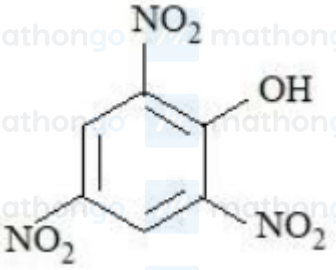
(3) 

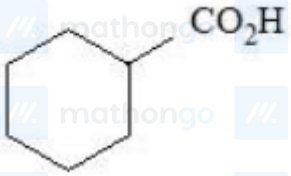
(4) 

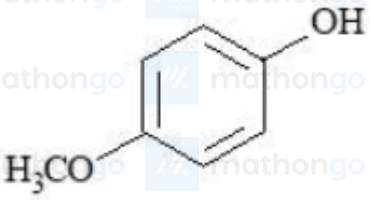
Q1. The compounds that produce CO_2 with aqueous $NaHCO_3$ solution are:

A. 

B. 

C. 

D. 

E. 

Choose the correct answer from the options given below:

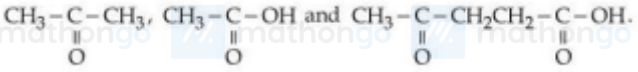
(1) A, C and D Only

(2) A, B and E Only

(3) A and C Only

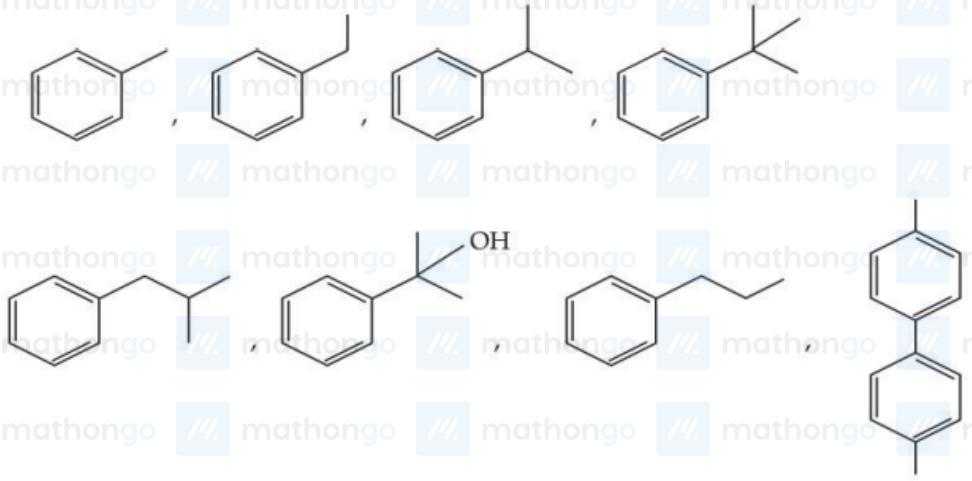
(4) A and B Only

Q2. A compound ' X′ absorbs 2 moles of hydrogen and ' X′ upon oxidation with $KMnO_4$ | H^+gives



The total number of σ bonds present in the compound ' X′ is_____

Q3. The total number of compounds from below when treated with hot $KMnO_4$ giving benzoic acid is :



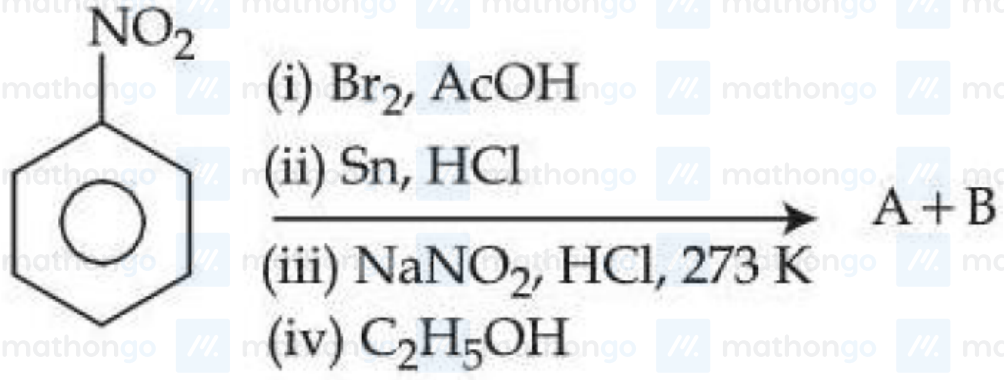
(1) 6

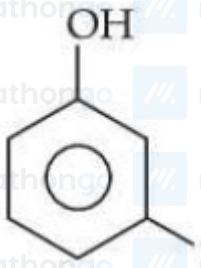
(2) 3

(3) 5

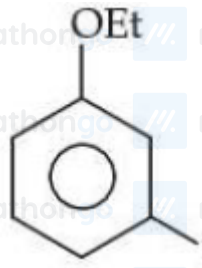
(4) 4

Q1. The products formed in the following reaction sequence are :

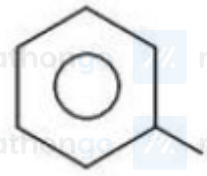


(1) 

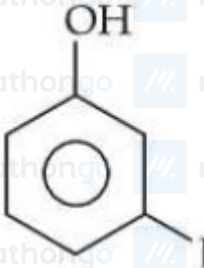
, $CH_3 - CHO$

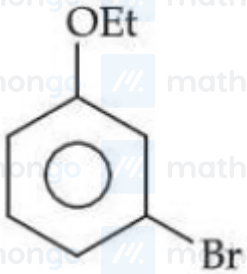
(2) 

, $CH_3 - COOH$

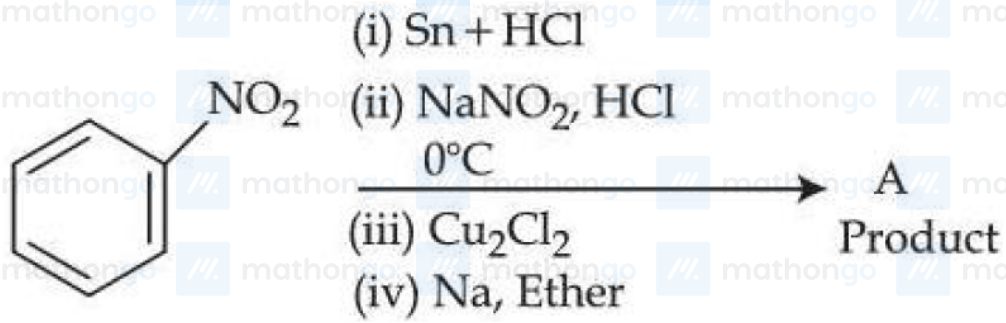
(3) 

, $CH_3 - CHO$

(4) 

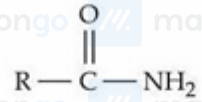
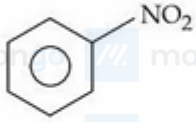
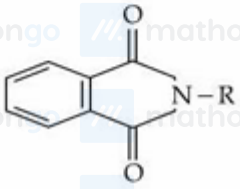
, 

Q2. Consider the following sequence of reactions :



Molar mass of the product formed (A) is _____ $gmol^{-1}$.

Q3. Match the Compounds (List - I) with the appropriate Catalyst/Reagents (List - II) for their reduction into corresponding amines.

List - I (Compounds)		List - II (Catalyst/Reagents)	
(A)		(I)	NaOH (aqueous)
(B)		(II)	H_2/Ni
(C)	$R-C\equiv N$	(III)	$LiAlH_4$, H_2O
(D)		(IV)	Sn, HCl

Choose the correct answer from the options given below :

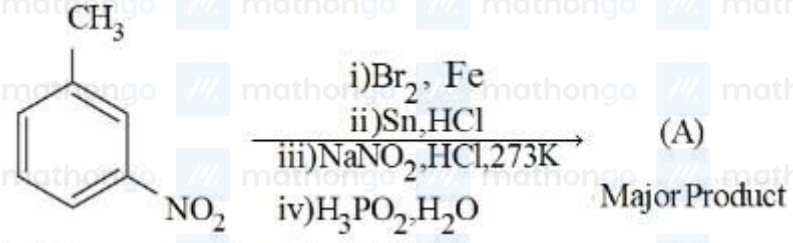
(1) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

(2) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

(3) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

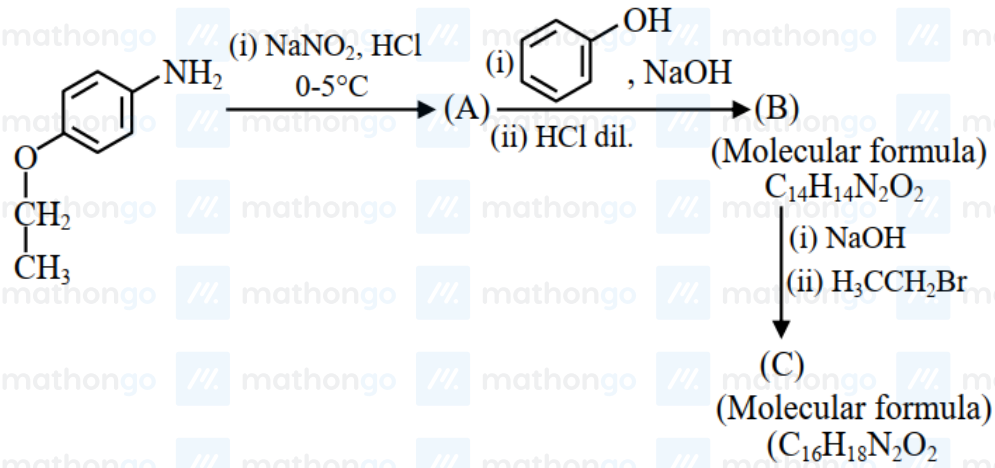
(4) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

Q4. Consider the following sequence of reactions to produce major product (A)



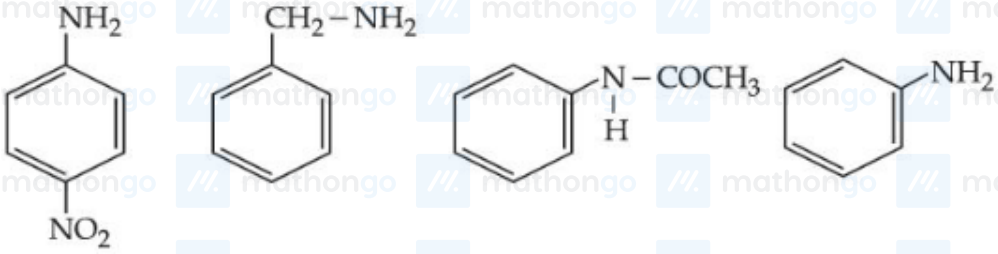
Molar mass of product (A) is _____ $gmol^{-1}$.
(Given molar mass in $gmol^{-1}$ of C : 12, H : 1, O : 16, Br : 80, N : 14, P : 31)

Q5. Consider the following sequence of reactions.



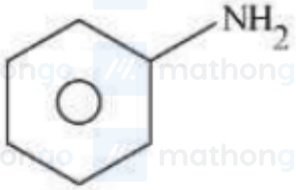
Total number of sp^3 hybridised carbon atoms in the major product C formed is_____

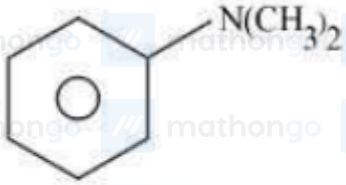
Q6. Given below are some nitrogen containing compounds



Each of them is treated with HCl separately. 1.0 g of the most basic compound will consume _____ mg of HCl.
(Given molar mass in $gmol^{-1}$ C : 12, H : 1, O : 16, Cl : 35.5)

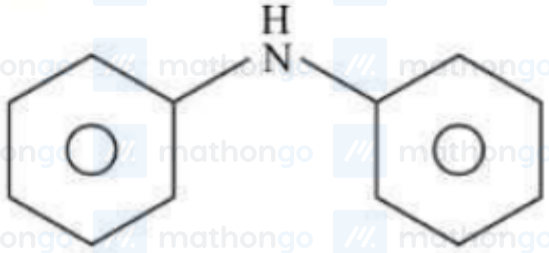
Q7. Which among the following react with Hinsberg's reagent?

A. 

B. 

C. $CH_3 - NH_2$

D. $N(CH_3)_3$

E. 

Choose the correct answer from the options given below:

(1) A, B and E Only

(2) A, C and E Only

(3) C and D Only

(4) B and D Only

Q8. Identify correct statements :

(A) Primary amines do not give diazonium salts when treated with $NaNO_2$ in acidic condition.

(B) Aliphatic and aromatic primary amines on heating with $CHCl_3$ and ethanolic KOH form carbylamines.

(C) Secondary and tertiary amines also give carbylamine test.

(D) Benzenesulfonyl chloride is known as Hinsberg's reagent.

(E) Tertiary amines reacts with benzenesulfonyl chloride very easily.

Choose the correct answer from the options given below :

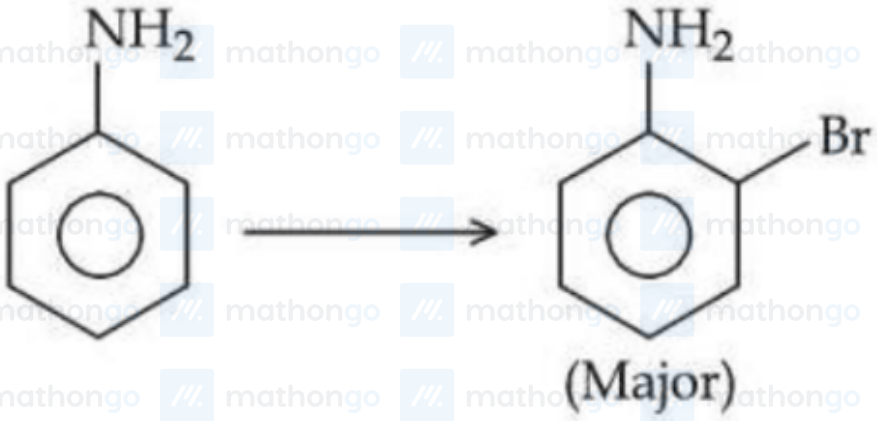
(1) (A) and (B) only

(2) (D) and (E) only

(3) (B) and (D) only

(4) (B) and (C) only

Q9. For reaction



The correct order of set of reagents for the above conversion is :

(1) $Br_2 \mid FeBr_3, H_2O(\Delta), NaOH$

(2) $H_2SO_4, Ac_2O, Br_2, H_2O(\Delta), NaOH$

(3) $Ac_2O, Br_2, H_2O(\Delta), NaOH$

(4) $Ac_2O, H_2SO_4, Br_2, NaOH$

Q1. Identify the essential amino acids from below :
(A) Valine
(B) Proline
(C) Lysine
(D) Threonine
(E) Tyrosine
Choose the correct answer from the options given below :

(1) (A), (C) and (E) only

(2) (A), (C) and (D) only

(3) (C), (D) and (E) only

(4) (B), (C) and (E) only

Q2. The α-Helix and β - Pleated sheet structures of protein are associated with its :

(1) tertiary structure

(2) quaternary structure

(3) secondary structure

(4) primary structure

Q3. Which of the following acids is a vitamin?

(1) Adipic acid

(2) Ascorbic acid

(3) Saccharic acid

(4) Aspartic acid

Q4. Given below are two statements:
Statement I: Fructose does not contain an aldehydic group but still reduces Tollen's reagent
Statement II: In the presence of base, fructose undergoes rearrangement to give glucose.
In the light of the above statements, choose the correct answer from the options given below

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is true but Statement II is false

Q5. The carbohydrate "Ribose" present in DNA, is

A. A pentose sugar

B. present in pyranose from

C. in "D" configuration

D. a reducing sugar, when free

E. in α-anomeric form

Choose the correct answer from the options given below:

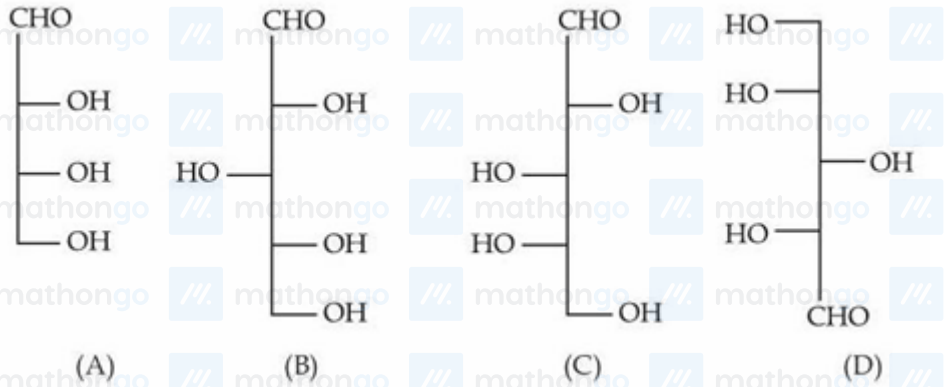
(1) A, D and E Only

(2) A, C and D Only

(3) A, B and E Only

(4) B, D and E Only

Q6. Identify the number of structure/s from the following which can be correlated to D-glyceraldehyde.



(1) four

(2) one

(3) two

(4) three

Q7. Given below are two statements:

Statement I : D-glucose pentaacetate reacts with 2, 4-dinitrophenylhydrazine

Statement II : Starch, on heating with concentrated sulfuric acid at 100°C and 2-3 atmosphere pressure produces glucose.

In the light of the above statements, choose the correct answer from the options given below

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II is false

Q8. Match List - I with List - II.

	List - I (Saccharides)		List - II (Glycosidic-linkages found)
(A)	Sucrose	(I)	$\alpha\ 1-4$
(B)	Maltose	(II)	$\alpha\ 1-4$ and $\alpha\ 1-6$
(C)	Lactose	(III)	$\alpha\ 1-\beta\ 2$
(D)	Amylopectin	(IV)	$\beta\ 1-4$

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

(2) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

(3) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

(4) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

Q9. Match List - I with List - II.

	List - I (Carbohydrate)	List - II (Linkage Source)
(A)	Amylose	(I) $\beta - C_1 - C_4$, plant
(B)	Cellulose	(II) $\alpha - C_1 - C_4$, animal
(C)	Glycogen	(III) $\alpha - C_1 - C_4$, $\alpha - C_1 - C_6$, plant
(D)	Amylopectin	(IV) $\alpha - C_1 - C_4$, plant

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

(2) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(3) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

(4) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Q10. Identify correct conversion during acidic hydrolysis from the following :

(A) starch gives galactose.

(B) cane sugar gives equal amount of glucose and fructose.

(C) milk sugar gives glucose and galactose.

(D) amylopectin gives glucose and fructose.

(E) amylose gives only glucose.

Choose the correct answer from the options given below :

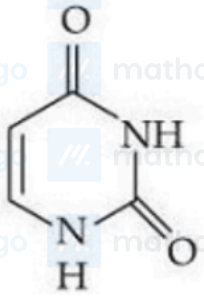
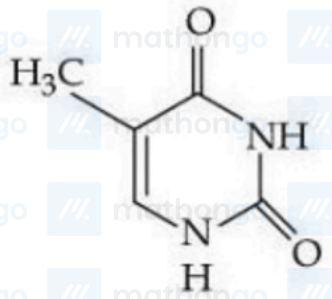
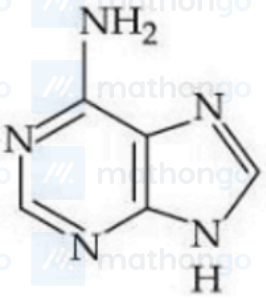
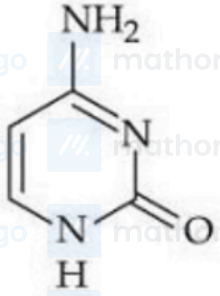
(1) (A), (B) and (C) only

(2) (B), (C) and (E) only

(3) (C), (D) and (E) only

(4) (B), (C) and (D) only

Q11. Match List - I with List - II.

List - I	List - II
(A) Adenine	(I) 
(B) Cytosine	(II) 
(C) Thymine	(III) 
(D) Uracil	(IV) 

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

(2) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Some Basic Concepts of Chemistry

1. (57) **2.** (3) **3.** (4) **4.** (3) **5.** (100) **6.** (153) **7.** (61) **8.** (2)
9. (125) **10.** (2) **11.** (420) **12.** (1655) **13.** (2)

Structure of Atom

1. (2) **2.** (4) **3.** (3) **4.** (4) **5.** (1) **6.** (3) **7.** (1) **8.** (3)
9. (3) **10.** (1) **11.** (2) **12.** (3)

States of Matter

1. (4)

Thermodynamics (C)

1. (3) **2.** (700) **3.** (1) **4.** (4) **5.** (2) **6.** (1) **7.** (3) **8.** (3)
9. (3) **10.** (2850) **11.** (4) **12.** (95) **13.** (200) **14.** (2) **15.** (48) **16.** (2)
17. (466)

Chemical Equilibrium

1. (2) **2.** (1) **3.** (962) **4.** (2) **5.** (3) **6.** (2)

Ionic Equilibrium

1. (12) **2.** (4) **3.** (7) **4.** (1) **5.** (2) **6.** (3) **7.** (3) **8.** (4)

Redox Reactions

1. (4) **2.** (4) **3.** (2) **4.** (1) **5.** (45)

Solutions

1. (75) **2.** (16) **3.** (4) **4.** (4) **5.** (2) **6.** (4) **7.** (4) **8.** (1)
9. (4) **10.** (1)

Electrochemistry

1. (1) **2.** (2) **3.** (3) **4.** (2) **5.** (2) **6.** (3) **7.** (1) **8.** (2)
9. (1) **10.** (2) **11.** (3) **12.** (2) **13.** (150)

Chemical Kinetics

1. (1) **2.** (3) **3.** (3) **4.** (1) **5.** (69) **6.** (897) **7.** (2) **8.** (2)
9. (1) **10.** (4) **11.** (2) **12.** (20)

Classification of Elements and Periodicity in Properties

1. (4) **2.** (2) **3.** (1) **4.** (4) **5.** (1) **6.** (4) **7.** (1) **8.** (1)
9. (3) **10.** (2) **11.** (3)

Chemical Bonding and Molecular Structure

1. (3) **2.** (6) **3.** (2) **4.** (2) **5.** (15) **6.** (2) **7.** (1) **8.** (3)
9. (4) **10.** (2) **11.** (6) **12.** (2) **13.** (2)

p Block Elements (Group 13 & 14)

1. (3) **2.** (4)

p Block Elements (Group 15, 16, 17 & 18)

1. (2) **2.** (15) **3.** (1) **4.** (1) **5.** (4)

d and f Block Elements

1. (2) **2.** (4) **3.** (11) **4.** (2) **5.** (2) **6.** (4) **7.** (5) **8.** (3)
9. (4) **10.** (2) **11.** (160) **12.** (3) **13.** (2) **14.** (1)

Coordination Compounds

1. (4) **2.** (3) **3.** (14) **4.** (3) **5.** (3) **6.** (3) **7.** (2) **8.** (3)
9. (1) **10.** (4) **11.** (1) **12.** (0) **13.** (4) **14.** (4) **15.** (3) **16.** (2)
17. (2) **18.** (1) **19.** (3)

Practical Chemistry

1. (3) **2.** (4) **3.** (4)

General Organic Chemistry

1. (3) **2.** (2) **3.** (3) **4.** (1) **5.** (1) **6.** (1) **7.** (3) **8.** (2)
9. (4) **10.** (4) **11.** (1) **12.** (4) **13.** (2) **14.** (3) **15.** (4) **16.** (4)
17. (4) **18.** (4) **19.** (1) **20.** (20) **21.** (40) **22.** (255) **23.** (275)

Hydrocarbons

1. (2) **2.** (4) **3.** (3) **4.** (4) **5.** (3) **6.** (2) **7.** (3) **8.** (4)
9. (4) **10.** (4) **11.** (1) **12.** (3) **13.** (2)

Haloalkanes and Haloarenes

1. (2) **2.** (3) **3.** (8) **4.** (1) **5.** (4) **6.** (3) **7.** (2) **8.** (3)
9. (2) **10.** (93)

Alcohols Phenols and Ethers

1. (4) **2.** (2) **3.** (2) **4.** (3) **5.** (60) **6.** (13)

Aldehydes and Ketones

1. (4) **2.** (3) **3.** (4) **4.** (4) **5.** (1) **6.** (3) **7.** (1) **8.** (2)
9. (4) **10.** (4) **11.** (3)

Carboxylic Acid Derivatives

1. (1) **2.** (27) **3.** (3)

Amines

1. (3) **2.** (154) **3.** (4) **4.** (171) **5.** (4) **6.** (341) **7.** (2) **8.** (3)
9. (2)

Biomolecules

1. (2) **2.** (3) **3.** (2) **4.** (1) **5.** (2) **6.** (4) **7.** (1) **8.** (3)
9. (4) **10.** (2) **11.** (2)

Q1. **(57)**

$$M_F = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$
$$= \frac{2 \times 20 + 0.5 \times 400}{420} = 0.571\text{M}$$
$$= 57.1 \times 10^{-2}\text{M}$$
$$= 57$$

Q2. **(3)**

Element	Mass %	Mole %	Molar ratio
C	90	7.5	1
H	10	10	1.33

$\therefore$ Empirical formula is C_3H_4

Molecular mass $= 80\ \text{g mol}^{-1}$.

Molecular formula $= (C_3H_4)_n$

$n = \frac{\text{Molecular mass}}{\text{EF mass}} = \frac{80}{40} = 2$

$\therefore$ Molecular formula is C_6H_8

Degree of unsaturation $= \frac{2\times6+2-8}{2} = 3$

Q3. **(4)**

Element	Mass %	Mole %	Molar ratio
C	54.2	4.52	2
H	9.2	9.2	4
O	36.6	2.28	1

Empirical formula of compound is C_2H_4O

Molecular mass of compound $= 132\ \text{g mol}^{-1}$ Molecular formula of compound is $(C_2H_4O)_n$

$n = \frac{\text{Molecular mass}}{\text{EF mass}} = \frac{132}{44} = 3$

$\therefore$ Molecular formula of compound is $C_6H_{12}O_3$

Q4. **(3)**

Moles of removed $CO_2 = \frac{10^{21}}{6.02\times10^{23}}$ mol

$= 1.66 \times 10^{-3}$ mol

mole of CO_2 left $= 2.8 \times 10^{-3}$moles total moles of CO_2 taken initially

$= (2.8 + 1.66) \times 10^{-3}$ mol

mass of CO_2 taken initially

$= 4.46 \times 10^{-3} \times 44$

$= 196.24 \times 10^{-3}$ g

$= 196.24$mg

Q5. **(100)**

Organic compound $\xrightarrow{\text{combustion}}$ $\underset{0.9\text{gm}}{H_2O}$

$\therefore$ mole of $H_2O = \frac{0.9}{18} = 0.05$ mole

$\therefore$ mole of H in $H_2O = 0.05 \times 2 = 0.1$ mole

$=$ mole of H in 0.01 mole

Organic compound

$\therefore$ wt of H atom in 0.01 mole compound $= 0.1 \times 1 = 0.1\text{gm}$

$\therefore$ wt of H atom in one mole compound

$= \frac{0.1}{0.01} = 10\text{gm}$

$\because$ wt. % of H $= \frac{\text{wt. of H in one mole compound}}{\text{Molar mass of compound}} \times 1$

$10 = \frac{10}{M} \times 100$

$\therefore M = 100$

Q6. $4\text{Al} + 3\text{O}_2 \longrightarrow 2\text{Al}_2\text{O}_3$

(153) $\frac{81}{27} = 3$ mole $\frac{128}{32} = 4$ mole

Limiting reagent

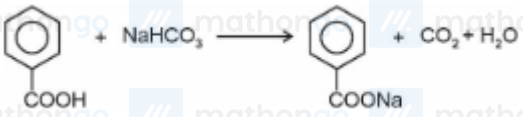
$\therefore$ mole of Al_2O_3 formed $= \frac{1}{2} \times 3$ mole

$\therefore$ wt. of Al_2O_3 formed $= \frac{3}{2} \times 102$

$= 153\text{gm}$

Q7.

(61)



1 mole benzoic acid will release 1 mole CO_2

11.2 LCO_2 at STP is $\frac{1}{2}$ mole$_{\text{CO}}^{2}$ which will be released by reaction with $\frac{1}{2}$ mole benzoic acid

Mass of benzoic acid $= \frac{1}{2} \times 122$

$= 61\text{gm}$

Q8. $3\text{MNaCl}, \text{d}_{\text{sol}} = 1.25\text{gm/mol}$

(2) $\text{Molality} = \frac{\text{M} \times 1000}{1000\,\text{d} - \text{M} \times \text{M}_{\text{W}}}$

$= \frac{3000}{1250 - 175.5} = 2.79$

Q9. Moles of solute $= \frac{70}{70} = 1$

(125) Volume of solution $= \frac{100}{1.25} = 80$ mL

$M = \frac{1}{80} \times 1000 = 12.5$

$M = 125 \times 10^{-1}$

Q10. 75% by mass means :

(2) $\because$ 75 gHNO_3 in 100 g solution.

$\therefore$ 30 gHNO_3 in $\frac{100}{75} \times 30$ g solution.

$\text{m}_{\text{solution}} = \frac{100 \times 30}{75}$ g

$\because \quad \text{V}_{\text{sol}} = \frac{\text{m}_{\text{sol}}}{\text{d}_{\text{sol}}} = \frac{100 \times 30}{75 \times 1.25} = 32$ mL

Q11. (420)

$$\text{moles of } Fe_3O_4 = \frac{2.32 \times 10^3 \times 10^3}{232} = 10000 \text{ mol}$$

$$\text{moles of } CO = \frac{2.8 \times 10^2 \times 10^3}{28} = 10000 \text{ mol}$$

$$Fe_3^3O_4 + 4CO \longrightarrow 3Fe + 4CO_2$$

10^4 mol $\quad 10^4$ mol

CO is L.R.

$$\text{mole of Fe} = \frac{3}{4} \times 10^4$$

$$\text{mass of Fe} = \frac{3}{4} \times \frac{10^4 \times 56}{1000} \text{ kg} = 420 \text{ kg}$$

Q12. (1655)

	C	Cl	H	O
\%mass	14.5	64.46	1.8	19.24
Molar ratio	$\frac{14.5}{12}$	$\frac{64.46}{35.5}$	$\frac{1.8}{1}$	$\frac{19.24}{16}$
	1.2	1.8	1.8	1.2
Minimum integral ratio	2	3	3	2

Empiricial formula $= C_2H_3Cl_3O_2$

Mass $= 165.5$

Mass $= 1655 \times 10^{-1}$

Q13. (2) Mass of substance is amount of matter present in it. Weight is force exerted by gravity on object.

Q1. $r = a_0\left(\frac{n^2}{z}\right)$

(2) $r = \frac{a_0(2)^2}{(2)}$

$r = 2a_0$

Q2. $A : n = 1, \ell = 0,\ m_\ell = 0$ orbital

(4) $B : n = 2, \ell = 0,\ m_\ell = 0$ 1 s

$C : n = 3, \ell = 1,\ m_\ell = 1$ 2 s

$D : n = 3, \ell = 2,\ m_\ell = 1$ 3p

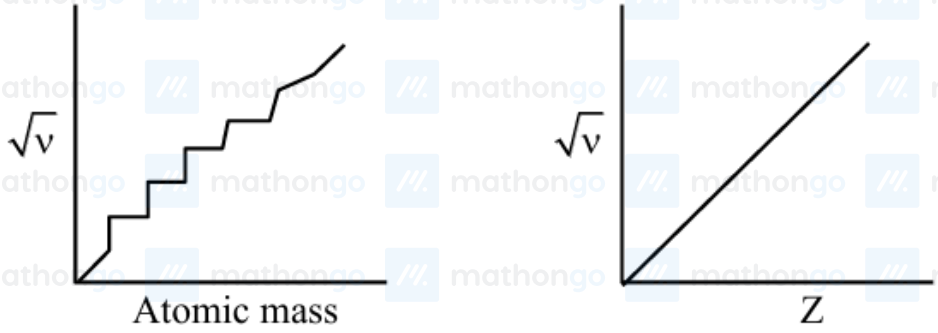
$E : n = 3, \ell = 2,\ m_\ell = 0$ 3 d

3 d

In absence of electric and magnetic fields, all orbitals of 3d are degenerate

Q3.

(3)



Q4. $r \propto q^-$(for isoelectronic species)

(4) $\propto \frac{1}{q^+}$

$\therefore$ Statement I is correct

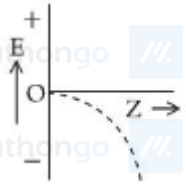
Magnitude of electron gain enthalpy

$Cl > F > Br > I$

Q5. $E_n = -13.6\frac{z^2}{n^2}$

(1) $E_n \propto -z^2$

$y = kx^2$



Q6. $\lambda = 900\ \text{nm}$ H-atom $(\text{Z} = 1)$

(3) $= 9 \times 10^{-5}\ \text{cm}$

$\text{R}_\text{H} = 10^5\ \text{cm}^{-1}$

$$\text{Ryderg eq.} = \frac{1}{\lambda} = \text{R}_\text{H}\text{Z}^2 \times \left(\frac{1}{\text{n}_1^2} - \frac{1}{\text{n}_2^2}\right)$$

$$\Rightarrow \frac{1}{\lambda \times \text{R}_\text{H}} = \frac{1}{\text{n}_1^2} - \frac{1}{\text{n}_2^2}$$

$$\Rightarrow \frac{1}{9 \times 10^{-5}\ \text{cm} \times 10^5\ \text{cm}^{-1}} = \left(\frac{1}{\text{n}_1^2} - \frac{1}{\text{n}_2^2}\right)$$

$$\Rightarrow \frac{1}{\text{n}_1^2} - \frac{1}{\text{n}_2^2} = \frac{1}{9}$$

It is possible when $\text{n}_1 = 3, \text{n}_2 = \infty$

Possible series : $\infty \to 3$

Q7. Bohr radius of hychogon atom $\to a_0$

(1) According to Bohr, the equation used to calculate the angular momentum of an election in a hydrogen atom is $\text{mvr} = \frac{\text{nh}}{2\text{x}}$...(i)

$m \to$ mass of electron

$v \to$ velocity of electron

$r \to$ radius of the orbit

$n \to$ orbit. number. in. which electron is present.

Given that; election is present in second orbit, $\text{n} = 2$

The radius of the second orbit $r_2 = a_0 \times 2^2 = 4a_0$

General formula for radius of n^{th} orbit,

$r_n = a_0 \times n^2$ From (1)

$mvr = n\frac{h}{2\pi}$

$2\pi r = n\frac{h}{mv}$

$\frac{h}{mv} = \lambda$ (de Broglie relation ship, $\lambda \to$ de Broglie Wavelength

So, $2\pi r = n\lambda$

For the electron in the second orbit, $2\pi r_2 = n\lambda$

Substitute for r_2

$2\pi \times 4a_0 = n\lambda$

$8\pi a_0 = n\lambda$

$\therefore \lambda = \dfrac{8\pi a_0}{n}$

Q8. According to Heisenberg's uncertainty principle, it is impossible to determine simultaneously the exact position

(3) and momentum of particle like electron

If

$$\Delta p = \Delta x$$

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

$$(\Delta p)^2 \geq \frac{h}{4\pi}$$

$$\Delta p \geq \sqrt{\frac{h}{\pi}} \times \frac{1}{2}$$

$$m\Delta v \geq \sqrt{\frac{h}{\pi}} \times \frac{1}{2}$$

$$\Delta v \geq \sqrt{\frac{h}{\pi}} \times \frac{1}{2m}$$

Q9. For a shell total number of orbitals $= n^2$

(3) Magnetic quantum number have values $(-\ell$ to $+\ell)$ including 0.

Q10. For hydrogen atom and one electron species, the energy of orbitals is decided by the value of principal quantum

(1) number. Higher the value of principal quantum number, higher will be the energy of orbital.

(A) 4s	n = 4
(B) $3p_x$	n = 3
(C) $3d_{x^2-y^2}$	n = 3
(D) $3d_{z^2}$	n = 3
(E) $4p_z$	n = 4

$\therefore$ $(B), (C)$ and (D) have orbitals with the lowest energy.

Q11. $2p_x$ and $2p_y$ are degenerated orbitals hence having equal energy and therefore no spectral line will be observed

(2) for $2p_x \rightarrow 2p_y$ transition.

Q12. For single electron species energy only depends on ' n ' (principal quantum number)

(3) So energy of 2 s $=$ 2p

and energy of 3 d $<$ 4 s

Q1.

(4)

$$N_2O_{5\,(g)} \longrightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$$

$t = 0$	P_0	—	—
$t = t$	$P_0 - x$	$2x$	$\frac{x}{2}$

$$x = \frac{P_0}{2}$$

$$P_{\text{total}} = P_0 - \frac{P_0}{2} + P_0 + \frac{P_0}{4} = \frac{7}{4}P_0$$

Q1. Thermally insulated $\Rightarrow q=0$ from I^{st} law

(3) $\Delta \mathrm{U}=\mathrm{q}+\mathrm{w}$

$\Delta \mathrm{U}=\mathrm{w}$

$\mathrm{w}>0, \Delta \mathrm{U}>0$

Q2. $\frac{1}{2} \mathrm{X}_2+\frac{5}{2} \mathrm{Y}_2 \rightleftharpoons \mathrm{XY}_5$

(700) $\Delta \mathrm{S}_{\mathrm{Rxn}}^0=110-\left[\left(\frac{1}{2} \times 70\right)+\left(\frac{5}{2} \times 50\right)\right]$

$=110-160=-50 \mathrm{JK}^{-1} \mathrm{~mol}^{-1}$

$\Delta \mathrm{G}^0=0$ at eqb

$\Delta \mathrm{G}^0=\Delta \mathrm{H}^0-\mathrm{T} \Delta \mathrm{S}^0$

$0=-35000-\mathrm{T}(-50)$

$\mathrm{T}=700 \mathrm{Kelvin}$

Q3. $\because \Delta \mathrm{G}=\Delta \mathrm{H}-\mathrm{T} \Delta \mathrm{S}$

(1) For spontaneity of reaction: $\Delta \mathrm{G}=-\mathrm{ve}$

Q4. $\mathrm{C(diamond)} + \mathrm{O_2(g)} \rightarrow \mathrm{CO_2(g)}\ ;\ \Delta H_1 = -Y\ \mathrm{kJ\ mol^{-1}}$

(4) $\mathrm{CO_2(g)} \rightarrow \mathrm{C(graphite)} + \mathrm{O_2(g)}\ ;\ \Delta H_2 = Z\ \mathrm{kJ\ mol^{-1}}$

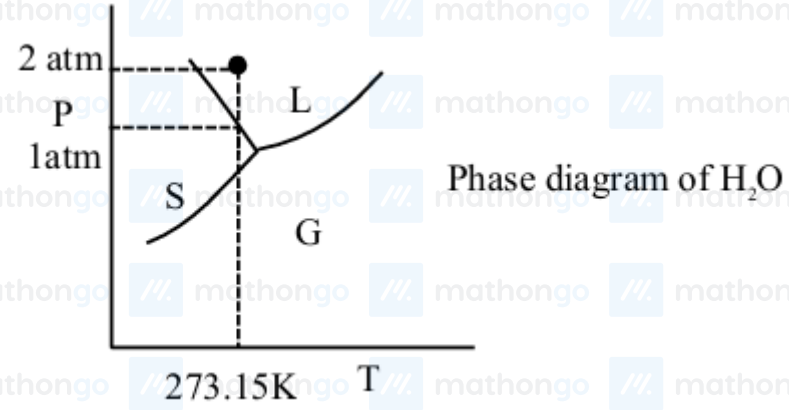
$\mathrm{C(diamond)} \rightarrow \mathrm{C(graphite)}\ ;\ \Delta H_3 = -Y + Z$

$-X = -Y + Z$

$X = Y - Z$

Q5.

(2)



Phase diagram of $\mathrm{H_2O}$

If pressure is made two time then mixture of ice and water will completely convert into water (liquid) form.

Q6. As internal energy ' U ' is a state function, its cyclic integral must be zero in a cyclic process

(1) $\therefore \Delta U$ case $(I)=\Delta U$ case (II) $=\Delta U$ case (III)

Q7. $q_p = n \times c_p \times \Delta T$

(3) $\Rightarrow 500 = 0.5 \times \frac{5}{2} \times 8.3\,(T_f - 298)$

$\Rightarrow T_f \simeq 346.2\ K$

$\frac{\Delta H}{\Delta U} = \frac{C_p}{C_v} = \left(\frac{5}{3}\right)$

$\Rightarrow \Delta U = \frac{3}{5} \times 500 = 300\ J$

Q8. $\because \quad dH = dq\ (\text{at } P = \text{ constant})$

(3) $dH = CpdT^{dT}$

$\left(\frac{dH}{dT}\right)_P = C_P$

$dU = dq \quad (\text{at } V = \text{ constant})$

$dU = C_V dT$

$\left(\frac{dU}{dT}\right)_V = C_V$

$\because dG = VdP - SdT$

at $P = $ constant, $dP = 0$

$\left(\frac{dG}{dT}\right)_P = -S$

at $T = $ constant

$\left(\frac{dG}{dP}\right)_T = V$

Q9. The rise in temperature of neutralization reaction will be maximum for maximum number of moles of strong

(3) acid and strong base neutralized and lower volume of final solution.

(3) $HCl + NaOH \rightarrow NaCl + H_2O$

mmol 30 30

Final volume of solution = 60 mL

Option (1) and (2) have weak acids and in option

(4) only 20 mmol of HCl will be neutralized with 70 mL final volume.

Q10. $\Delta H^o_{rxn} = 55\ kJ/mol, \quad T = 298\ K$

(2850) $\Delta\ S^o_{rxn} = 175\ J/mol$

$\Delta G^o_{rxn} = \Delta H^o_{rxn} - T\Delta S^\circ_{rxn}$

$\Rightarrow \Delta G^o_{rxn} = 55000\ J/mol - 298 \times 175\ J/mol$

$\Rightarrow \Delta G^o_{rxn} = 55000 - 52150$

$\Rightarrow \Delta G^o_{rxn} = 2850\ J/mol$

Q11. On increasing temperature, the given endothermic reaction becomes spontaneous.

(4) $\Delta G = \Delta H - T\Delta S$

For spontaneity,

$\Delta G < 0$

Given,

$\Delta H > 0$

So, ΔS should be +ve.

Q12. $2C_{(graphite)} + 3H_2(g) \rightarrow C_2H_6(g) \quad \Delta H_f = ?$

(95) $C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

$\Delta H_1 = -1550$

$C_{(graphite)} + O_2(g) \rightarrow CO_2(g) \Delta H_2 = -393.5$

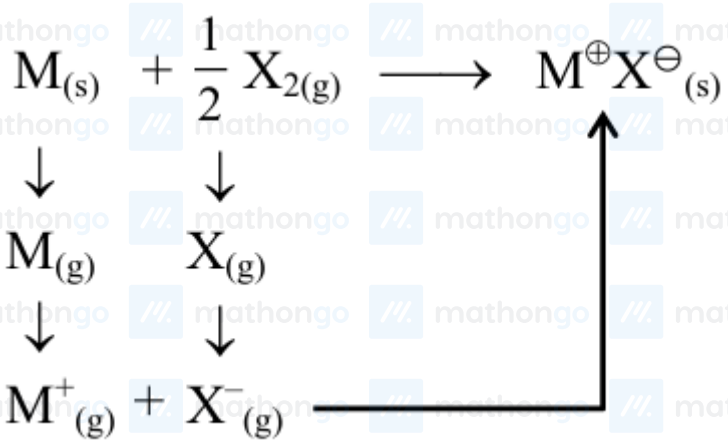
$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(/) \Delta H_3 = -286$

$\Delta H_f = 2\Delta H_2 + 3\Delta H_3 - \Delta H_1$

$= 95 \text{ kJ/mole}^2$

Q13.

(200)



$\therefore \Delta H_f(MX) =$

$\Delta H_{sub}(M) + \text{I.E.}(M) + \frac{1}{2}[\text{B.E.}(X-X)]$

$+EG(X) + \text{L.E.}(MX)$

$-400 = (100) + (500) + \frac{1}{2}(\text{B.E.}) + (-300) + (-800)$

$\therefore \text{B.E.} = 200 \text{ kJ mole}^{-1}$

Q14. (i) $S(g) + \frac{3}{2}O_2(g) \rightarrow SO_3(g) + 2x \text{ kcal } \Delta H_1$

(2) (ii) $SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g) + y \text{ kcal } \Delta H_2$

(i) - (ii)

$S(g) + O_2(g) \rightarrow SO_2(g) \Delta H$

$\Delta H = \Delta H_1 - \Delta H_2$

$= -2x - (-y) = (y - 2x)\text{kcal}$

Q15. $\Delta H_f[CO_2(g)] = -393.5 \text{ kJ/mole}$

(48) $\Delta H_f[H_2O(\ell)] = -286.0 \text{ kJ/mole}$

$\Delta H_c[C_6H_6] = -3267.0 \text{ kJ/mole}$

$\Delta H_f C_6H_6 = (?)$

$C_6H_6 + \frac{15}{2}O_2(g) \longrightarrow 6CO_2(g) + 3H_2O(\ell)$

$\Delta H_R = \Delta H_C = \Sigma\Delta H_f(P) - \Sigma\Delta H_f(R)$

$-3267 = 6 \times (-393.5) + 3(-286) - \Delta H_f(C_6H_6)$

$\Delta H_f(C_6H_6) = 48 \text{ kJ/mole}$

Q16. **(2)**

$$\underset{-5^{\circ}C}{H_2O(s)} \rightarrow \underset{0^{\circ}C}{H_2O(s)}; \Delta S_1 = \int_{268\ K}^{273\ K} \frac{C_p,\ mdT}{T}$$

$$\underset{0^{\circ}C}{H_2O(s)} \rightleftharpoons \underset{0^{\circ}C}{H_2O(l)}; \Delta S_2 = \frac{\Delta H_m,\ fus}{273}$$

$$\underset{0^{\circ}C}{H_2O(I)} \rightarrow \underset{100^{\circ}C}{H_2O(I)}; \Delta S_3 = \int_{273}^{373} \frac{C_p,\ mdt}{T}$$

$$\underset{100^{\circ}C}{H_2O(l)} \rightleftharpoons \underset{100^{\circ}C}{H_2O(g)}; \Delta S_4 = \frac{\Delta H_m,\ vap}{373}$$

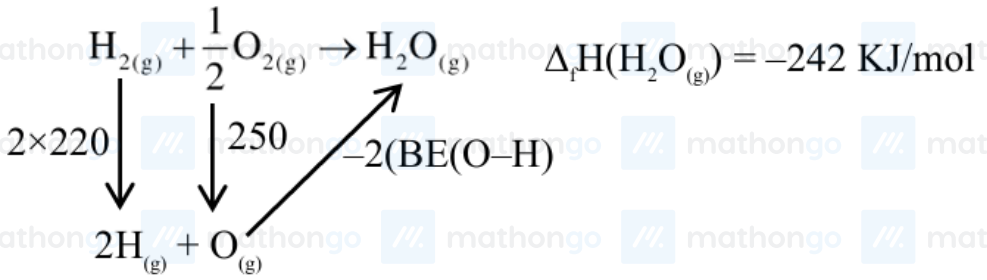
$$\underset{100^{\circ}C}{H_2O(g)} \rightarrow \underset{110^{\circ}C}{H_2O(g)}; \Delta S_5 = \int_{373}^{383} \frac{C_{p,\,m}dT}{T}$$

$$\Delta S_{total} = \Delta S_1 + \Delta S_2 + \Delta S_3 + \Delta S_4 + \Delta S_5$$

Q17. **(466)**

$$\frac{1}{2}H_{2(g)} \rightarrow H(g) \quad ; \quad \Delta_f H\left(H_{(g)}\right) = 220 KJ/mol$$

$$\frac{1}{2}O_{2(g)} \rightarrow O(g) \quad ; \quad \Delta_f H\left(O_{(g)}\right) = 250 KJ/mol$$



$$\Delta H_f\left(H_2O_{(l)}\right) = -242 = 440 + 250 - 2(B.E.(O-H))$$

$$BE(O-H) = 466 KJ/mol$$

Q1. 1 mol

(2) $X_2Y(g) \rightarrow \underset{x}{X}X_2(g) + \frac{1}{2}Y_2(g)$

$\frac{x}{2}$

$\therefore \quad P_{x_2y}$

$= \frac{1-x}{1+\frac{x}{2}} \times p$

$P_{x_2} = \frac{x}{1+\frac{x}{2}} \times p$

$P_{y_2} = \frac{x/2}{1+\frac{x}{2}} \times p$

$\therefore \quad K_p = \frac{\left(\frac{x}{1+\frac{x}{2}}p\right)\left(\frac{x}{2\left(1+\frac{x}{2}\right)}p\right)^{1/2}}{\left(\frac{1-x}{1+\frac{x}{2}}\right) \times p}$

$\therefore \quad K_p = \left(\frac{x}{1-x}\right)\left(\frac{x}{2\left(1+\frac{x}{2}\right)}\right)^{1/2} \times p^{1/2}$

$\therefore \quad x$ to be very small

$\therefore K_p = \frac{x^{3/2}}{2^{(1/2)}} \times p^{1/2}$

$\therefore x^{3/2} = \frac{K_p \times 2^{1/2}}{p^{1/2}}$

$x^3 = \frac{K_p^2 \times 2}{p}$

$x = \left(\frac{K_p^2 \times 2}{p}\right)^{1/3}$

Q2. $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

(1) $0.5 \qquad - \qquad -$

$0.5 - x \qquad\qquad 2x$

$P_{total} = 0.5 + x = 0.8$

$x = 0.3$

$K_P = \frac{(0.6)^2}{0.2} = 1.8$

Q3. Initial pressure of N_2O_5

(962) $= \frac{\frac{37.8}{108} \times 0.082 \times 500}{1} = 14.35$ bar

$2\,N_2O_5 \rightleftharpoons 2\,N_2O_4 + O_2$

$t = 0 \quad 14.35$
$t = eq \quad 14.35 - 2P \quad 2P$
P_{Total} at eqb $= 14.35 + P = 18.65$
$P = 4.3$
$P_{N_2O_5} = 5.75$ bar
$P_{N_2O_4} = 8.6$bar
$P_{O_2} = 4.3$ bar

$$k_p = \frac{(8.6)^2 \times (4.3)}{(5.75)^2} = 9.619 = x \times 10^{-2}$$

$x = 961.9 \approx 962$

Q4. $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(2) Concentrations of $H_2(g)$ and $I_2(g)$ decrease with time while concentration of $HI(g)$ increases with time. At equilibrium $H_2(g), I_2(g)$ and $HI(g)$ attain constant values. Correct plot of molar concentration with time is

Q5. $AB_2(g) \rightleftharpoons AB(g) + \frac{1}{2} B_2(g)$

(3)

$t = 0$	p_0		
$t = t_{eq}$	$p_0(1-x)$	p_0x	$\frac{p_0x}{2}$

$$p = p_0x - p_0x + p_0x + \frac{p_0x}{2}$$

$$p = p_0\left(1 + \frac{x}{2}\right)$$

$$p_0 = \frac{p}{\left(1 + \frac{x}{2}\right)}$$

$$K_p = \frac{(p_{AB})(p_{B_2})^{1/2}}{(p_{AB_2})}$$

$$K_p = \frac{(p_0x)\left(\frac{p_0x}{2}\right)^{1/2}}{p_0(1-x)}$$

$$K_p = \frac{\frac{px}{\left(1+\frac{x}{2}\right)}\left(\frac{p}{1+\frac{x}{2}} \times \frac{x}{2}\right)^{1/2}}{\frac{p(1-x)}{\left(1+\frac{x}{2}\right)}}$$

Since $x \ll 1$

$$K_p = \frac{p^{1/2}x^{3/2}}{2^{1/2}}$$

$$x = \sqrt[3]{\frac{2K_p^2}{p}}$$

Q6. $CO(g) + 3H_2 \rightleftharpoons CH_4(g) + H_2O(g)$

(2) $\Delta n_g = -2$

If pressure of system increases then according to Le-Chatelier's principle reaction will move in forward direction.

Concentration of reactant and products both increases but concentration of product increases more.

Q1. $\ddot{O}=\ddot{N}-\ddot{O}:^{-}$

(12) Number of non-bonding electrons = 12

Q2.

	$H \rightleftharpoons$	H^+	+	A^-
	C	–		–
(4)	C(1–x)	Cx		Cx

$$K_a = \frac{[H^+](x)}{C(1-x)}$$

$$[H^+] = K_a\frac{(1-x)}{x}$$

$$\log H^+ = \log K_a + \log\left(\frac{1-x}{x}\right)$$

$$-\log H^+ = -\log K_a - \log\frac{1-x}{x}$$

$$pH = pK_a - \log\frac{1-x}{x}$$

$$pH - pK_a = \log\frac{x}{1-x}$$

Q3.

(7)

$$C_2H_5NH_2(aq) + H_2O \rightleftharpoons C_2H_2NH_3^+ + \overset{\ominus}{O}H$$

$C = 10^{-3}$ M	-	-
C(1 - α)	Cα	Cα
$\Rightarrow C = 10^{-3}$	$=10^{-5}$	$=10^{-5}$

$$\boxed{1-\alpha \simeq 1}$$

Given, $P^H = 9 \Rightarrow P^{OH} = 5 \Rightarrow [\overset{\ominus}{O}H] = 10^{-5}M$

Now, $K_b = \frac{[C_2H_5NH_3^+][\overset{\ominus}{O}H]}{[C_2H_5NH_2]}$

$\Rightarrow K_b = \frac{10^{-5}\times10^{-5}}{10^{-3}} = 10^{-7}$

Q4. At $25^\circ C$, pure water has $pH = 7$

(1) As temperature increased, water molecules dissociate more into hydrogen ions (H^+) and hydroxide ions (OH^-). This increased dissociation leads to slightly decrease in pH.

At $80^\circ C, pH \approx 6.93$

Q5.

(2)

$$Zr_3(PO_4)_4(s) \rightleftharpoons \underset{-}{} \underset{3\,s}{3Zr^{+4}(aq)} + \underset{4\,s}{4PO_4^{-3}(aq)}$$

$$K_{sp} = (3\,s)^3(4\,s)^4 = 6912\,s^7$$

$$s = \left(\frac{K_{sp}}{6912}\right)^{1/7}$$

Q6. Condition for precipitation $Q_{ip} > K_{sp}$

(3) For $[A(OH)_2]$

$\left[A^{2+}\right][OH]^2 > 9 \times 10^{-10}$

$\left[A^{+2}\right] = 1M$

$\Rightarrow \left[OH^-\right] > 3 \times 10^{-5}M$

For $[B(OH)_3]$

$\left[B^{3+}\right]\left[OH^-\right]^3 > 27 \times 10^{-18}$

$\left[B^{3+}\right] = 1M$

$\Rightarrow \left[OH^-\right] > 3 \times 10^{-6}M$

So, $B(OH)_3$ will precipitate before $A(OH)_2$

Q7. $Cr(OH)_3 \rightleftharpoons \underset{s}{Cr^{3+}_5}(aq) + \underset{3\,s}{3OH^-}(aq)$

(3)

$K_{sp} = s(3\,s)^3$

$1.6 \times 10^{-30} = 27\,s^4$

$\sqrt[4]{\frac{1.6 \times 10^{-30}}{27}} = s$

Q8. Based on the Ksp values and salt analysis cation identification, we can say that order of Ksp value is:

(4) $HgS < PbS < AgBr < Ca(OH)_2$

K sp values

$HgS \rightarrow 4 \times 10^{-53}$

$PbS \rightarrow 8 \times 10^{-28}$

$AgBr \rightarrow 5 \times 10^{-13}$

$Ca(OH)_2 \rightarrow 5.5 \times 10^{-6}$

Q1. (A) $CH_4(g) + 2O_2(g) \xrightarrow{\Delta} 2CO_2(g) + H_2O(l) \Rightarrow$ combination reaction

(4) (B) $2\ NaH\ (s) \xrightarrow{\Delta} 2Na(s) + H_2(g) \Rightarrow$ Decomposition reaction

(C) $V_2O_5(s) + 5Ca(s) \xrightarrow{\Delta} 2\ V(s) + 5CaO(s) \Rightarrow$ Displacement reaction

(D) $2H_2O_2\ (aq.) \xrightarrow{\Delta} 2H_2O(l) + O_2(g) \Rightarrow$ Disproportionation reaction

Q2. $ClO_4^- \rightarrow x + \{(-2) \times 4\} = -1 \Rightarrow x = +7$

(4) Chlorine is in its maximum oxidation state, so disproportionation not possible in ClO_4^-.

Q3. Heating is required in oxalic acid filtration due to High activation energy.

(2) Heating is not required in FAS vs $KMnO_4$ titration because Fe^{2+} will get converted into Fe^{3+} by oxygen of air and error may be introduced in the experiment.

Both Statement-I and Statement-II are correct.

Q4. $E_{KIO_3} = \dfrac{\text{Molecular welght}}{n_f}$

(1) $nff_f = 5$

$E_{KIO_3} = \dfrac{\text{Molecular welght}}{5}$

(D) is correct meq of $KI = 0.1 \times 200 = 20$ meq of $KIO_3 = 4 \times 5 = 20$

(A) is correct

Q5. Let moles of $CO_2 = n$ moles of $Ca(OH)_2$ total initially $= 2n$ excess $Ca(OH)_2 = n$ gm equivalent of

(45) $Ca(OH)_2 =$ gm equivalent of HCl

$n \times 2 = 0.1 \times \dfrac{40}{1000} \times 1$

$n = 2 \times 10^{-3}$

Volume of $CO_2 = 2 \times 10^{-3} \times 22400 = 44.8\ cm^3$

Q1. Normal molar mass of $MX_2 = 164.0\ g\ mol^{-1}$

(75) Observed molar mass of $MX_2 = 65.6\ g\ mol^{-1}$

$$\text{Van't Hoff factor (i)} = \frac{\text{Normal molar mass}}{\text{Observed molar mass}}$$

$$= \frac{164}{65.6} = 2.5$$

If α is the degree of ionisation, then

$$\underset{1-\alpha}{MX_2} \rightleftharpoons \underset{\alpha}{M^{2+}} + \underset{2\alpha}{2X^-}$$

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

$$1 + 2\alpha = 2.5$$

$$\alpha = 0.75$$

$\therefore$ Percent degree of ionisation $= 75\%$

Q2.

AB_2	$\rightleftharpoons$	A^{2+}	+	$2B^-$
1		0		0
$1-\alpha$		α		2α

(16)

$$i = 1 + 2\alpha$$

$$= 1 + 2 \times (0.3)$$

$$= 1.6$$

$$= 16 \times 10^{-1}$$

Q3. A mixture of salt and ice is known as freezing mixture. Freezing mixture decreases freezing point of ice. Both

(4) statements are true.

Q4. Living cell $= 0.9$gm in 100 gm of solution

(4) $\%w/w = 0.9$

Solution is have equal moles of glucose and water $= 0.5$

Weight of solution $= 0.5 \times 180 + 0.5 \times 18 = 99$gm $\%w/w \simeq 90\%$

Concentrated solution = Cell will shrink.

Q5. $\because$ For liquid solution of two liquids ' 1 ' and ' 2 '

(2)

$$P_1 = P_T y_1 = P_1^\circ x_1$$

$$\therefore \frac{P_T}{x_1} = \frac{P_1^\circ}{y_1}$$

$$\therefore \frac{P_2^\circ + x_1 P_1^\circ - P_2^\circ}{x_1} = \frac{P_1^\circ}{y_1}$$

$$\therefore \frac{P_2^\circ}{x_1} + P_1^\circ - P_2^\circ = \frac{P_1^\circ}{y_1}$$

$$\therefore \frac{1}{x_1} = \frac{P_1^\circ 1}{P_2^\circ \frac{1}{y_1}} + \frac{P_2^\circ - P_1^\circ}{P_2^\circ}$$

$$\therefore \text{Slope} = \frac{P_1^\circ}{P_2^\circ}$$

$$\therefore \text{Intercept} = \frac{P_2^\circ - P_1^\circ}{P_2^\circ}$$

Q6. $\because P^{\circ}-P \propto X_{solute}$

(4) and $\because 10 \propto 0.2$

$\therefore 20 \propto 0.4$

$\therefore X_{solvent} = 1 - X_{solute}$

$= 1 - 0.4$

$= 0.6$

Q7. For 10^{-4}MNaCl$i = 2$

(4) $10^{-4}M$ Urea $i = 1$

$10^{-3}MMgCl_2 i = 3$

$10^{-2}MNaCli = 2$

More the value of i, C, more will be the elevation in boiling point hence increasing order of boding point is

$10^{-4}M$ Urea $<$

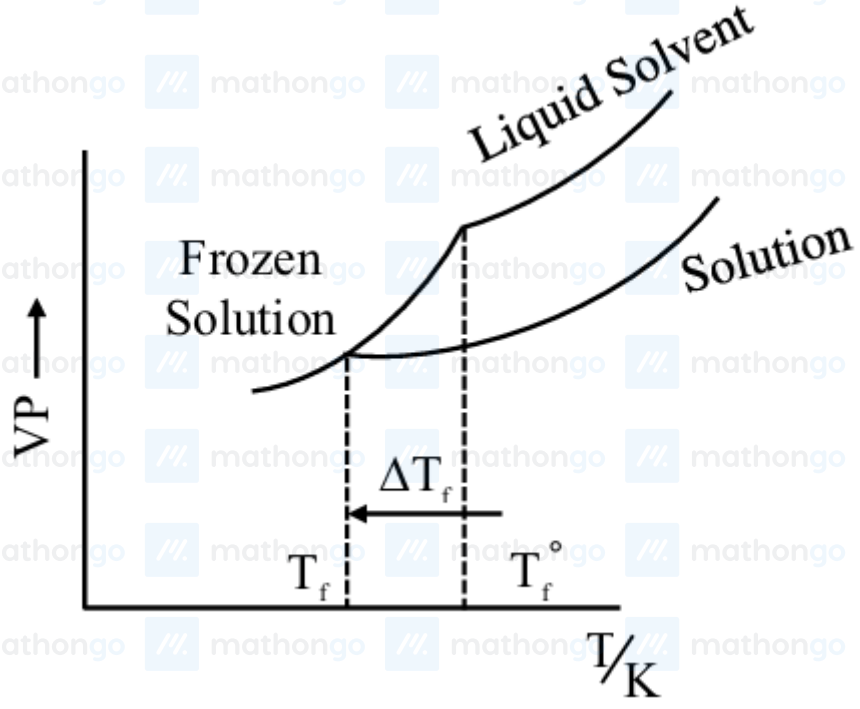
$10^{-4}\text{MNaCl} < 10^{-3}\text{MMgCl}l_2 < 10^{-2}\text{MNaCl}$

Q8. On adding non-volatile solute in a solvent, the freezing point of solution decreases.

(1) $T_f < T_f^0$

F.P. of solution $<$ F.P. of pure solvent

Also V.P. of solution decreases on adding nonvolatile solute in a solvent.



Q9. $\Delta T_f = K_b \cdot m$

(4) $0.4 = K_b \dfrac{\frac{1}{256}}{50 \times 10^{-3}}$

$K_b = 5.12\ \text{K kg/mol}$

Q10. For AX_2

(1) $\Delta T_b = i\, K\, m$

$$0.0156 = i \times 0.52 \times \frac{1.24}{124 \times 1}$$

$3 = i$

$3 = 1 + 2\alpha$

$1 = \alpha$

For AY_2

$\Delta T_b = i\, K_b\, m$

$$0.0260 = i \times 0.52 \times \frac{25.4}{250 \times 2}$$

$i \approx 1$

$\therefore AX_2$ is completely ionised $\& AY_2$ is completely unionised

Q1. $\because \Delta G^{\circ} = -nFE^{\circ}$

(1) Option $(1) E^{\circ} = 0.8 + 0.76$

$= 1.56\ V$

$\therefore \Delta G^{\circ} = -2 \times F \times 1.56$

$= -3.12\ V$

Option $(2)\ E^{\circ} = -2.37 + 0.76$

$= -1.61\ V$

$\therefore \Delta G^{\circ} = -2 \times F \times (-1.61)$

$= +3.22\ V$

Option $(3)\ E^{\circ} = -2.37 - 0.8$

$= -3.17\ V$

$\Delta G^{\circ} = -2\ ) \times F \times (-3.17)$

$= +6.34$

Option $(4) E^{\circ} = 0.8 - 0.34$

$= 0.46\ V$

$\Delta G^{\circ} = -2 \times F \times 0.46$

$= -0.92\ V$

Q2. Cathode $(Ag + (aq) + e^{-} \rightarrow Ag) \times 2$

(2) Anode $Mg \rightarrow Mg^{2+}(aq) + 2e^{-}$

Cell reaction $2Ag^{+} + Mg \rightarrow 2Ag + Mg^{2+}$

$$Q = \frac{[Mg^{2+}]}{[Ag^{+}]^2}$$

By Nernst equation

$$E_{cell} = E^{\circ}_{cell} - \frac{RT}{nF} \ln Q$$

$$E_{cell} = E^{\circ}_{cell} - \frac{RT}{nF} \ln \frac{\left[Mg^{2+}\right]}{\left[Ag^{+}\right]^2}$$

$$= E^{\circ}_{cell} + \frac{RT}{2F} \ln \frac{\left[Ag^{+}\right]^2}{\left[Mg^{2+}\right]}$$

Q3. Statement I :

(3) Corrosion is an example of electrochemical phenomenon

In which pure metal act as anode and impure metal (rusted metal) act as cathode.

Statement II :

Corrosion is more favourable in acid medium than alkaline so rate of corrosion is high is acid medium then alkaline.

Q4. $Al^{1++} + 3e^{-} \longrightarrow Al$

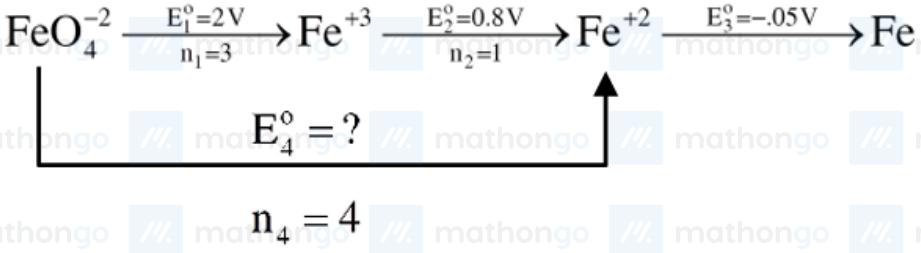
(2) Moles of electron $= \frac{2 \times 30 \times 60}{96500}$

$= \frac{36}{965}$

$$\text{Moles of Al} = \frac{36}{3 \times 965}$$
$$= \frac{12}{965}$$
$$\text{Mass of Al} = \frac{12}{965} \times 27$$
$$= 0.336\text{gm}$$

Q5.

(2)

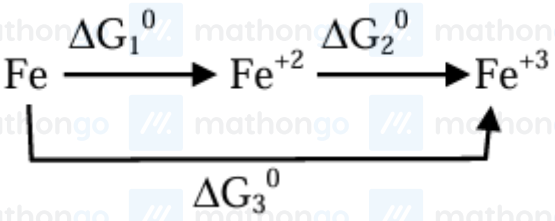


$$n_4 = 4$$

$$\Delta G_4^\circ = \Delta G_1^\circ + \Delta G_2^\circ$$
$$\Rightarrow -n_4 F E_4^\circ = -n_1 F E_1^0 - n_2 F E_2^\circ$$
$$\Rightarrow +4E_4^\circ = 3 \times 2 + (1 \times 0.8)$$
$$\Rightarrow E_4^\circ = \frac{6.8}{4}\ \text{V}$$
$$\Rightarrow E_4^\circ = 1.7\ \text{V}$$

Q6. $Fe^{2+}(aq) + Ag^+(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$

(3)



$$\Delta G_3^0 = \Delta G_1^0 + \Delta G_2^0$$
$$-3\,F(-z) = -2\,F(-y) + \Delta G_2{}^0$$
$$\Delta G_2^0 = 3Fz - 2Fy$$
$$\text{Also } \Delta G_2^0 = -nFE^0_{Fe^{+2}/Fe^{t43}}$$
$$3Fz - 2Fy = -1\ F\left(E^0_{Fe^{t2}/Fe^{43}}\right)$$
$$E^0_{Fe^{2+2}/Fe^{t3}} = 2y - 3z$$
E^0_{Cell} for reaction will be
$$E^0_{Ag^+/Ag} + E^{03}_{Fe^{t2/Fe}}$$
$$= x + 2y - 3z$$

Q7. $E^0_{Cr_2Of_4^\circ/ca^8} = 1.33\ V^\circ_{C_2/Cr} = 1.36\ V$

(1) $E^\circ_{MnO_4/Mm^2} = 1.51\ VE^0_{Cr^2/Cr} = -0.74\ V$

The species which has the most negative value of standard reduction potential will be the strongest reducing agent. Since Cr^{3+}/Cr has SRP value of -0.74 V, Cr is the strongest reducing agent.

Q8. Electrolysis of NaCl is

(2) $NaCl + H_2O(aq) \rightarrow NaOH(aq) + \frac{1}{2}Cl_2(g) + \frac{1}{2}H_2(g)$

Since during electrolysis pH changes to 12

So $\left[OH^{\ominus}\right] = 10^{-2}$ and $\left[H^{+}\right] = 10^{-12}$

So by Faraday law

Gram amount of substance deposited = Amount of electricity passed

$$10^{-2} \times \frac{600}{1000} \times 96500 = I \times t$$

$$\frac{10^{-2} \times 600}{1000} \times 96500 = I \times 5 \times 60$$

$$I = \frac{10^{-2} \times 600 \times 96500}{1000 \times 5 \times 60}$$

$I = 1.93$ ampere

So , $I = 2$ ampere (nearest integer)

Q9. The element having strongest oxidising capacity will have highest value of standard reduction potential

(1)

Q10. When an aqueous solution of $AgNO_3$ is electrolysed using Pt electrodes

(2) Cathode: $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$

Anode : $2H_2O(l) \rightleftharpoons 4H^{+}(aq) + O_2(g) + 4e^{-}$

$\Rightarrow$ When dilute H_2SO_4 is electrolysed using Pt electrodes

$\Rightarrow$ When dilute H_2SO_4 is electrolysed using Pt electrodes

Anode : $2H_2O(l) \rightarrow O_2(g) + 4H^{+}(aq) + 4e^{-}$

Cathode: $2H^{+}(aq) + 2e^{-} \rightarrow H_2(g)$

Q11. In transistor, anode is Zn and cathode is carbon.

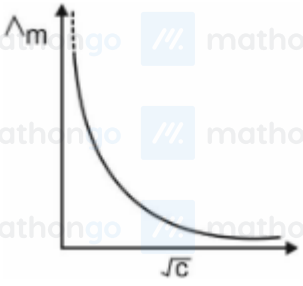
(3) In hearing, aids mercury battery are used.

In invertors, lead storage battery is used.

In apollo space ship, hydrogen fuel cell was used.

Q12. For weak electrolyte, variation of $\wedge_m$ with $\sqrt{c}$ is

(2)



Q13. **(150)**

$$\mathrm{R}=\rho\frac{\ell}{\mathrm{A}}$$

$$\kappa=\mathrm{G}\cdot\mathrm{G}^{*}\quad \mathrm{G}=\frac{1}{\mathrm{R}};\kappa=\frac{1}{\rho}$$

$$\mathrm{G}^{*}=\frac{\ell}{\mathrm{A}}$$

$\mathrm{R}=$ Resistance

$\rho=$ Resistivity

$\frac{\ell}{\mathrm{A}}=$ cell constant $\left(\mathrm{G}^{*}\right)$

$$\frac{\kappa_{\mathrm{c}}}{\kappa_{\mathrm{d}}}=\frac{\mathrm{R}_{\mathrm{d}}}{\mathrm{R}_{\mathrm{c}}};\lambda_{\mathrm{m}}=\frac{\kappa\times1000}{\mathrm{C}}$$

$$\frac{\kappa_{\mathrm{c}}}{\kappa_{\mathrm{d}}}=\frac{\left(\lambda_{\mathrm{m}}\cdot\mathrm{C}\right)}{\left(\lambda_{\mathrm{m}}\cdot C\right)_{\mathrm{d}}}=\frac{\mathrm{R}_{\mathrm{d}}}{R_{\mathrm{c}}}$$

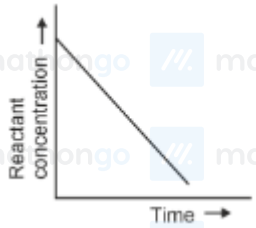
$\mathrm{c}=$ concentrated sol. $\quad \mathrm{d}=$ diluted solution

$$\frac{100\cdot(0.15)^{2}}{150.(0.1)^{2}}=\frac{R_{\mathrm{d}}}{100}$$

$$\mathrm{R}_{\mathrm{d}}=150\Omega$$

Q1. $[A]_t = [A]_0 - kt$

(1) Straight line with negative slope



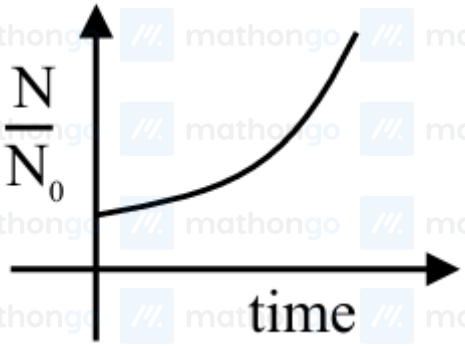
Graph of reactant concentration versus time for zero order reaction.

Q2. Because no. of bacteria initial $= N_0$ and No. of bacteria at any time $t = N$

(3) Since bacterial growth is given as

$N = N_0 e^{Kt}$

Where K = growth constant for bacterial growth



Q3. Since, the reaction is elementary

(3) $\text{Rate } = k[A]^1[B]^1$

When V is reduced to $\frac{1}{3}$ V, concentration will be tripled.

Hence, rate $= 9 \times (\text{ rate })_{\text{initial}}$

$x = 9$

Q4. For radioactive decay, decay constant does not depend upon temperature because for radioactive decay

(1) activation energy is zero.

Q5. $t_{1/2} = \dfrac{0.693}{K}$

(69) $K = Ae^{-Ea/RT}$

$= 10^{20} \times e^{-\frac{191.48 \times 10^3}{8.314 \times 1000}}$

$= 10^{20} \times e^{-23.031} = 10^{20} \times -e^{\ln 10 \times 10}$

$= \dfrac{10^{20}}{10^{10}} = 10^{10}\text{sec.}$

$t_{1/2} = \dfrac{0.693}{10^{10}} = 6.93 \times 10^{-11}$

$= 69.3 \times 10^{-12}\text{sec.}$

Q6. $2\,N_2O_5(\,g) \rightarrow 2\,N_2O_4(\,g) + O_2(\,g)$

(897) $k = \dfrac{2.303}{t}\log\dfrac{0.9-0.6}{(0.9-x)}$

$2\times10^{-2}\times100 = \log\dfrac{0.3}{(0.9-x)}$

$100 = \dfrac{0.3}{(0.9-x)}$

$= \dfrac{0.9-x}{0.3} = 0.01$

$0.9 - X = 0.003$

$= 897\times10^{-3}$

Q7. $\frac{t_1}{2} \propto (C_0)^{1-\eta}$

(2) $\dfrac{t_1}{t_2} = \left(\dfrac{C_1}{C_2}\right)^{1-\eta}$

$\Rightarrow \dfrac{200}{100} = \left(\dfrac{0.100}{0.025}\right)^{1-\eta}$

$\Rightarrow 2 = (4)^{1-\eta}$

$(1-\eta) = \dfrac{1}{2}$

$\eta = \dfrac{1}{2}$

For $\eta = \dfrac{1}{2}$

$\dfrac{-dA}{dt} = k(A)^{\frac{1}{2}}$

$\displaystyle\int_{C_0}^{C}\frac{dA}{(A)^{\frac{1}{2}}} = -\int_0^t kdt$

$\Rightarrow 2\,A^{\frac{1}{2}} = -kt$

$\Rightarrow \sqrt{C} - \sqrt{C_0} = \dfrac{-kt}{2}$

$\sqrt{C} - \sqrt{C_0} - \dfrac{kt}{2}$

For $C_0 = 0.1 \Rightarrow t_{\frac{1}{2}} = 200$ min

$\sqrt{\dfrac{c_0}{2}} = \sqrt{c_0} - \dfrac{kt}{2}$

$\dfrac{kt}{2} = \sqrt{c_0} - \sqrt{\dfrac{c_0}{2}}$

$\dfrac{kt}{2} = \sqrt{c_0}\left(\dfrac{\sqrt{2}-1}{\sqrt{2}}\right)$

$t_{\frac{1}{2}} = \dfrac{2\sqrt{c_0}}{k}\left(\dfrac{\sqrt{2}-1}{\sqrt{2}}\right)$

$200 = \dfrac{2\sqrt{0.1}}{k}\left(\dfrac{\sqrt{2}-1}{\sqrt{2}}\right)$

$k = \frac{\sqrt{0.1}}{100}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$

For $C_0 = 1M$

$t_{\frac{1}{2}} = \frac{2\times100(\sqrt{2})}{\sqrt{0.1}(\sqrt{2}-1)} \times \frac{(\sqrt{2}-1)}{\sqrt{2}}$

$\Rightarrow 200\sqrt{10}$ min.

$\Rightarrow B$ is correct

C is incorrect

For $C_0 = 1.6M$

$$t_{\frac{1}{2}} = \frac{2\sqrt{1.6}(\sqrt{2})(\sqrt{2}-1)\times100}{\sqrt{0.1}(\sqrt{2}-1)(\sqrt{2})}$$

$t_{\frac{1}{2}} = 400 \times 2$ min

$t_{\frac{1}{2}} = 800$ min

Q8. Drug X $\xrightarrow{\text{1st order}}$ Product

(2)

Initial concentration of drug $= 16mg/mL$

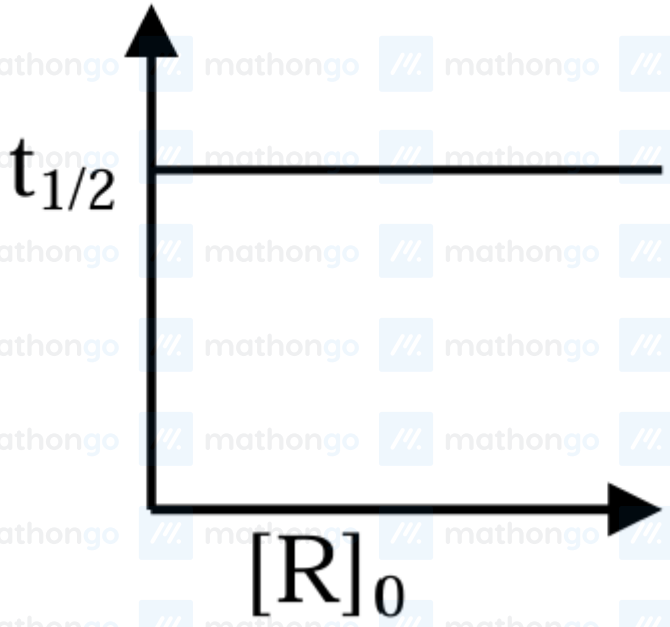
Concentration of drug after 12 months $= 4mg/mL$

Half life of drug = 6 months

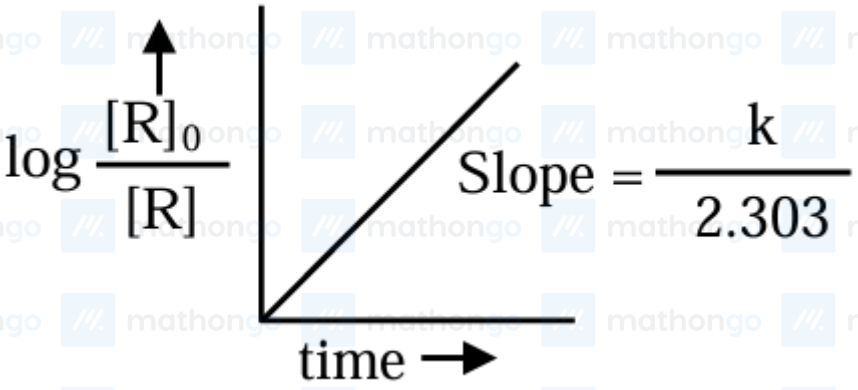
Drug become ineffective after 50\% decomposition. The expiry time of drug $= 6$ months

Q9. For first order reaction $t_{1/2} = \frac{\ell n2}{k}$

(1)



For first order reaction



$$\log \frac{[R]_0}{[R]} = \frac{1}{2.303} \mathrm{kt}$$

$$\log \frac{[\mathrm{R}]_0}{[\mathrm{R}]} = \left(\frac{\mathrm{k}}{2.303}\right) \times \mathrm{t}$$

Q10. $\text{rate} = \mathrm{k}_2[\mathrm{A}][\mathrm{B}_2] \ldots\ldots$

(4) $\left(\frac{\mathrm{k}_1}{\mathrm{k}_{-1}}\right) = \left(\frac{[\mathrm{A}]^2}{[\mathrm{A}_2]}\right)$

$$\Rightarrow [\mathrm{A}] = \sqrt{\frac{\mathrm{k}_1}{\mathrm{k}_{-1}}} \cdot \sqrt{[\mathrm{A}_2]}$$

Substituting in (1) ; we get

$$\text{Rate} = \mathrm{k}_2 \sqrt{\frac{\mathrm{k}_1}{\mathrm{k}_{-1}}} \cdot [\mathrm{A}_2]^{\frac{1}{2}} \cdot [\mathrm{B}_2]$$

$$\therefore \text{ order } = \left(\frac{3}{2}\right) = 1.5$$

Q11. Activation energy of forward reaction $= E_1 + E_2$

(2) Energy of product $>$ Energy of reactant

Stability

Reactant $>$ Product

Q12. $\mathrm{k}_1, \mathrm{k}_2$ and k_3 are given as rate constants of three steps of a complex reaction. Rate constant (k) of the overall

(20) reaction is given as

$$k = \sqrt{\frac{k_1 k_3}{k_2}}$$

Activation energies of the three steps are given as

$\mathrm{E}_{\mathrm{a}_1} = 60 \text{ kJ mol}^{-1}, \mathrm{E}_{\mathrm{a}_2} = 30 \text{ kJ mol}^{-1}$,

$\mathrm{E}_{\mathrm{a}_3} = 10 \text{ kJ mol}^{-1}$

From Arrhenius equation, we know that

$\mathrm{k} = \mathrm{Ae}^{-\mathrm{Ea}/\mathrm{RT}T}$

If E_a is the activation energy of the overall reaction, then

$$E_a = \frac{1}{2}[E_{a_1} + E_{a_3} - E_{a_2}]$$

$$= \frac{1}{2}[60 + 10 - 30] = 20 \text{ kJ mol}^{-1}$$

Q1. Analyzing Statement (I)

(4) The extreme left of the periodic table corresponds to the alkali metals (Group 1) and alkaline earth metals (Group 2).

These metals typically form basic (or occasionally amphoteric, in the case of some Group 2 elements) oxides, not acidic oxides.

For example, Na_2O, K_2O, MgO, CaO, etc., all form basic solutions (e.g., $Na_2O + H_2O \rightarrow 2NaOH$).

Hence, Statement (I)-that an element in the extreme left forms acidic oxides-is false.

Analyzing Statement (II)

The extreme right of the periodic table corresponds to the nonmetals in Groups 15, 16, 17 (and noble gases in Group 18).

Nonmetal oxides (such as those of sulfur, phosphorus, chlorine) are generally acidic.

When these oxides dissolve in water, they typically form acids.

Example: $SO_3 + H_2O \rightarrow H_2SO_4$ (sulfuric acid)

Example: $P_2O_5 + 3H_2O \rightarrow 2H_3PO_4$ (phosphoric acid)

Example: $Cl_2O_7 + H_2O \rightarrow 2HClO_4$ (perchloric acid)

Thus, Statement (II)-that acid is formed when water reacts with an oxide of a reactive element in the extreme right-is true.

Conclusion

Statement (I) is false.

Statement (II) is true.

Q2. Correct order of atomic radii : $Be < Mg > Al > Si$

(2)

Q3. Law of octaves was arranged in the increasing order of their atomic weight.

(1) Lothar Meyer plotted the physical properties such as atomic volume, melting point and boiling point against atomic weight.

Q4. Palladium $\Rightarrow 5^{th}$ period

(4) Iridium, Osmium, Platinum $\Rightarrow 6^{th}$ Period

Q5. Properties of elements are function of atomic numbers.

(1) Elements having similar outer electronic configuration are arranged in same group.

Number of elements in a period is double of number of atomic orbitals available in energy level that is being filled.

Q6. **(4)**

	Li	Be	B	C	N	O	F
(E.N.)=	1	1.5	2	2.5	3	3.5	4.0

On pauling scale

	Na	Mg	Al	Si	P	S	Cl
(E.N.)=	0.9	1.2	1.5	1.8	2.1	2.5	3.0

Correct order Mg < Al < B < N

Q7. Ionic radii $-\mathrm{Al}^{3+} < \mathrm{Mg}^{2+} < \mathrm{Na}^{+} < \mathrm{F}^{-}$

(1) Ionisation energy - $\mathrm{B} < \mathrm{C} < \mathrm{O} < \mathrm{N}$

Metallic character $-\mathrm{B} < \mathrm{Al} < \mathrm{Mg} < \mathrm{K}$

Electron negativity $-\mathrm{Si} < \mathrm{P} < \mathrm{S} < \mathrm{Cl}$

Q8. The successive 5 ionisation energies of an element are $800, 2427, 3658, 25024$ and $32824\ \mathrm{kJ/mol}$, respectively.

(1) $\frac{\mathrm{IE}_2}{\mathrm{IE}_1} = \frac{2427}{800} = 3.03$

$\frac{\mathrm{IE}}{\mathrm{IE}_2} = \frac{3658}{2427} = 1.51$

$\frac{\mathrm{IE}}{\mathrm{IE}_3} = \frac{25024}{3658} = 6.84$

$\frac{\mathrm{IE}_5}{\mathrm{IE}_4} = \frac{32824}{25024} = 1.31$

Since ($\mathrm{IE}_4/\mathrm{IE}_3$) value is maximum, the element belongs to group 13.

Q9. The element having high value of Electron gain enthalpy (magnitude) will form a compound having higher ionic

(3) character so order of ionic character

$EB > EA > EC > ED$

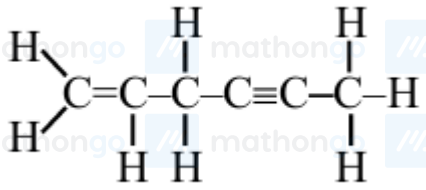
Q10. Among given atoms, Boron has least atomic radius oxide of Boron $= \mathrm{B_2O_3}$

(2)

Q11. The main component of apatite family is phosphorus.

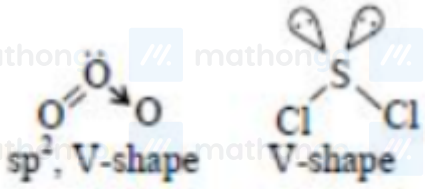
(3) Order of IE_1 of group 15 elements $\mathrm{N} > \mathrm{P} > \mathrm{As} > \mathrm{Sb}$ IE of phosphorus $= 1012\ \mathrm{kJ\ mol^{-1}}$.

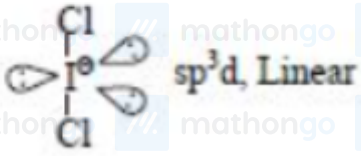
Q1.
(3)



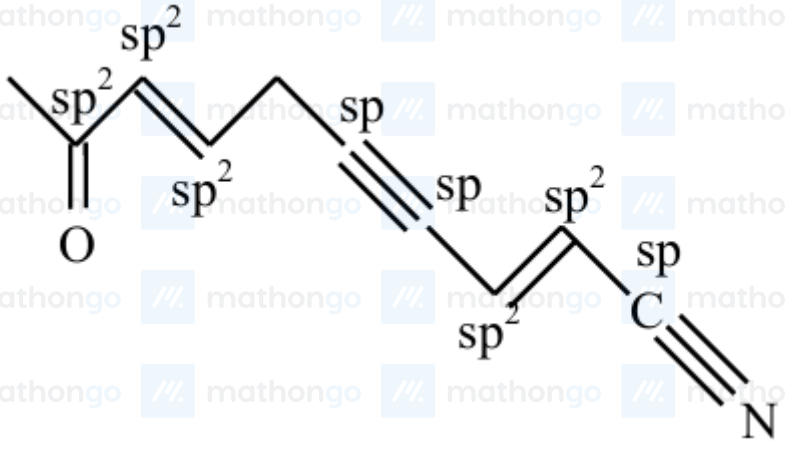
σ bonds $= 13$
π bonds $= 3$

Q2. $Cl-Be-Cl$ $N \equiv N :\rightarrow O$
(6) sp, linear sp, linear
$N^- = N^+ = N^-$ $O = N^+ = O$
sp, linear sp, linear
like $I_3^-, XeF_2 \rightarrow sp^3d_1$, Linear
Ans. $= 4$





Q3.
(2)

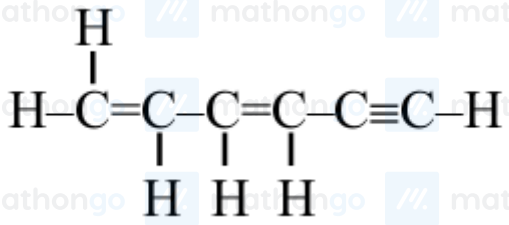


Number of sp and sp^2 hybridised carbon atom are 3 and 5.

Q4. $NO = 7e^-$ Incomplete octet with
(2) $NO_2 = 7e^-$ $\int$ odd electron
$BCl_3 = 6e^-$, $AlCl_3 = 6e^-$ } Incomplete octet
$H_2SO_4 = 12e^-, PCl_5 = 10e^- \Rightarrow$ molecules with expanded octet
$CCl_4 = 8e^-, CO_2 = 8e^- \Rightarrow$ molecules obeying octet rule

Q5.

(15)



Number of σ bond $= 11$

Number of π bond $= 4$

$\sigma + \pi = 11 + 4 = 15$

Q6. First ionization energy of Lead $= 715$ kJ mol^{-1}

(2) First ionization energy of Tin $= 708$ kJ mol^{-1}

(IE_1) of Lead is greater than that of Tin due to ineffective shielding of d - and f -electrons.

Therefore Statement-I is true.

First ionization energy of Germanium $= 761$ kJ mol^{-1}

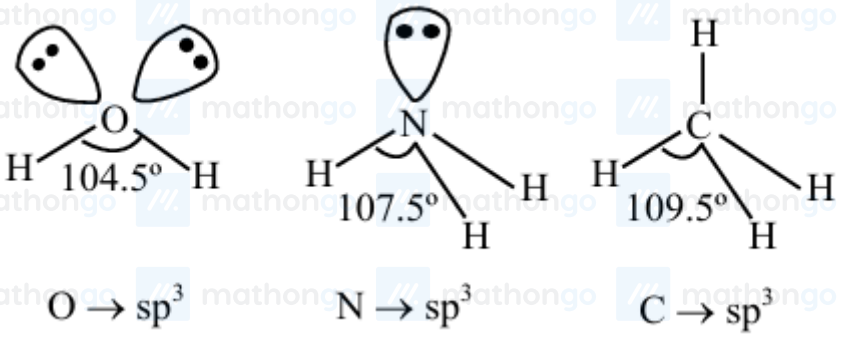
First ionization energy of Silicon $= 786$ kJ mol^{-1}

(IE_1) of Germanium is lower than that of Silicon as the effect of higher atomic radius of Ge outweighs the increase in nuclear charge from Si to Ge and effective shielding of inner electrons.

Therefore Statement-II is false.

Q7.

(1)



$O \rightarrow sp^3$ $N \rightarrow sp^3$ $C \rightarrow sp^3$

Dipole moment $H_2O > NH_3 > CH_4$

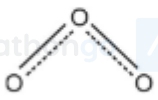
H_2O&NH_3 are Lewis Bases

NH_3 act as Lowry- Bronsted base

Hence, A, B \& C are correct

Q8.

(3)

Bond	(O – O) Bond order
(O – O)	1.0
	1.5
O = O	2.0

Bond length $\propto \frac{1}{\text{Bond order}}$

Order of $O-O$ bond length

$O=O<O_3<O-O$

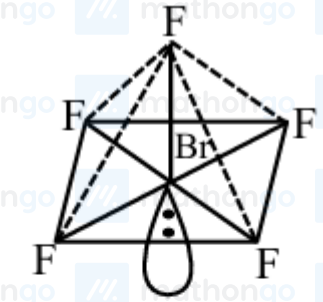
$\therefore$ Statement I is true.

Lone pair-lone pair repulsion between O-atoms is not solely responsible for the correct order of O-O bond length. Bond order also should be considered.

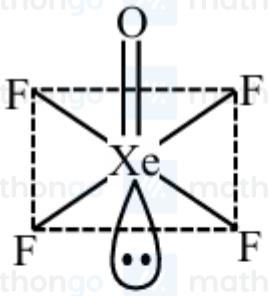
$\therefore$ Statement II is false.

Q9.

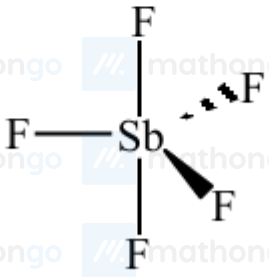
(4)



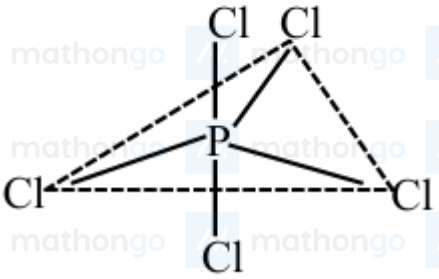
Square pyramidal



Square pyramidal



Trigonal Bipyramidal



Trigonal Bipyramidal

BrF_5 : Square pyramedal

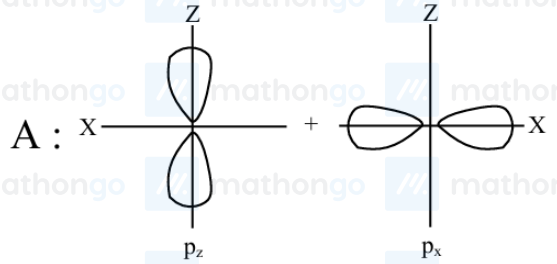
$XeOF_4$: Square pyramedal

SbF_5 : Trigonal bipyramidal

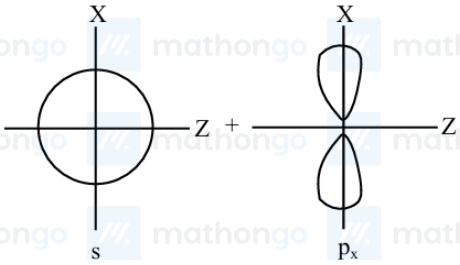
PCl_5 : Trigonal bipyramidal

Q10.

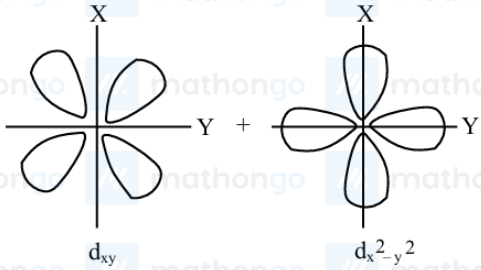
(2)

A : 

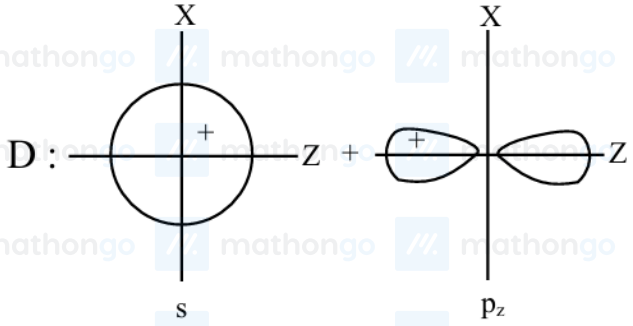
$\Rightarrow$ no molecular orbital

B : 

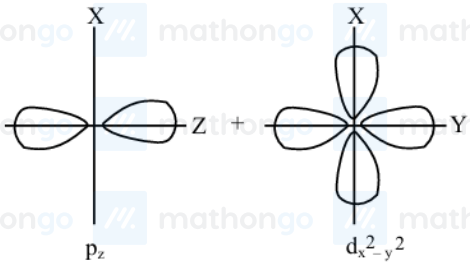
$\Rightarrow$ no molecular orbital

C : 

$\Rightarrow$ no molecular orbital

D : 

$\Rightarrow$ 
Sigma molecular orbital

E : 

$\Rightarrow$ no molecular orbital

Q11. $O_2 \rightarrow$ 2 unpaired electrons according to MOT

(6) $O_2^+ \rightarrow$ 1 unpaired electrons according to MOT

$O_2^- \rightarrow$ 1 unpaired electrons according to MOT

$NO \rightarrow$ odd electron species

$NO_2 \rightarrow$ odd electron species

$K_2[NiCl_4] \rightarrow Ni^{2+} \Rightarrow 3\,d^8$ weak Ligand, C.N. $= 4$

$\Rightarrow$ Tetrahedral, Paramagnetic with 2 unpaired electrons

Q12. **(2)**

$\mu_{HBr} = 0.78D$

$\mu_{H_2S} = 0.95D$

$\mu_{NF_3} = 0.24D$

$\mu_{CHCl_3} = 1.01D$

Hence dipole moment of

$NF_3 < HBr < H_2S < CHCl_3$

Q13. Melting point order **(2)**

$Fe > Mn$

$Ru > Tc$

$Re > Os$

Q1. Among $\mathrm{Al, In, Tl, Ge, Sn, Pb}$, the metal having highest $\mathrm{IE_1}$ is Ge and lowest $\mathrm{IE_1}$ is In.

(3) Most stable oxidation state of Ge is +4 and In is +3.

Q2. Order of M.P. of group 14: $\mathrm{C > Si > Ge > Pb > Sn}$

(4)

element	M.P. (°C)
$\mathrm{Z = 6 = C}$	3730
$\mathrm{Z = 14 = Si}$	1410
$\mathrm{Z = 32 = Ge}$	937
$\mathrm{Z = 50 = Sn}$	232
$\mathrm{Z = 82 = Pb}$	327

Q1. $\overset{+4}{S}O_2$ can acts as both oxidising agent as well reducing agents because due to intermediate oxidation state, it can
(2) oxidise and reduce as well.

Q2. Phosphorus belongs to 15^{th} group and forms $d\pi - d\pi$ bond with transition metal and PH_3 is strongest base
(15) among the other group members excepet NH_3.

Q3. $N - N < P - P$: single (σ) bond strength
(1) Due to L.P.-L.P. replusion
and maximum possible covalency of nitrogen is 4.

Q4. The large difference in the melting and boiling points of oxygen and sulphur is due to atomicity as oxygen exists
(1) as O_2 and sulphur exists as S_8.

Q5. Theory based.
(4) At anode :
$2HSO_4^- \rightarrow H_2\, S_2O_8 + 2e^-$

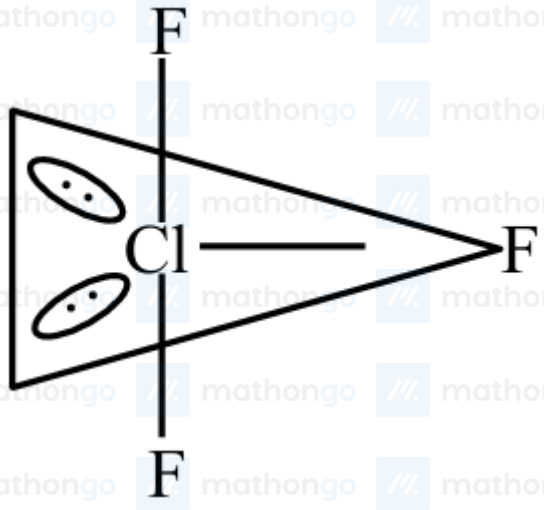
Q1. - Bronze is an alloy of copper and Tin. (A-IV)
(2) - Brass is an alloy of copper and Zinc. (B-III)
- UK Silver coin is an alloy of copper and Nickel. (C-I)
- Stainless steel is an alloy of Fe, Cr, Ni, C. (D-II)

Q2. Preparation of $KMnO_4$
(4) $$MnO_2 \xrightarrow[KNO_3]{KOH} K_2MnO_4 \xrightarrow[\text{Oxidation in Alkaline solution}]{\text{Elecrolta}} KMnO_4$$

Q3. $Z = 41 \rightarrow Nb$ (Niobium) : $[Kr]_{36} 4\,d^4 5\,s^1$
(11) Number of electron in 4 d $= 4 = x$
$Z = 44 \rightarrow Ru$ (Ruthenium) $[Kr]_{36} 4\,d^7 5\,s^1$
Number of electron in 4 d $= 7 = y$
$x + y = 11$

Q4. (1) V^{2+} (Violet), Cr^{3+} (Violet), Mn^{3+}(Violet)
(2) (2) Zn^{2+} (Colourless), V^{3+} (Green), Fe^{3+} (Yellow)
(3) Ti^{4+} (Colourless), V^{4+} (Blue), Mn^{2+} (Pink)
(4) Sc^{3+}(Colourless), Ti^{3+} (Purple), Cr^{2+} (Blue)

Q5. ClF_3
(2)



n = 2(No of lone pair present in equitorial plane) (Unpaired e^-)
(A) V^{+3} : $[Ar]3\,d^2$ 2
(B) Ti^{3+} : $[Ar]3\,d^1$ 1
(C) Cu^{+2} : $[Ar]3\,d^9$ 1
(D) Ni^{+2} : $[Ar]3\,d^8$ 2
(E) Ti^{+2} : $[Ar]3\,d^2$ 2

Q6. V_2O_5 is amphoteric oxide.
(4) V_2O_5 gives VO_4^{3-} on reaction with alkali oxidation state of V in $VO_4^{3-} = +5$

Q7. Strongest oxidising power among the option is Mn_2O_3 because of E° value

(5) $E^\circ_{Mn^{+3}/Mn^{+2}} = +1.57\ V$

$Mn^{+3} \rightarrow d^4$ configuration

$\mu = \sqrt{24}BM$

$= 4.89BM$

$\Rightarrow 5$

Q8. $K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} K_2CrO_4 \xrightarrow[-H_2O]{H_2SO_4} K_2Cr_2O_7 + K_2SO_4$

(3)

[A]

[B]

Q9. $I^- \xrightarrow{OH} IO_3^-$

(4)

$S^{-2} \xrightarrow{H^+} S$

$S_2O_3^{2-} \xrightarrow{OH} SO_4^{2-}$

$Fe^{+2} \longrightarrow Fe^{+3}$

$S_2O_3^{2-} \xrightarrow{H^+} S \downarrow + SO_4^{2-}$

Q10. $As_2\ S_3$ and $As_2\ S_5$ are yellow colour sulphides, $(NH_4)_2\ S$ is colourless, PbS is black, CuS is black in colour

(2)

Q11. $FeCr_2O_4 + Na_2CO_3 + O_2 \rightarrow Na_2CrO_4 + Fe_2O_3 + CO_2$

(160) Insoluble product will be Fe_2O_3

molar mass $= 56 \times 2 + 16 \times 3$

$= 112 + 48$

$= 160$

Q12. $_{63}Eu^{2+} - [Xe]4f^7 6\ s^0$

(3) $_{64}Gd^{3+} - [Xe]4f^7 5\ d^0 6\ s^0$

$_{63}Eu^{3+} - [Xe]4f^6 6\ s^0$

$_{65}\ Tb^{3+} - [Xe]4f^8 6\ s^0$

$_{62}Sm^{2+} - [Xe]4f^6 6\ s^0$

$Eu^{2+} \& Gd^{3+}$

Q13. Tb^{4+} is strongest oxidising agent as it will reduce to Tb^{3+} (common O.S. of Ln)

(2)

Q14. Compound (A) in the given reaction sequence is likely to be CoS.

(1) $CoS + HNO_3 + 3HCl \rightarrow Co^{2+} + S \downarrow + NOCl \uparrow + 2Cl^- + 2H_2O$

The above solution is neutralised with NH_4OH.

To a neutral solution of Co^{2+}, acetic acid and saturated solution of KNO_2 are added which results in the formation of yellow precipitate of $K_3\left[Co(NO_2)_6\right]$

$Co^{2+} + 7NO_2^- + 2H^+ + 3\ K^+ \rightarrow K_3\left[Co(NO_2)_6\right] + NO \uparrow + H_2O$

Q1. $K_3\left[Fe(OH)_6\right]$

(4) $Fe^{3+} \Rightarrow 3\ d^5$

Fe^{3+} with OH^- (WFL)

$= t_{29}{}^3 e_g{}^2$

Number of unpaired electron (n) $= 5$

μ spin only $= 5.92BM$

$K_4\left[Fe(OH)_6\right]$

$Fe^{2+} \Rightarrow OH^-$ WFL

$Fe^{2+} \Rightarrow 3\ d^6 = t_{2\,g}^4 e_g^2$

$n = 4$

$\mu_{\text{spin only}} = 4.90BM$

Q2. $Fe^{+6} = [Ar] 3\ d^2$

(3) $Mn^{+3} = [Ar] 3\ d^4$

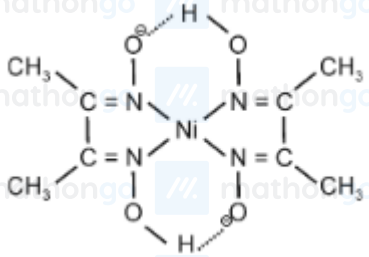
$Fe^{+3} = [Ar] 3\ d^5$

$Cr^{+2} = [Ar] 3\ d^4$

$Ni^{+4} = [Ar] 3\ d^6$

Q3. Ni^{2+} with(dmg) forms $[Ni(dmg)_2]^{2+}$ having 2 H -Bonds as shown:

(14) The no. of H atoms $= 14$



Q4. (A) $[FeO_4]^{2-} \Rightarrow Fe^{6+} = 3\ d^2$

(3) (B) $[Fe(CN)_8]^{3-} \Rightarrow Fe^{3+} = 3\ d^5$

(C) $[Fe(CN)_5NO]^{2-} \Rightarrow Fe^{2+} = 3\ d^6$

(D) $[CoCl4]^{2-} \Rightarrow Co^{2+} = 3\ d^7$

(E) $\left[Co(H_2O)_3\ F_3\right] \Rightarrow Co^{3+} = 3\ d^6$

(B) and (D) are homoleptic complex having odd no. of d electrons.

Q5. $Ma_3\ b_3$ type complexes show Facial - Meridional isomerism

(3) (i) $\left[Co(NH_3)_3Cl_3\right] \Rightarrow Ma_3\ b_3$

(ii) $\left[Co(NH_3)_4Cl_2\right]^+ \Rightarrow Ma_4\ b_2$

(iii) $[Co(en)_3]^{3+} \Rightarrow M(AA)_3$

(iv) $[Co(en)_2Cl_2]^+ \Rightarrow M(AA)_2\ b_2$

$a, b, = NH_3, Cl^-$

$AA = en$

Q6. $[NiCl_4]^{2-}$

(3) $Ni^{+2} - [Ar] 3\,d^8 4\,s^0 \rightarrow sp^3$, Tetrahedral

Number of unpaired electron $= 2$ paramagentic

$[Ni(CO)_4]$

$Ni(0) \rightarrow [Ar] 3\,d^{10} 4\,s^0$ (After rearrangement)

No unpaired electron

sp^3, Tetrahedral, Diamagnetic

Q7. (A) $[Fe(CN)_5NO]^{-2} \rightarrow$ Heteroleptic, $Fe^{+2}, 3\,d^6, t_{2\,g}{}^6 e_g{}^0,\ d^2sp^3$, Low spin (3 d series +SFL)

(2) (B) $[CoF_6]^{-3} \rightarrow$ Homoleptic, $sp^3\,d^2$, High spin, $Co^{+3}, 3\,d^6$(3 d series + WFL)

(C) $[Fe(CN)_6]^{-4} \rightarrow$ Homoleptic

$Fe^{+2}, 3\,d^6,\ d^2sp^3, t_{2\,g}{}^6 eg^0$ Low spin

(3 d series +SFL)

(D) $\left[Co(NH_3)_6\right]^{+3} \rightarrow$ Homoleptic, $Co^{+3} 3\,d^6,\ d^2sp^3$,

$t_{2\,g}{}^6 eg^0$, Low spin (3d series + SFL)

(E) $\left[Cr(H_2O)_6\right]^{+2} \rightarrow$ Homoleptic

$Cr^{+2} 3\,d^4,\ d^2sp^3$, High spin $t_{2\,g}{}^3 e_g{}^1$

(3d series + WFL)

Q8. $\left[Co(NH_3)_5Cl\right] Cl_2 \rightarrow \underbrace{\left[Co(NH_3)_5Cl\right]^{2+}(\text{ aq. }) + 2Cl^-(\text{aq. })}_{\text{3 ions in water}}$

(3)

$$\left[Co(NH_3)_5Cl\right] Cl_2(\text{ aq. }) + 2AgNO_3(\text{ aq. }) \rightarrow \left[Co(NH_3)_5Cl\right](NO_3)_2(\text{ aq. }) + 2AgCl(s)$$

Q9. $Sc^{+3} = 3\,d^o \quad \therefore \mu_{spin} = 0$

(1) $V^{+2} = 3\,d^3 \quad \therefore \mu_{spin} = 3.87\ B \cdot M.$

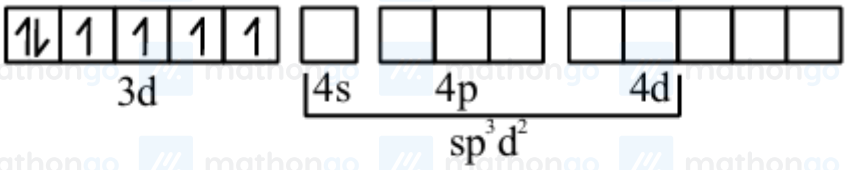
$Ni^{+2} = 3\,d^8 \quad \therefore \mu_{spin} = 2.84\ B \cdot M.$

$Ti^{+3} = 3\,d^1 \quad \therefore \mu_{spin} = 1.73\ B.M.$

Q10. (A) $[CoF_6]^{-3}$

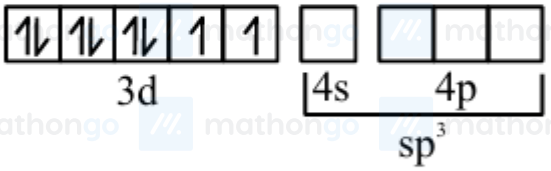
(4)

$Co^{3+} \rightarrow 3d^6$



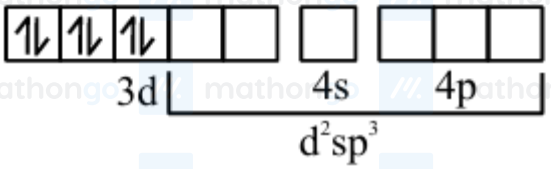
(B) $[NiCl_4]^{2-}$

$Ni^{2+} \rightarrow 3d^8$



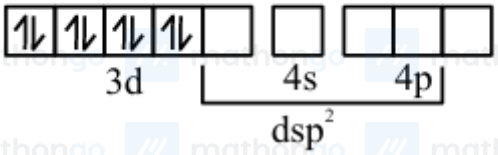
(C) $[Co(NH_3)_6]^{3+}$

$Co^{3+} \rightarrow 3d^6$



(D) $[Ni\ (CN)_4]^{2-}$

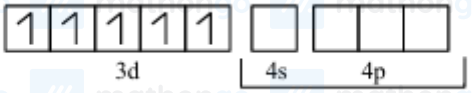
$Ni^{2+} \rightarrow 3d^8$



Q11. (A) $[\mathbf{MnBr_4}]^{2-}$

(1) $Mn^{+2} \Rightarrow [Ar]3\ d^5$

In presence of ligand field

$\Rightarrow$ [Ar] 

$\Rightarrow sp^3$ hybridization, paramagnetic in nature

(B) $[FeF_6]^{3-}$

$Fe^{+3} \Rightarrow [Ar]3\ d^5$

$\Rightarrow$ [Ar] 

In presence of ligand field

$\Rightarrow sp^3\, d^2$ hybridization, paramagnetic in nature

(C) $\left[Co(C_2O_4)_3\right]^{3-}$

$Co^{+3} \Rightarrow [Ar]3\, d^6$

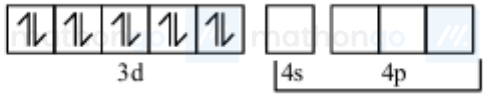
$\Rightarrow$ [Ar] 

In presence of ligand field

$\Rightarrow d^2sp^3$ hybridization, diamagnetic in nature

(D) $[Ni(CO)_4]$

$Ni^0 \Rightarrow [Ar]3\, d^8 4\, s^2$

$\Rightarrow$ [Ar] 

In presence of ligand field

$\Rightarrow sp^3$ hybridization, diamagnetic in nature

Q12. $K_3\left[Co(NO_2)_6\right] =$ Yellow $\Rightarrow Co^{3+} = 3\, d^6 \Rightarrow t_{2g}^6 e_g^0$

(0) $K_4[Fe(CN)_6] =$ Yellow $\Rightarrow Fe^{2+} = 3\, d^6 \Rightarrow t_{2g}^6 e_g^0$

$K_3[Fe(CN)_6] =$ Bright Red $\Rightarrow Fe^{3+} = 3\, d^5 \Rightarrow t_{2g}^5 e_g^0$

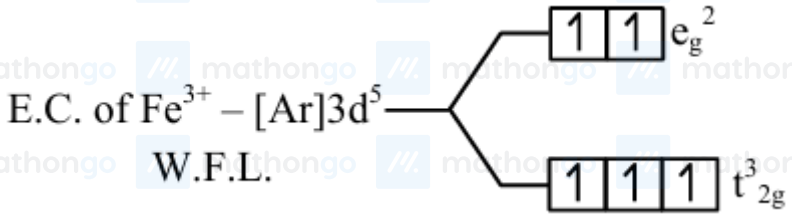
$Cu_2[Fe(CN)_6] =$ Chocolate brown

$Zn_2[Fe(CN)_6] =$ White

Spin only magnetic moment of complex having Yellow colour is zero.

Q13. For complex $K_3[Fe(SCN)_6]$

(4)



Calculation of CFSE

$= (-0.4 \times 3 + 0.6 \times 2)\Delta_0$

$= 0\Delta_0$

Q14. Crystal field splitting energy $(\Delta) \propto$ charge or oxidation state of central metal atom.

(4) Crystal field splitting energy $(\Delta) \propto$ Field strength of ligand (and chelation)

Crystal field stabilisation energy (CFSE) $= \left[-0.4 t_{g_g} + 0.6\ eg\right] \Delta_\circ$ (for octahedral)

For,

$[Co(en)_3]^{3+} : Co^{3+} : t_{2\,g}^6 eg^0; CFSE = -2.4(\Delta_0)_1$

$[Co(NH_3)_6]^{3+} : Co^{3+} : t_{2\,g}^6 eg^0; CFSE = -2.4(\Delta_0)_2$

$[Co(NH_3)_6]^{2+} : Co^{2+} : t_{2g}^5 eg^2; CFSE = -0.8(\Delta_0)_3$

$[Co(NH_3)_4]^{2+} : Co^{2+} : e^4 t_2^3; CFSE = -1.2\Delta_t$

$\left(as : (\Delta_t) = \frac{4}{9}(\Delta_0)_3\right)$

$\because \quad \Delta_t < (\Delta_0)_3 < (\Delta_0)_2 < (\Delta_0)_1$

Q15. Co^{2+} complex having $\mu = 3.95BM$

(3) Hence number of unpaired electron $= 3$

$Co^{2+} \Rightarrow 3d^7 = t_{2\,g}^5 e_g^2$

Q16. The conditions and consequence that favour $t_{2g}^3 e_g^1$ configuration in a metal complex are

(2) (i) weak field ligand, and

(ii) high spin complex

For weak field ligands, splitting energy (Δ_0) is lower than pairing energy (P). As a result distribution of electrons for 3 d^4 will be $t_{2\,g}^3 e_g^1$. It results in high spin complex due to maximum number of unpaired electrons.

Q17. Neglecting pairing energy

(2) I. $[Mn(CN)B]^{3-} \Rightarrow Mn^{3+}, t_2\ g^4, CFSE = -0.4 \times 4\Delta o = -1.6\Delta$ 。

II. $[Co(CN)8]^{4-} \Rightarrow Co^{2+}, t_2{}^6 eg^1, CFSE = -0.4 \times 6 + 0.6 \times 1 = -1.8\Delta$。

III. $[Fe(CN)_8]^{4-} \Rightarrow Fe^{2+}, t_{2g}{}^6 e^0, CFSE = -0.4 \times 6 = -2.4\Delta_0$

IV. $[Fe(CN)_8]^{3-} \Rightarrow Fe^{3+}, t_{2g}{}^5 e^0, CFSE = -0.4 \times 5 = -2\Delta_0$

Order of stability III > IV > II > I

Q18. $\Delta T_f = iK_f m$

(1) $0.558 = i \times 1.86 \times 0.1$

$i = \frac{0.558}{0.186} = 3$

Number of ions when 100\% ionisation takes place $= 3$

$[Cr(NH_3)_5Cl]\,Cl_2 \xrightarrow{\text{aqueous solution}} \left[Cr(NH_3)_5Cl^{2+}\right]^{2+} + 2Cl^-$

Number of ions $= 3$

Q19. $[Ni(H_2O)_6]^{+2}_{(aq)} + en_{(aq)} \rightarrow [Ni(H_2O)_4(en)]^{+2}_{(aq)} + 2H_2O$

(3) Green

$[Ni(H_2O)_4(en)]^{+2}_{(aq)} + en_{(aq)} \rightarrow [Ni(H_2O)_2(en)_2]^{+2}_{(aq)} + 2H_2O$

Pale Blue

$[Ni(H_2O)_2(en)]^{+2}_{(aq)} + en_{(aq)} \rightarrow [Ni(en)_3]^{+2}_{(aq)} + 2H_2O$

Blue / purple

Q1. Ni^{2+} gives violet colour with borax bead test in nonluminous flame under hot conditions. Ni^{2+} has d^8

(3) configuration which does not depend on nature of ligand present in octahedral field.

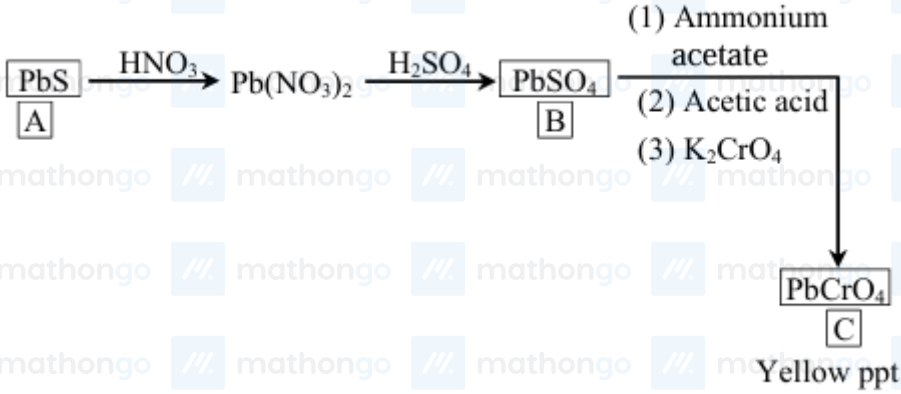
$Ni^{2+} \Rightarrow t_{2g}^6 eg^2$

Q2. Only $Cu^{2+}, Fe^{3+}, Ca^{2+}$ & Zn^{2+} form precipitate with $K_4[Fe(CN)_6]$

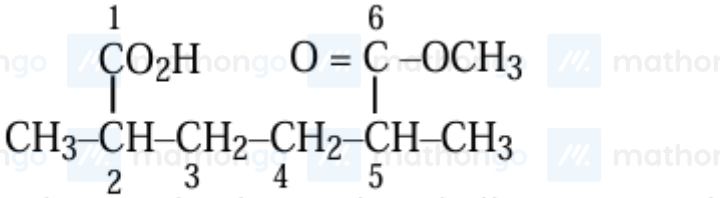
(4)

Q3.

(4)

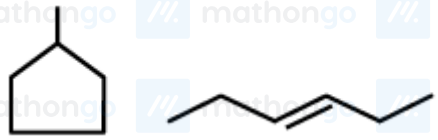


Q1.
(3)

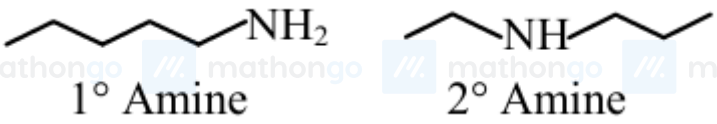


6-Methoxycarbonly-2,5-dimethylhexanoic acid

Q2. Statement-I → True
(2)



Both are ring chain isomers



1° Amine 2° Amine

Statement-II → True

1° Amine and 2° Amine are different functional groups, hence both are functional group isomers.

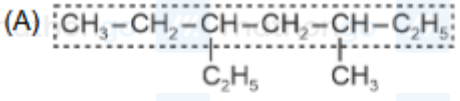
Q3. Phase transfer from solid to vapour directly is known as sublimation.
(3)

Q4. Statement *I* is true.
(1) In partition chromatography, stationary phase is thin liquid film present in the inert support.

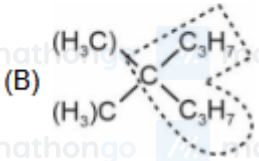
Statement II is false.
Because stationary phase in paper chromatography is water.

Q5. In Dumas method nitrogen present in organic compound is converted into N_2 gas whose volumetric analysis
(1) gives the percentage of nitrogen atom in the organic compound.

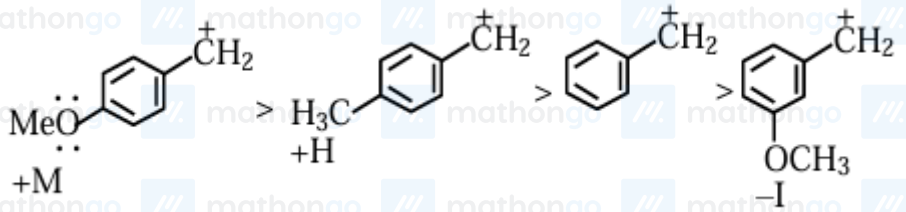
Q6.
(1)

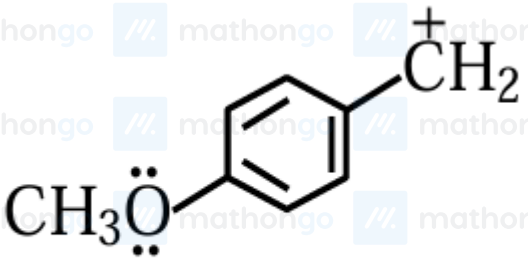


3-Ethyl-5-methylheptane



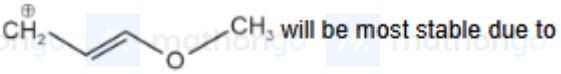
Q7.
(3)





Due to +M effect of -OMe at para position
Will be most stable among these

Q8.
(2)

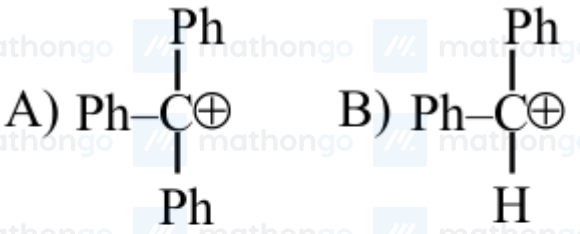
Sol.  will be most stable due to extended conjugation

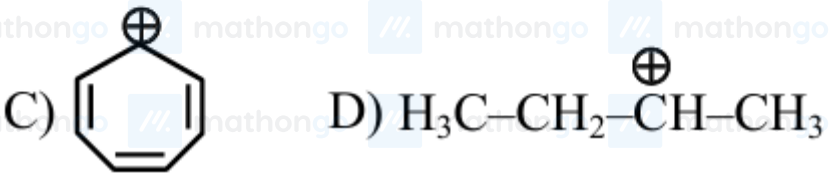
(3) will be less stable due to –M of 

Q9.
(4)

$-OCH_3$, $NHCOCH_3$ and -OH are activating groups because the atom directly bonded to benzene ring activates the ring by +R effect using its lone pair of electrons. Activating groups are ortho- and para directing groups. -CN and $-SO_3H$ are deactivating groups because the atom directly bonded to benzene is bonded to more electronegative atom through multiple bonds and they are meta directing groups due to -R effect. Halides are deactivating groups due to -I effect.

Q10.
(4)





C is aromatic due to ⊕ve charge hence it is most stable
A have more resonance structure
B have less resonance structure

D have only hyper conjugation

Consider First Aromaticity > Resonance > Hyper conjugation

Ans. D < B < A < C

Q11. q is aromatic

(1) r is non-aromatic

p is antiaromatic

q > r > p (order of stability)

Aromatic > non-aromatic > antiaromatic

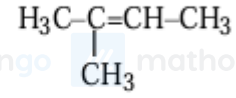
Q12. Total five nucleophiles are present

(4) $NH_3, PhSH, (H_3C)_2S, CH_2=CH_2, \overset{\ominus}{O}H$

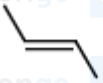
Q13. (A) $CH_3-CH=CH_2$. GI is not possible

(2) (B) Trans isomer has identical atoms/groups on the opposite side of double bond.

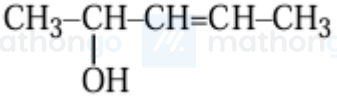
(C)  > (dipole moment only)

(D)  (does not show GI)

2-methylbut-2-ene

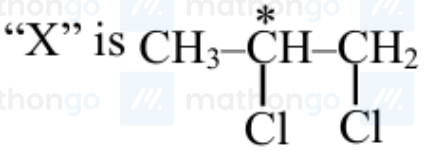
(E)  >  (Melting point)

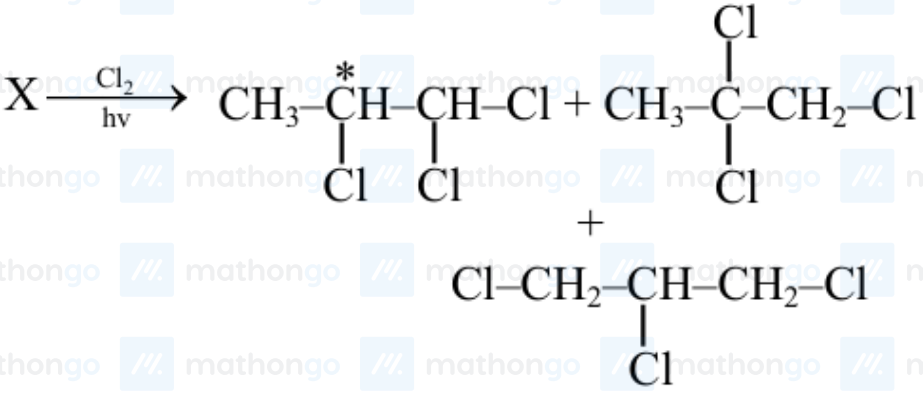
Q14.

(3) 

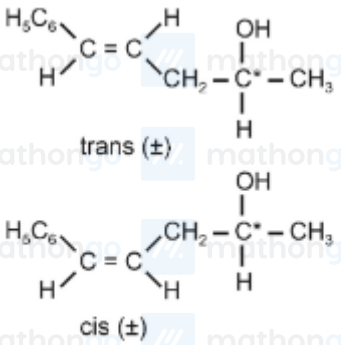
It has 4 stereoisomers $\begin{bmatrix} R\text{ cis} & \text{R trans} \\ \text{Scis} & \text{Strans} \end{bmatrix}$

Q15.
(4)

"X" is 

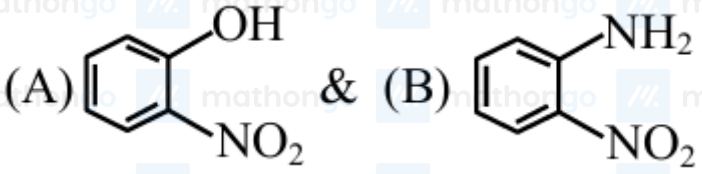


Q16. The given compound is 5-phenylpent-4-en-2-ol. Possible stereoisomers are
(4)



∴ 4 possible stereoisomers

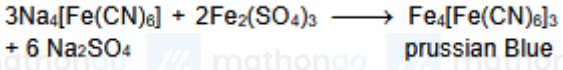
Q17.
(4)



are steam volatile due to intramolecular hydrogen bonding.

Q18. The elements present in the compound are converted from covalent form into ionic form by fusing the compound with sodium in Lassigne's test
(4)

Q19. Lassaigne's test is a general test for detection of halogen, nitrogen and sulphur in an organic compound. These elements covalently bonded to the organic compounds, In order to detect them, these have to converted into ionic forms.
(1)



Q20. **(20)**

$$n_{Cl} = n_{AgCl} = \frac{143.5 \times 10^{-3}}{143.5} = 10^{-3}$$

$$\%Cl = \frac{10^{-3} \times 35.5}{180 \times 10^{-3}} \times 100 = 19.72$$

Q21. **(40)**

$$\text{m mole of } BaSO_4 = \text{ mmoles of S} = \frac{466}{233}$$

$$\text{Mass of S} = \frac{466}{233} \times 32\text{mg}$$

$$= 64\text{mg}$$

$$\% \text{ S} = \frac{64}{160} \times 100 = 40\%$$

Q22. **(255)** Mass of organic compound $= 0.25$ g

Mass of AgBr $= 0.15$ g

$$\text{No. of moles of Br} = \text{No. of moles of AgBr} = \frac{0.15}{188}$$

$$\text{Mass of Br} = \frac{0.15 \times 80}{188} \text{ g}$$

$$\% \text{ of Br} = \frac{0.15 \times 80 \times 100}{188 \times 0.25}$$

$$= 25.5\%$$

$$= 255 \times 10^{-1}\%$$

Q23. **(275)**

$$\text{Organic Compound} \longrightarrow BaSO_4$$

0.20gm $\quad$ 0.40gm

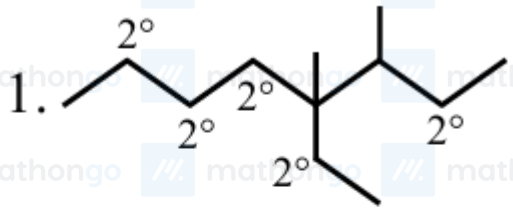
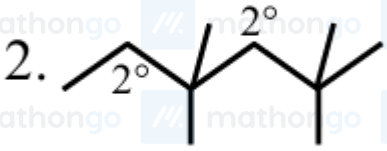
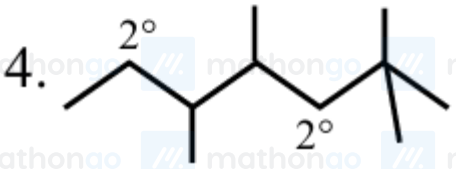
$\frac{0.40}{233}$ mol $(BaSO_4)$

$\frac{0.40}{233}$ mol (Sulphur)

$\frac{0.40}{233} \times 32$gm (sulphur)

$$\% \text{ S} = \frac{\frac{0.40 \times 32}{233} \times 100}{0.20} = 27.5\% \text{ or } 275 \times 10^{-1}\%$$

Q1.
(2)

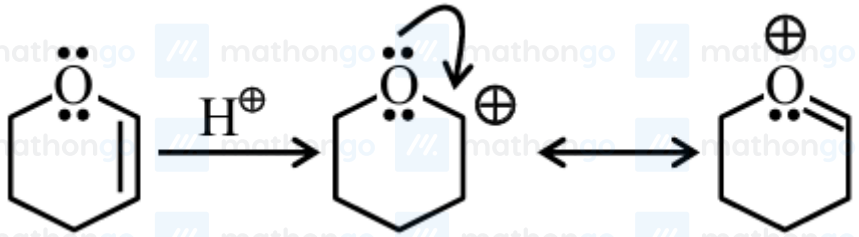
Alkane	2°H
1. 	10
2. 	4
3. 	2
4. 	4

Q2.
(4)

	LIST-I Name reaction		LIST-II Product obtainable
A.	Swarts reaction	I.	$Et-\underset{DF}{IKF}Et-F$
B.	Sandmeyer's reaction	II.	$PhN_2^{\oplus}Cl^- \xrightarrow[CuCN/KCN]{PhCN+N_2}$
C.	Wurtz Fittig reaction	III.	$Ph-Cl+EtCl \xrightarrow[ether]{Na}$ $Ph-Et+Ph-Ph+Et-Et$
D.	Finkelstein reaction	IV.	$Et-Cl \xrightarrow[actone]{NaI} Et-I+NaCl$

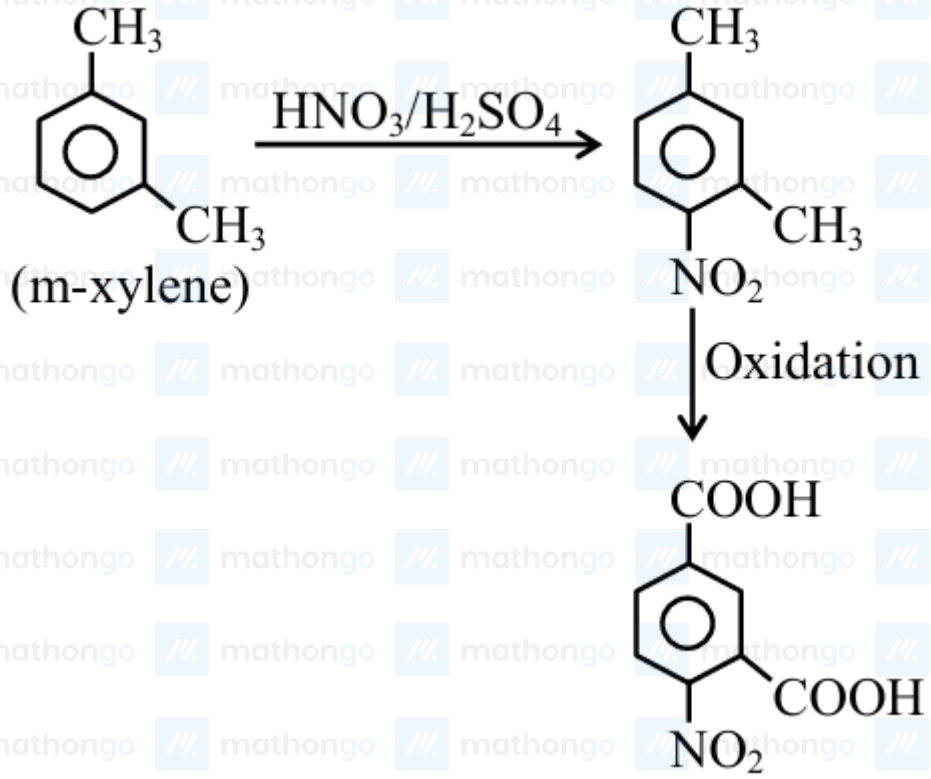
Q3. Addition of $H-Br_{(aq)}$ to alkene follows electrophilic addition mechanism. In the rate determining step a
(3) carbocation intermediate is formed. Among P, Q, R \& S compound Q will form most stable carbocation

intermediate since it is resonance stabilized.



Q4. Statement - I

(4)



Statement-II $-CH_3$ group is o/p directing while $-NO_2$ group is meta directing.

Q5. $CH_3 - C \equiv CH + Na \rightarrow CH_3 - C \equiv C^-Na^+ + \frac{1}{2}H_2$

(3) Statement-l is correct.

Moles of $C_3H_4 = \frac{4}{40} = 0.1$ mole

$CH_3 - C \equiv CH + NaNH_2 \rightarrow CH_3 - C \equiv C^-Na^+ + NH_3$

0.1 mole

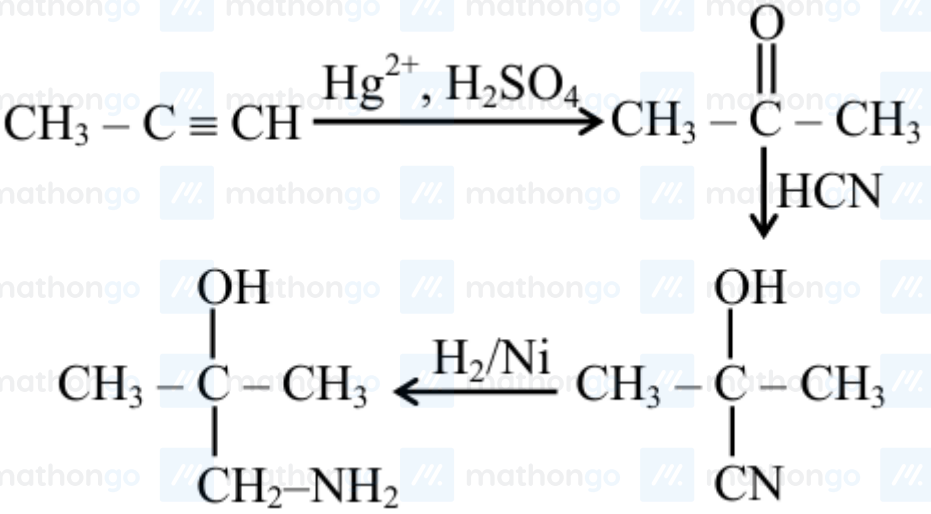
0.1 mole

Volume of $NH_3 = (0.1)(22.4) = 2.24$ L

Statement-II is incorrect.

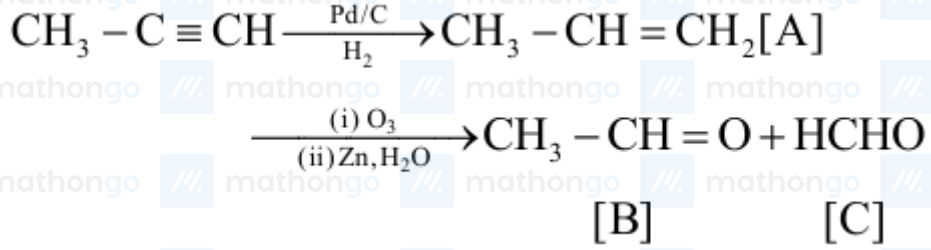
Q6.

(2)


CH3 – C ≡ CH
Hg2+, H2SO4
CH3 – C – CH3
O
HCN
OH
CH3 – C – CH3
CH2–NH2
H2/Ni
OH
CH3 – C – CH3
CN

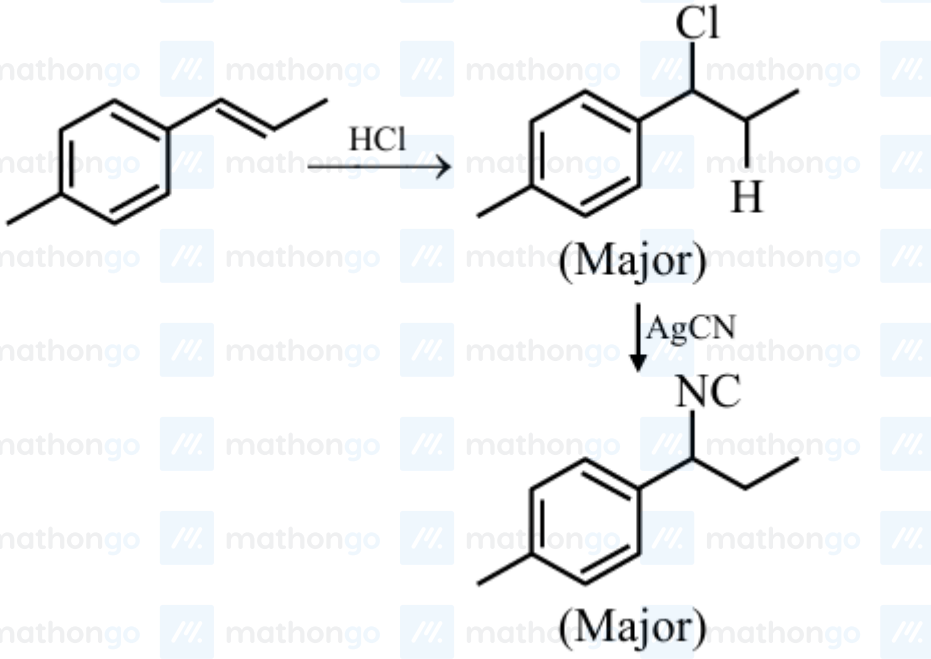
Q7.

(3)


CH3 – C ≡ CH
Pd/C
H2
CH3 – CH = CH2 [A]
(i) O3
(ii) Zn, H2O
CH3 – CH = O + HCHO
[B]
[C]

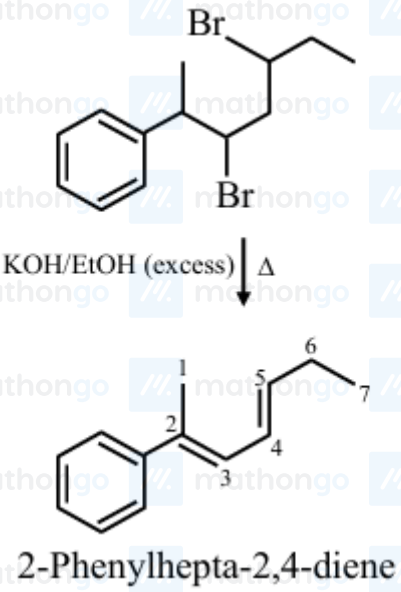
Q8.

(4)


HCl
Cl
H
(Major)
AgCN
NC
(Major)

Q9.

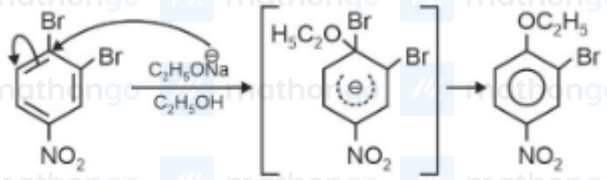
(4)



2-Phenylhepta-2,4-diene

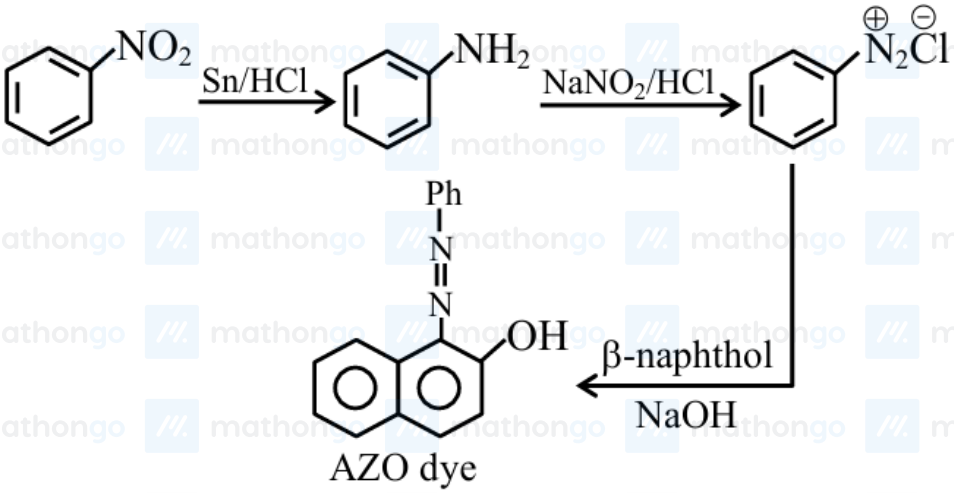
Q10. Br at the para of NO_2 will undergo aromatic nucleophilic substitution by nucleophile C_2H_5ONa.

(4)



Q11.

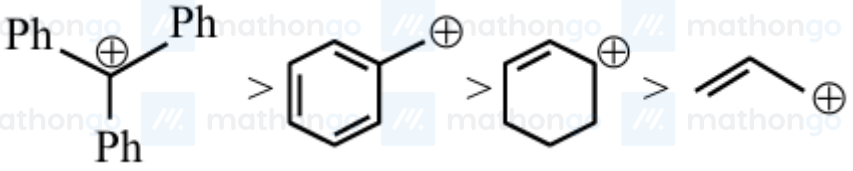
(1)



AZO dye

Q12. Stability order of carbocation

(3)

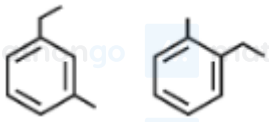


Q13. **(2)**

Degree of unsaturation $= \mathrm{C} + 1 - \frac{\mathrm{H}}{2}$

$= 9 + 1 - 6 = 4$

Benzene shows negative Baeyer's test



Both compounds have four different non-aliphatic substitution sites.

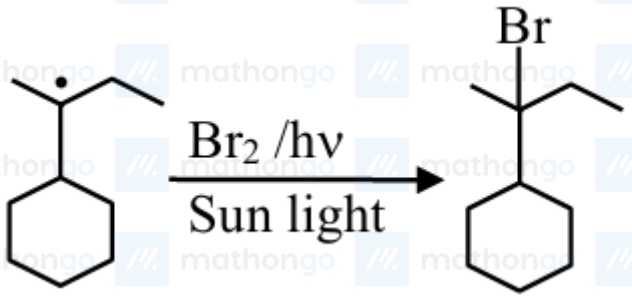
Q1. Both statement-I and statement-II are correct

(2) Statement - I: $CH_3 - O - \overset{\oplus}{C}H_2$ is highly stable carbocation.

Statement - II: Due to hindrance, S_N2 will not take place easily.

Q2.

(3)



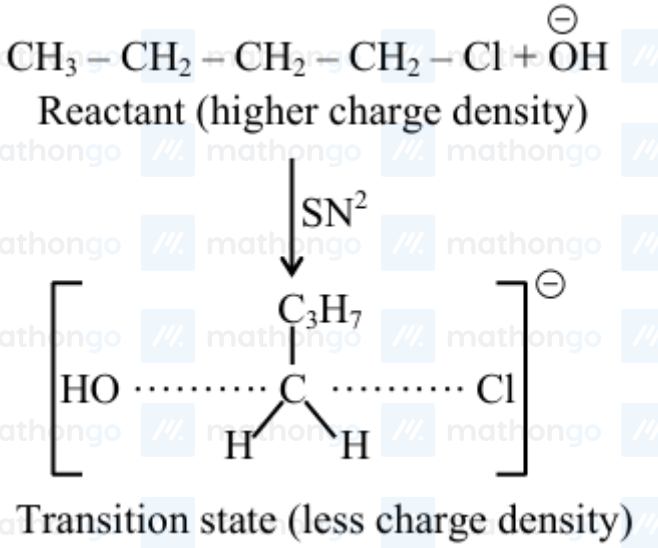
Formation of more stable free radical intermediate

Q3. Since 4 moles of H_2 is being added for complete hydrogenation the degree of unsaturation $= 4$

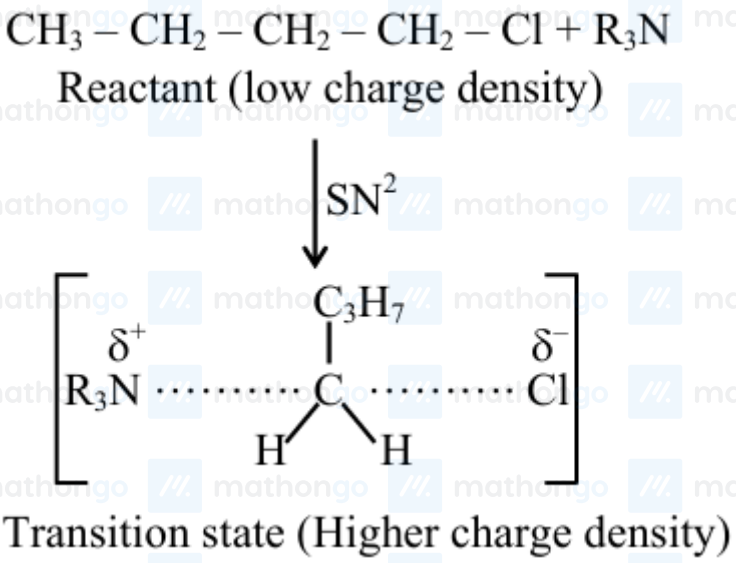
(8) No. of π electrons in $C_6H_6 = 4 \times 2 = 8$

Q4.

(1)

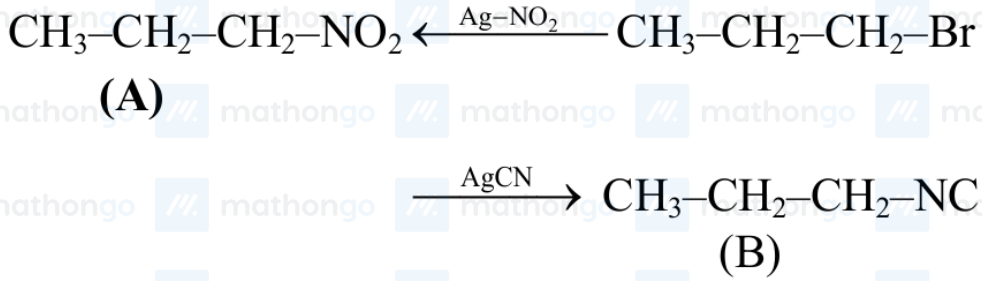


$\Rightarrow$ This reaction will proceed faster in less polar medium which will not increase the activation energy value.

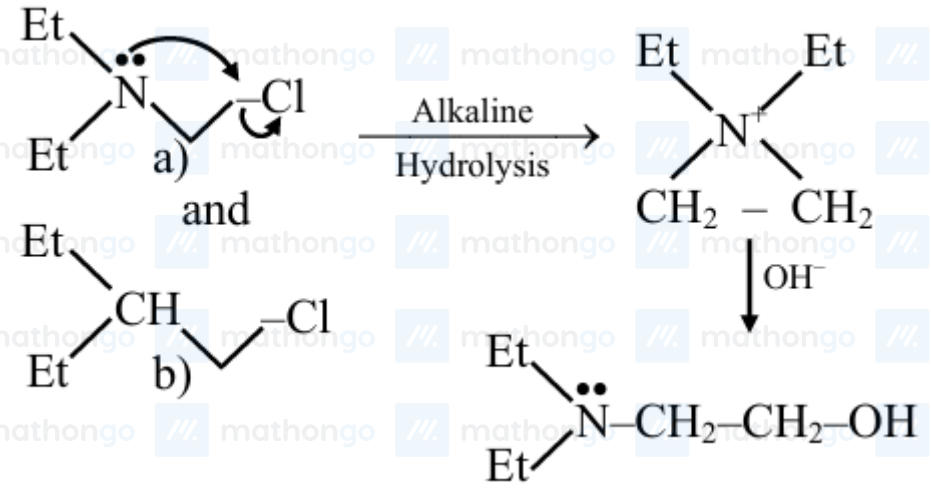


⇒ This reaction will proceed faster in more polar medium which will decrease the activation energy value.

Q5.
(4)

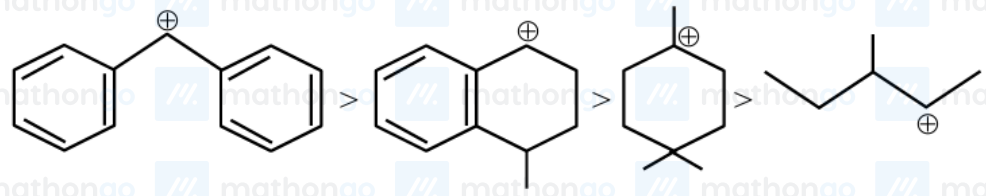


Q6.
(3)



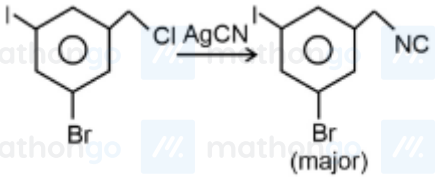
Rate of (a) is faster than rate of (b) because it is a intramolecular substitution.

Q7. Solvolysis or $S_N1 \propto$ stability of carboccation Stability order
(2)



Q8. Haloalkanes react with AgCN to give isocyanide as major product and haloarenes do not react with AgCN.

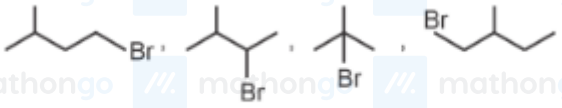
(3)



Q9. $RBr \xrightarrow[\text{dry Ether}]{Mg} RMgBr \xrightarrow{H_2O} R-H$

(2)

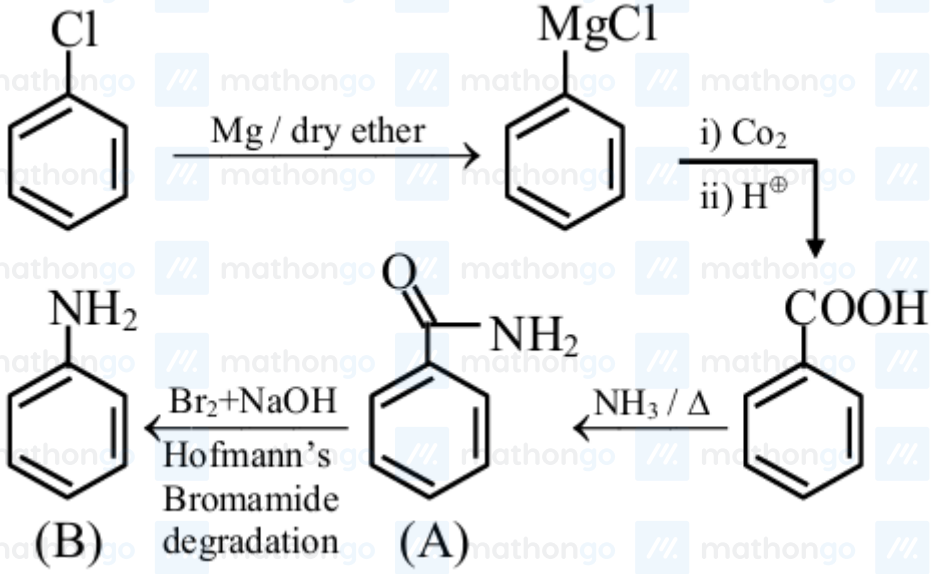
Hence, RBr Can be

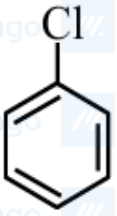
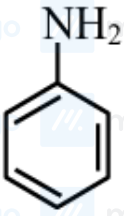


Total 4 Structural isomers.

Q10.

(93)



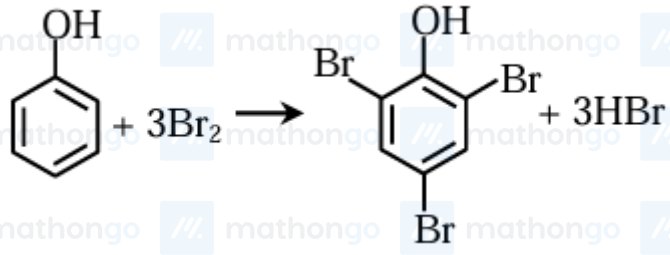
No. of moles of  = No. of moles of 

$$\frac{11.25 \times 10^{-3}}{112.5} = \frac{x \times 10^{-1} \times 10^{-3}}{93}$$

$$x \times 10^{-1} = 93 \times 0.1$$

$$x = 93\text{mg}$$

Q1.
(4)



$$\text{Moles of phenol } = \frac{2}{94} = 0.021$$

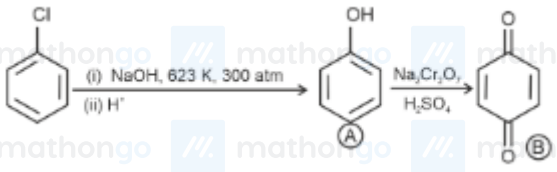
$$\therefore \text{ Moles of bromine } = 0.021 \times 3 = 0.064$$

$$\therefore \text{ Mass of bromine } = 0.064 \times 160 = 10.22 \text{ g}$$

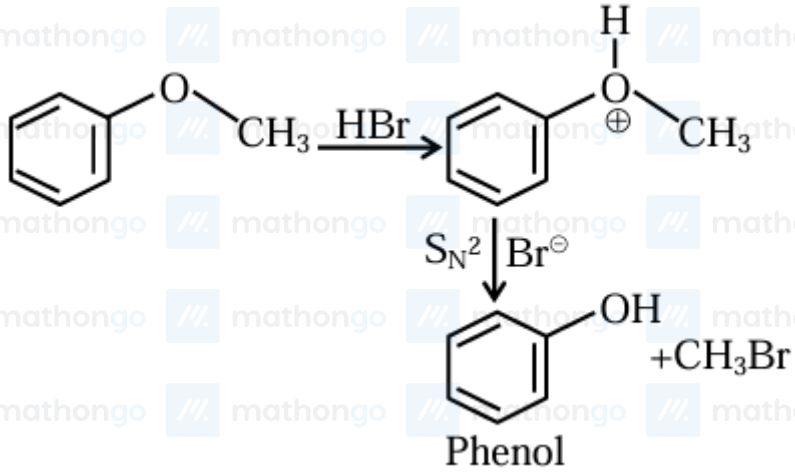
Q2. Statement I is correct as boiling point of alcohol phenols increase with increase in the number of C -atoms due to
(2) increase in van der Waals forces.

Statement II is correct, since alcohols phenols have intermolecular H -bonding therefore their boiling points are higher in comparison to other class of compounds such as ethers, haloalkanes.

Q3.
(2)

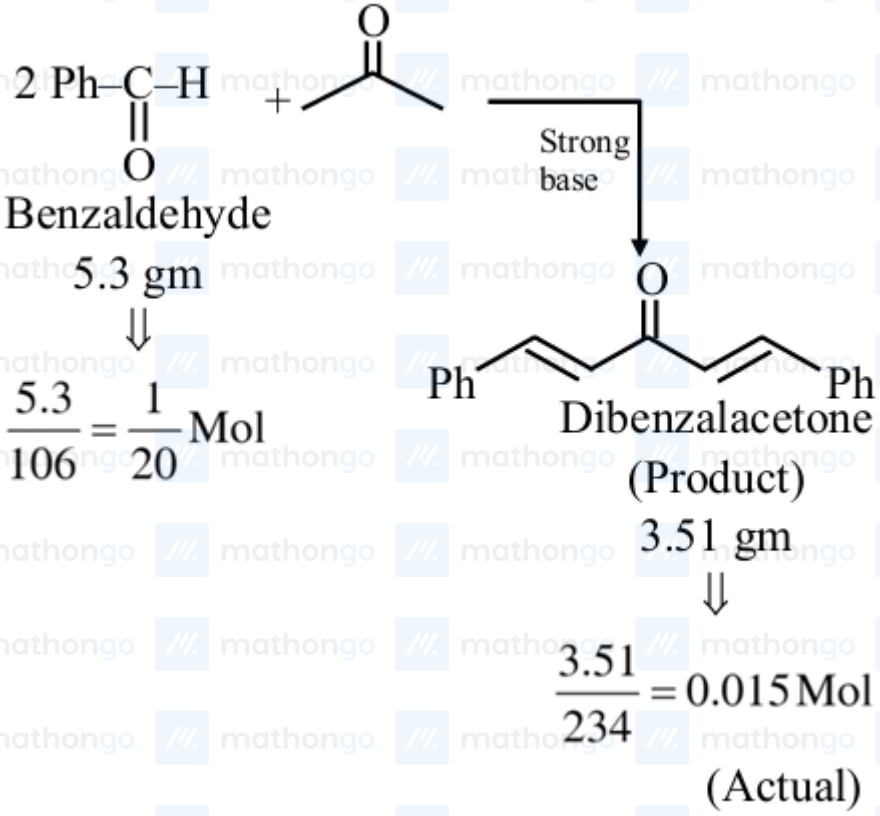


Q4.
(3)



Q5.

(60)



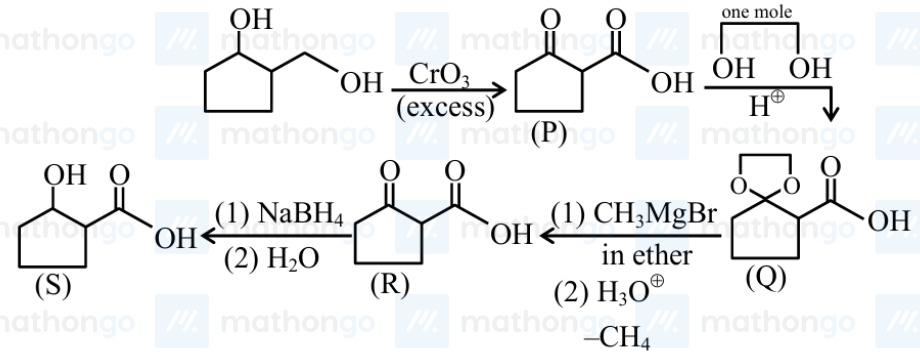
$$\text{Theoretical } = \frac{1}{40}\text{Mol}$$

$$\% \text{ yield } = \frac{0.015}{1/40} \times 100$$

$$\Rightarrow 60\%$$

Q6.

(13)



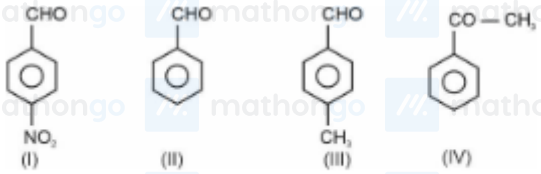
0.1 mole of compound (S) weight in gm

$= 0.1 \times$ molar mass of compound (S)

$= 0.1 \times 130 = 13\text{gm}$

Q1. Reactivity $\propto$ +ve charge on electrophilic carbon

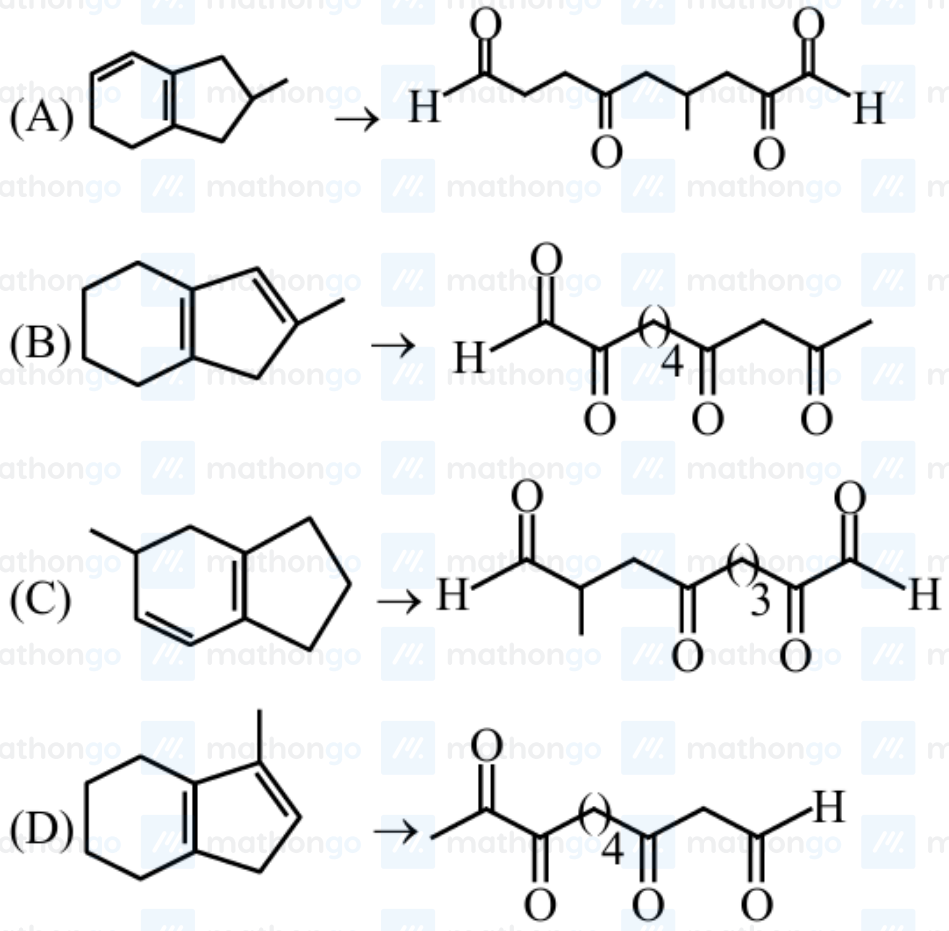
(4)



Correct order I > II >III > IV

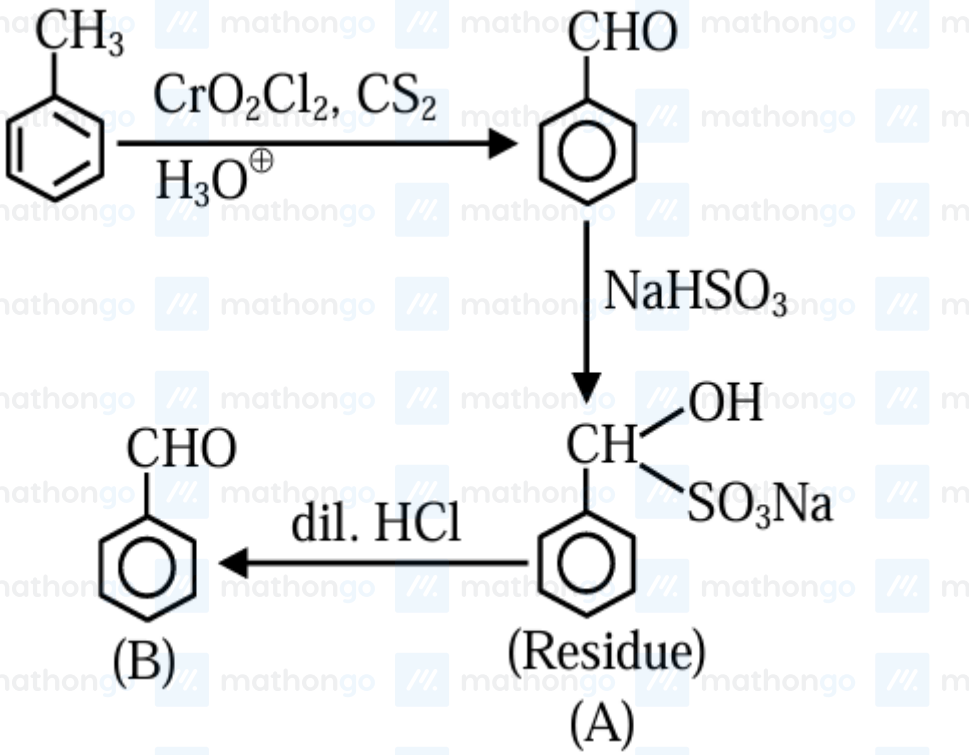
Q2. Ozonolysis product

(3)



Q3.

(4)

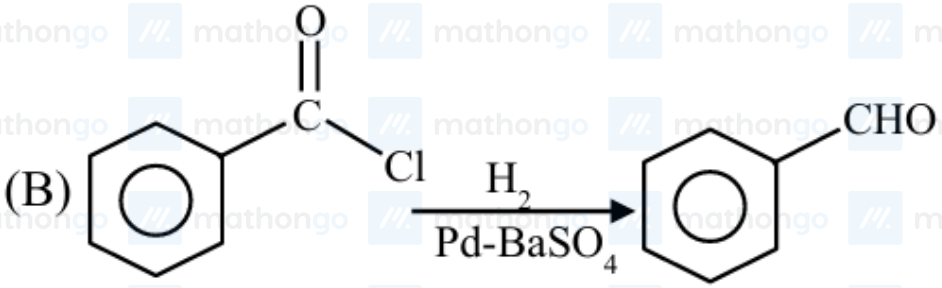


Q4.

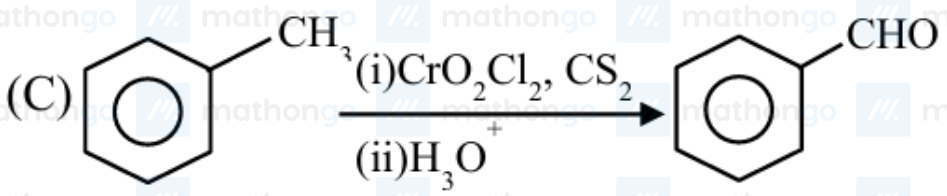
(4)

(A) $RCN \xrightarrow[(i)\ H_3O^+]{(i)\ SnCl_2,HCl} RCHO$

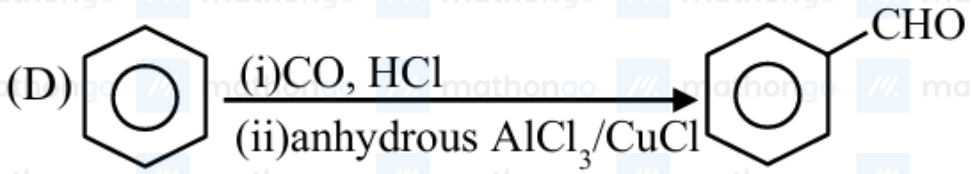
Stephen reaction



Rosenmund reduction



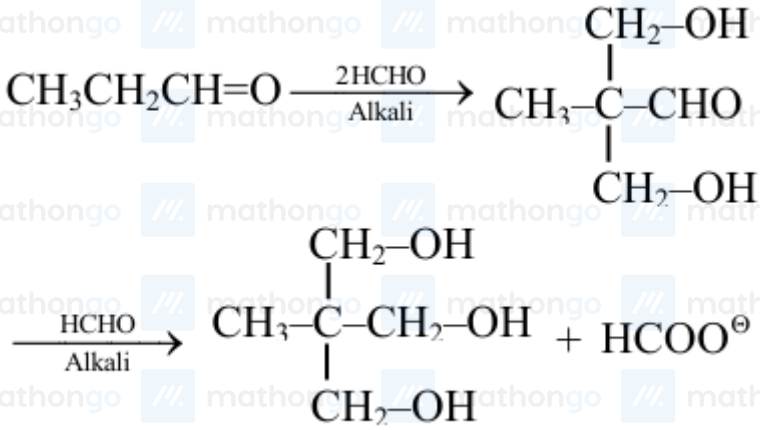
Etard reaction



Gatterman –Koch reaction

Q5. This is an example of Tollen's reaction i.e. multiple cross aldol followed by cross Cannizaro reaction

(1)



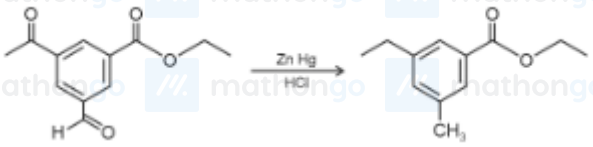
Q6.

(3)

	Name of Reaction	Acetaldehyde	Acetone
A.	Iodoform reaction	✓	✓
B.	Cannizaro reaction	×	×
C.	Aldol reaction	✓	✓
D.	Tollen's test	✓	×
E.	Clemmensen reduction	✓	✓

Q7. It is Clemmensen reduction, it will not reduce ester,

(1)



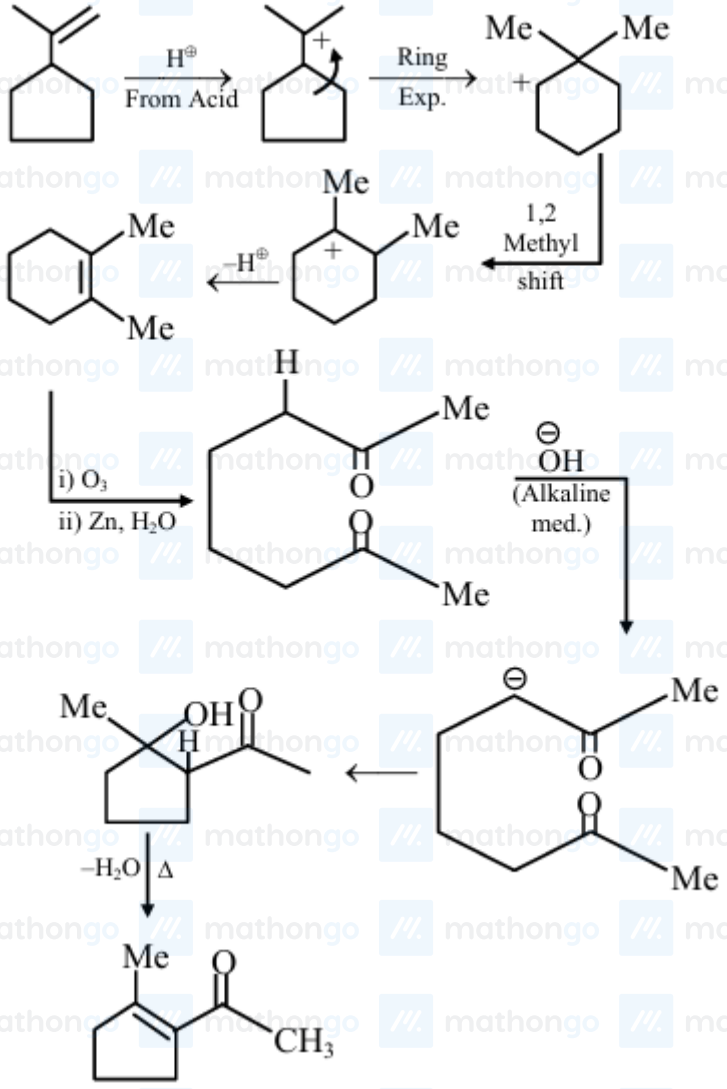
Ester cannot be reduced by clemmensen reduction

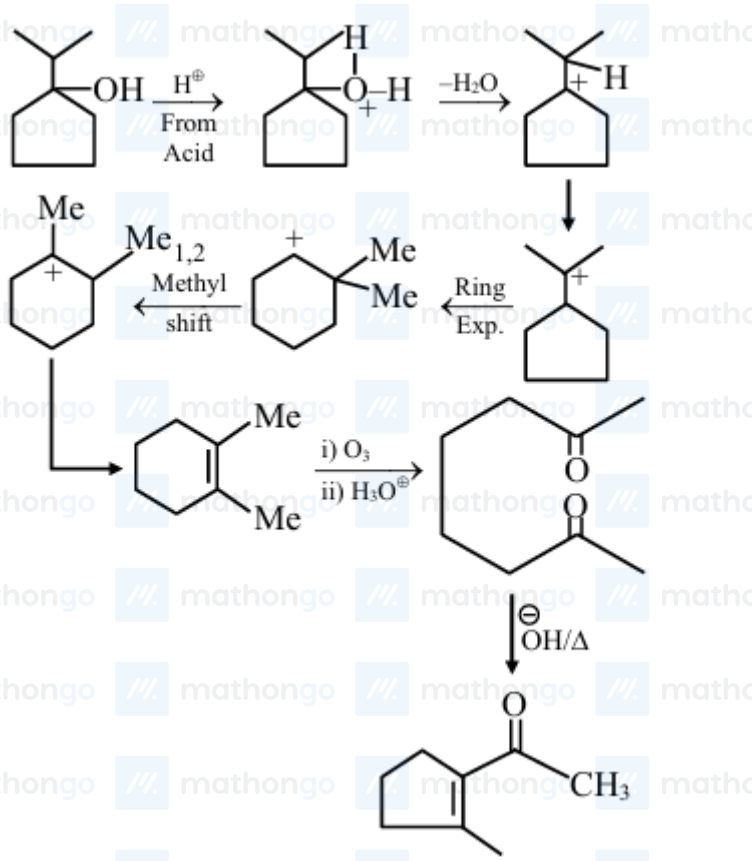
Q8. 

(2) Aliphatic aldehyde, α-hydroxy ketone givens fehlings solution test

Q9.

(4)


H⊕
From Acid
Ring
Exp.
Me
Me
1,2
Methyl
shift
–H⊕
i) O3
ii) Zn, H2O
OH
(Alkaline
med.)
–H2O
Δ
CH3



or

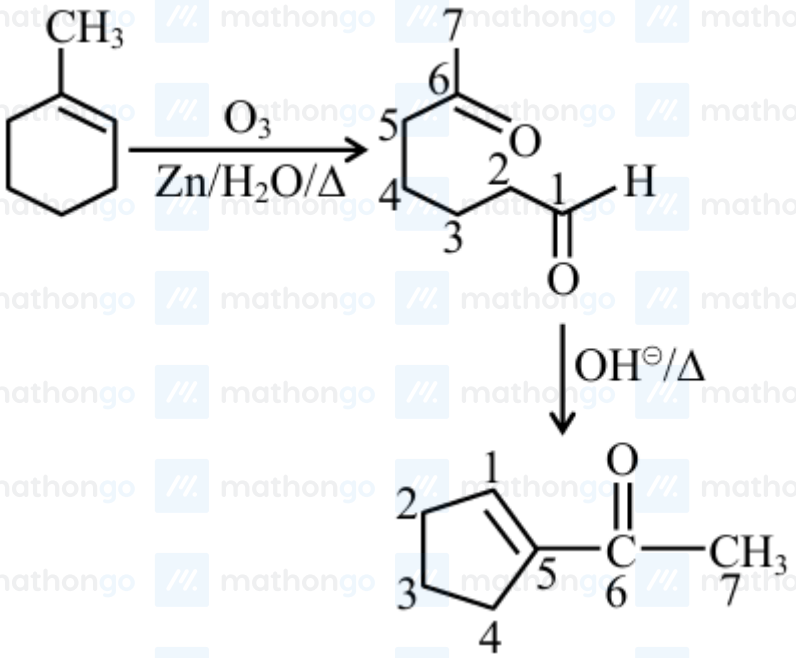
Q10. $k_{eq} = 2280$ is for HCHO

(4) $k_{eq} = 2000$ is for chloral

Both data is given in clayden and warren book. $k_{eq} > 1$ because HCHO and chloral are more electrophilic.

Q11.

(3)

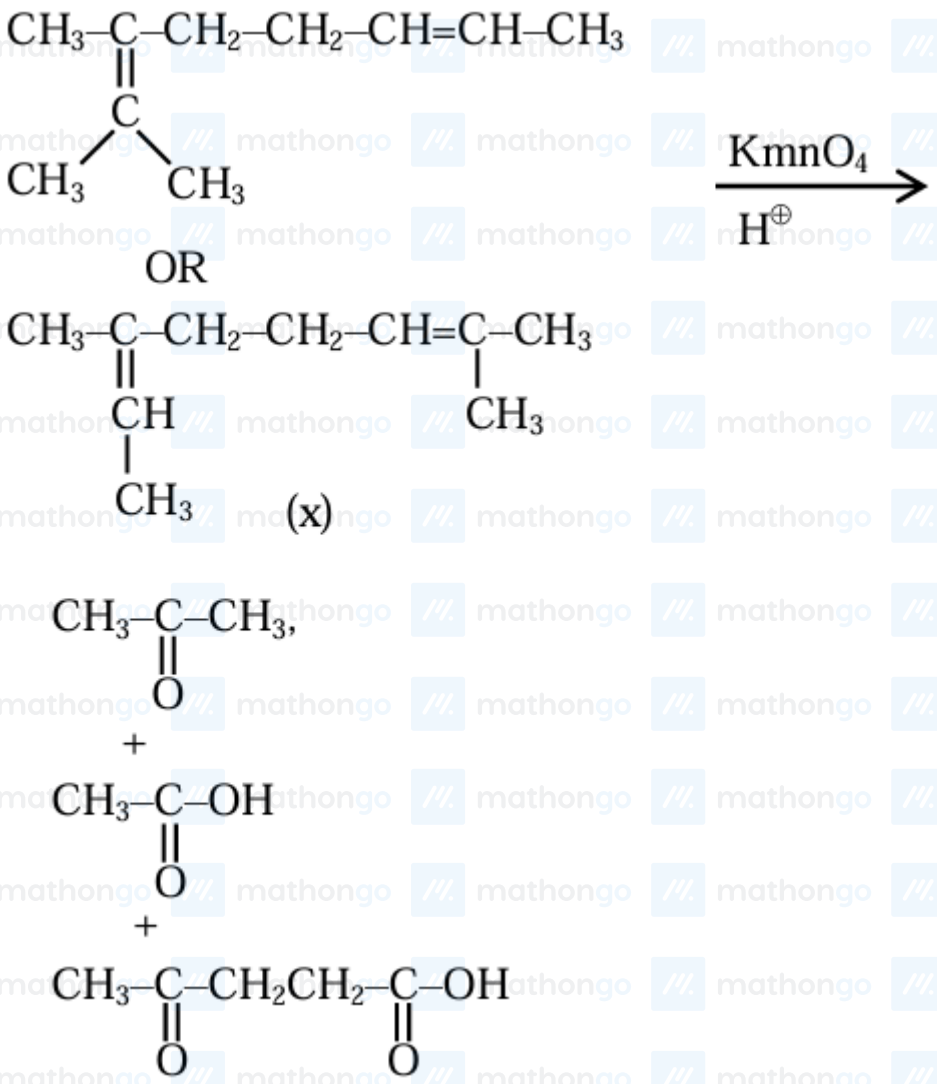


Q1. A, C, D produce CO_2 with aqueous $NaHCO_3$ solution.

(1) A, C, D acids are stronger acid than H_2CO_3 (Carbonic acid)

Q2.

(27)

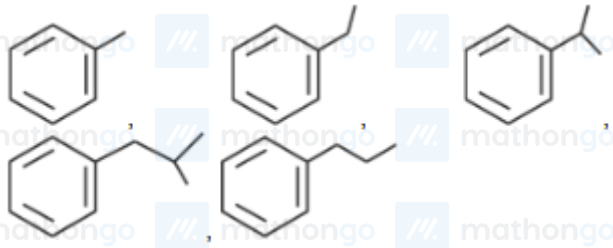


OR

(x)

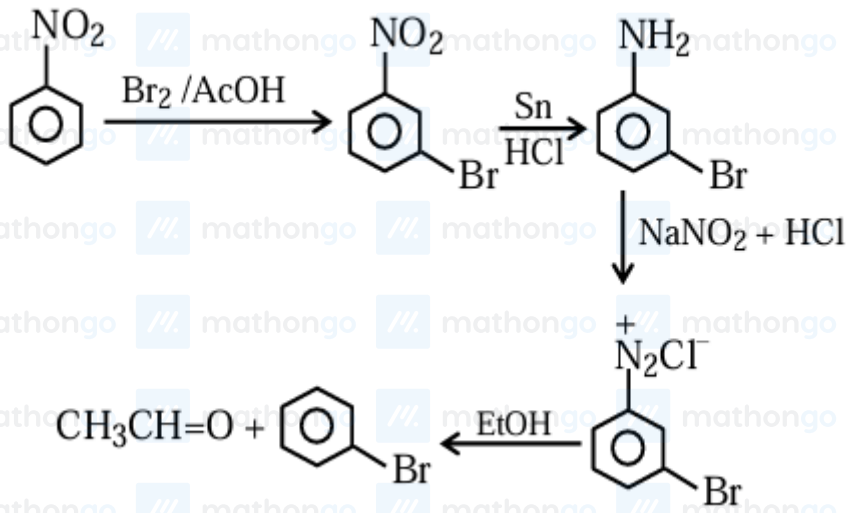
Q3. The compounds having benzylic hydrogen will give benzoic acid on treatment with hot KMnO 4.

(3) Which are following:



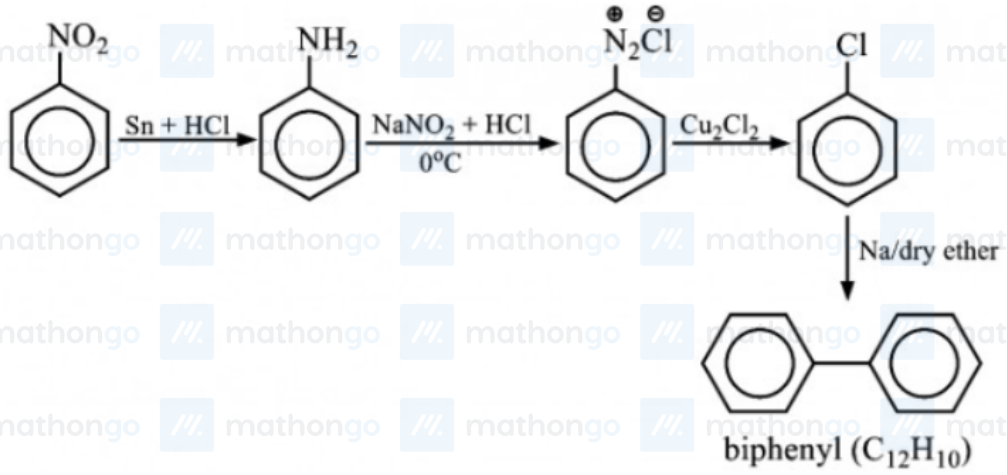
Q1.

(3)



Q2.

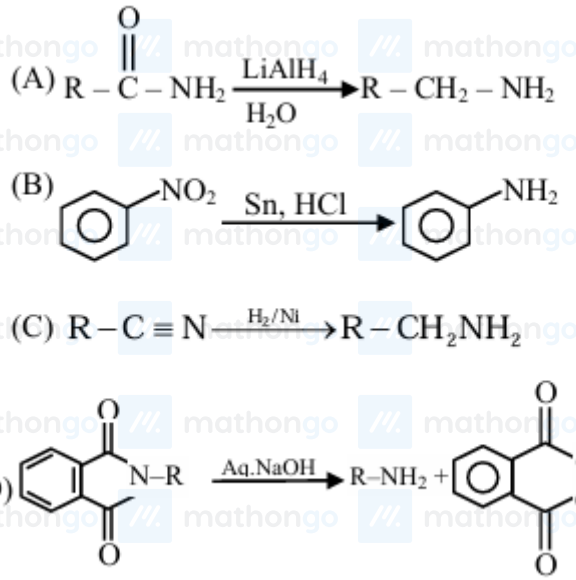
(154)



Molar mass $= 120 \times 12 + 10 \times 1 = 154$

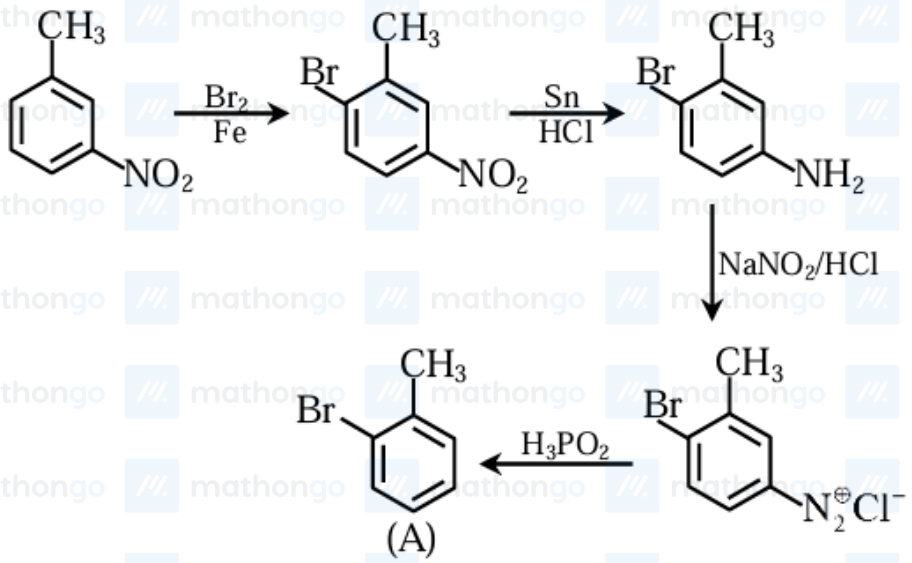
Q3.

(4)



Q4.

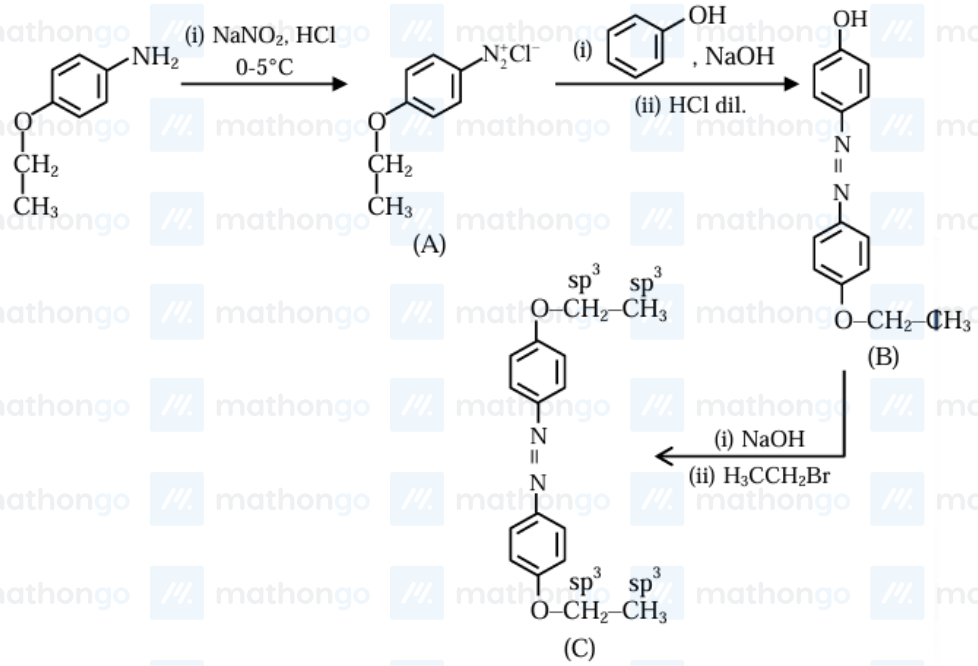
(171)



Molar mass of product (C_7H_7Br) (A) is 171 g mol^{-1}

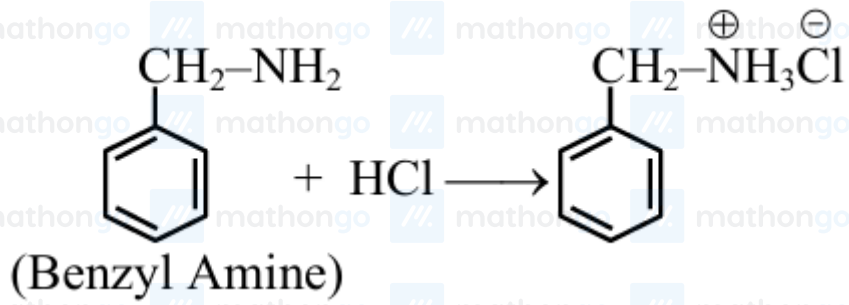
Q5.

(4)



Q6. Benzyl Amine is most basic due to localised lone pair.

(341)



Mole of benzyl Amine $\Rightarrow \frac{1}{107} = 0.00934$ mole

1 Mole of Benzyl amine consumed 1 mole of HCl

So, Mole of HCl consumed $\rightarrow 0.00934$ mole

Mass of HCl consumed $\rightarrow 0.00934\times$ molar mass of HCl

$= 0.00934 \times 36.5$

$= 0.341\text{gm}$

$= 341\text{mg}$

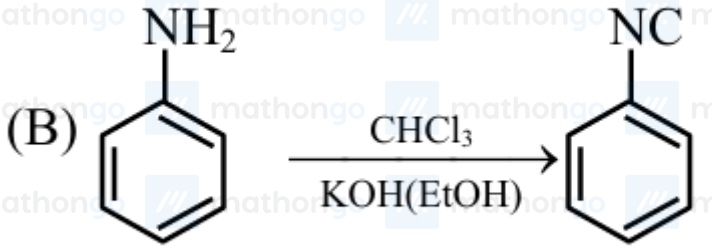
Q7. B and D are 3° amine which does not have replaceable H on N , So does not react.

(2)

Q8.

(3)

$$(A)\ R\text{–}NH_2 \xrightarrow[HCl]{NaNO_2} R - N_2^{\oplus}Cl^{\ominus}$$



$$R\text{–}NH_2 \xrightarrow[KOH(EtOH)]{CHCl_3} R\text{–}NC$$

(C) Only primary amine gives carbyl amine test

(D)

$Ph - SO_2Cl$ _____ Hinsberg reagent

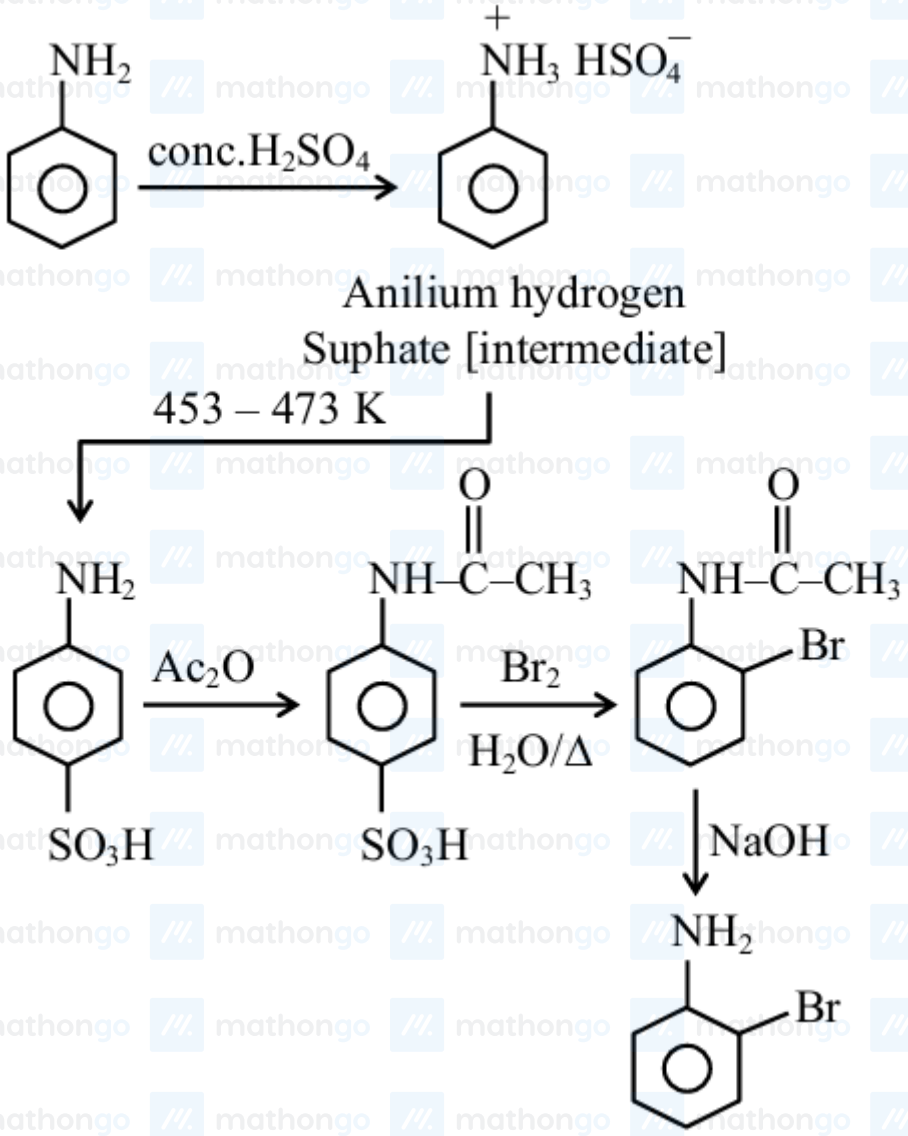
Benzene sulphonyl chloride

(E) Tertiary amine do not react with $Ph - SO_2Cl$

So correct options are (B) and (D) only

Q9.

(2)


NH2
conc.H2SO4
+
NH3 HSO4−
Anilium hydrogen
Suphate [intermediate]
453 – 473 K
NH2
SO3H
Ac2O
O
NH–C–CH3
SO3H
Br2
H2O/Δ
O
NH–C–CH3
Br
NaOH
NH2
Br

Q1. Valine, Lysine and Threonine are essential amino acids.

(2)

Q2. α-helix and β-pleated sheet belongs to secondary structure of protein, which have hydrogen bonds.

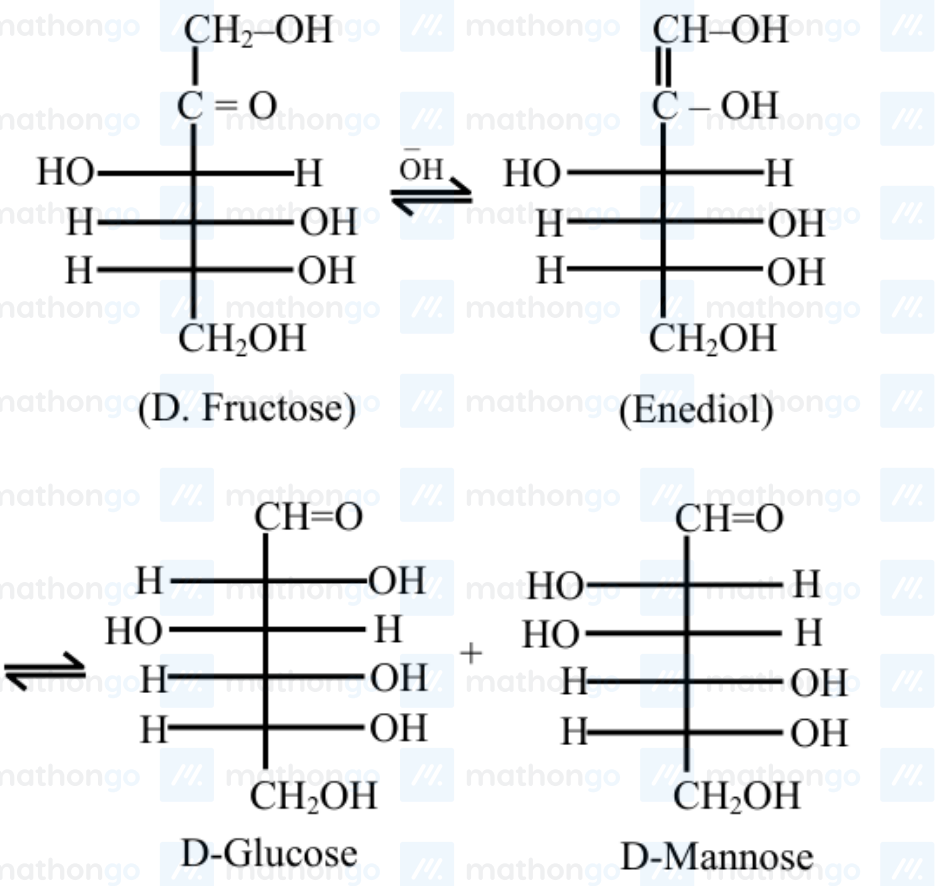
(3)

Q3. Vitamin-C is Ascorbic acid.

(2)

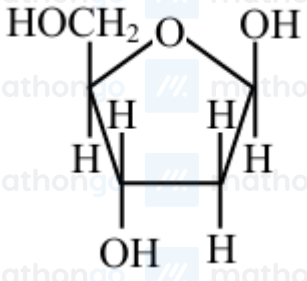
Q4.

(1)



Q5. In Ribose carbohydrate present in DNA is $\beta - 2-$ Deoxy-D-Ribose whose structure is

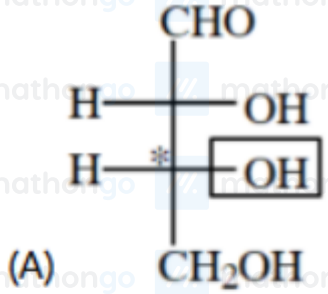
(2)



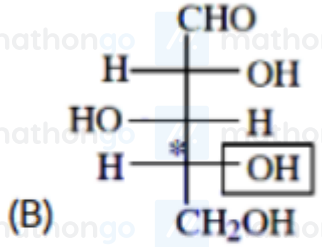
which is a reducing D-sugar in β anomeric form \& it is a pentose sugar.

Q6.

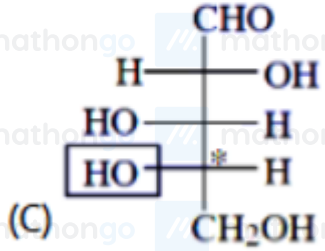
(4)



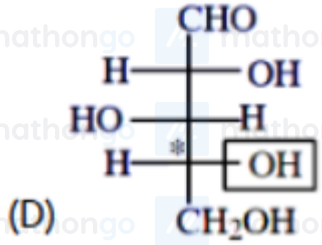
(A)



(B)



(C)



(D)

In A, B, D - OH group in right hand side then D-configuration is assigned

Q7. - D-glucose pentaacetate do not react with 2.4 DNP

(1) - Starch $\xrightarrow[\Delta]{\text{conc. } H_2SO_4}$ Glucose

$2-3$ atm

$100^{\circ}C$

Q8. (A) Sucrose $\rightarrow \alpha_1-\beta_2$ Glycosidic linkage

(3) (B) Maltose $\rightarrow \alpha$ 1-4 Glycosidic linkage

(C) Lactose $\rightarrow \beta$ 1-4 Glycosidic linkage

(D) Amylopectin $\rightarrow \alpha 1-4$ and $\alpha 1-6$ Glycosidic linkage

A-III, B-I, C-IV, D-II

Q9. Amylose $\Rightarrow$ It is a plant based starch it has $\alpha-C_1-C_4$ glycosidic linkage.

(4) Cellulose $\Rightarrow$ It has $\beta-C_1-C_4$ glycosidic linkage

Glycogen $\Rightarrow$ It has $\alpha - C_1 - C_4$ and glycosidic linkage (animal starch)

Amylopectin $\Rightarrow$ It is a plant based with $\alpha - C_1 - C_4$ and $C_1 - C_6$ glycosidic linkage

Q10. **(2)**

(A) Starch $\xrightarrow{H^+/H_2O}$ Glucose

(B) Cane sugar $\xrightarrow{H^+/H_2O}$ glucose + fructose (Sucrose) 50% 50%

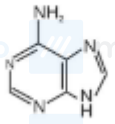
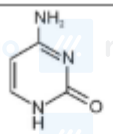
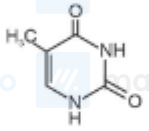
(C) Milk sugar $\xrightarrow{H^+/H_2O}$ glucose + galactose (Lactose)

(D) Amylopectin $\xrightarrow{H^+/H_2O}$ Glucose

(E) Amylose $\xrightarrow{H^+/H_2O}$ Glucose

So, correct options are B,C,and E only.

Q11. **(2)**

Compound		Structure	
(A)	Adenine	III.	
(B)	Cytosine	IV.	
(C)	Thymine	II.	
(D)	Uracil	I.