JEE Main 2025 (April)

Chapter-wise Qs Bank

Chemistry

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Content

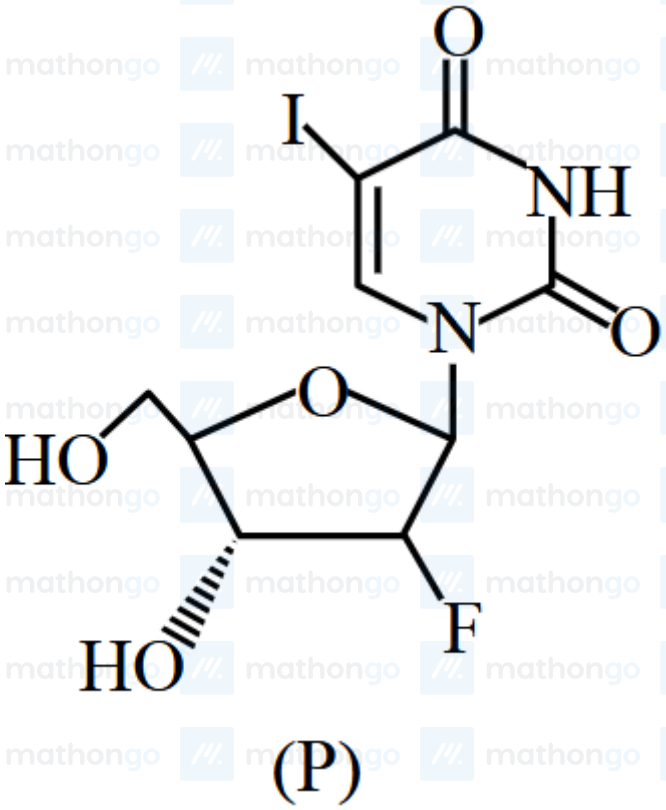
Questions

Solutions

Q1. The amount of calcium oxide produced on heating 150 kg limestone (75% pure) is _____ kg. (Nearest integer)
Given : Molar mass (in $gmol^{-1}$) of Ca-40, O-16, C-12

Q2. 20 mL of sodium iodide solution gave 4.74 g silver iodide when treated with excess of silver nitrate solution. The molarity of the sodium iodide solution is _____ M. (Nearest Integer value) (Given : $Na = 23, I = 127, Ag = 108,\ N = 14, O = 16\ g\ mol^{-1}$)

Q3. 0.1 mol of the following given antiviral compound
(P) will weigh _____ $\times 10^{-1}$ g



(P)

(Given : molar mass in $gmol^{-1}$ $H : 1, C : 12,\ N : 14, O : 16,\ F : 19, I : 127$)

Q4. Among 10^{-9} g (each) of the following elements, which one will have the highest number of atoms? Element : Pb, Po, Pr and Pt

(1) Po

(2) Pr

(3) Pb

(4) Pt

Q5. Fortification of food with iron is done using $FeSO_4 \cdot 7H_2O$. The mass in grams of the $FeSO_4 \cdot 7H_2O$ required to achieve 12 ppm of iron in 150 kg of wheat is ____ (Nearest integer)
[Given : Molar mass of Fe, S and O respectively are 56,32 and 16 $g\ mol^{-1}$]

Q6. $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) H_2O(l)$

Consider the above reaction, what mass of $CaCl_2$ will be formed if 250 mL of 0.76 M HCl reacts with 1000 g of $CaCO_3$?

(Given : Molar mass of Ca, C, O, H and Cl are 40, $12, 16, 1$ and $35.5\ g\ mol^{-1}$, respectively)

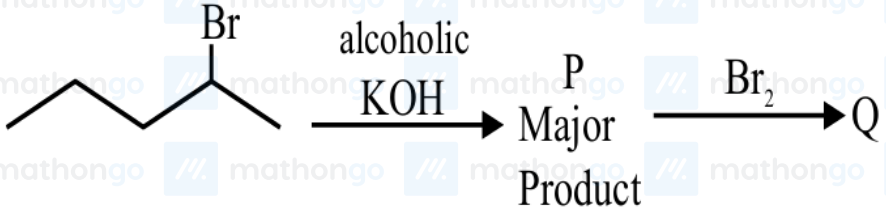
(1) 3.908 g

(2) 2.636 g

(3) 10.545 g

(4) 5.272 g

Q7.



Consider the above sequence of reactions. 151 g of 2-bromopentane is made to react. Yield of major product P is 80% whereas Q is 100%.

Mass of product Q obtained is ____ g.

(Given molar mass in $gmol^{-1}$ H : 1, C : 12, O : 16, Br : 80)

Q8. Mass of magnesium required to produce 220 mL of hydrogen gas at STP on reaction with excess of dil. HCl is

Given : Molar mass of Mg is 24 g mol^{-1}.

(1) 235.7 g

(2) 0.24 mg

(3) 236 mg

(4) 2.444 g

Q9. An organic compound weighing 500 mg , produced 220 mg of CO_2. on complete combustion. The percentage composition of carbon in the compound is _____ \%. (nearest integer)

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

Q10. Butane reacts with oxygen to produce carbon dioxide and water following the equation given below

$C_4H_{10}(g) + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$

If 174.0 kg of butane is mixed with 320.0 kg of O_2, the volume of water formed in litres is _____.(Nearest integer)

[Given : (a) Molar mass of C, H, O are 12, 1, 16 g mol^{-1} respectively, (b) Density of water $= 1\ g\ mL^{-1}$]

Q11. On combustion 0.210 g of an orgainc compound containing C, H and O gave 0.127 gH_2O and 0.307 gCO_2. The percentages of hydrogen and oxygen in the given organic compound respectively are:

(1) $53.41, 39.6$

(2) $6.72, 53.41$

(3) $7.55, 43.85$

(4) $6.72, 39.87$

Q12. On complete combustion 1.0 g of an organic compound (X) gave 1.46 g of CO_2 and 0.567 g of H_2O. The empirical formula mass of compound (X) is _____ g.
(Given molar mass in $gmol^{-1}$ $C : 12, H : 1, O : 16$)

(1) 30

(2) 45

(3) 60

(4) 15

Q1. According to Bohr's model of hydrogen atom, which of the following statement is incorrect?

(1) Radius of 3^{rd} orbit is nine times larger than that of 1^{st} orbit.

(2) Radius of 8^{th} orbit is four times larger than that of 4^{th} orbit.

(3) Radius of 6^{th} orbit is three time larger than that of 4^{th} orbit.

(4) Radius of 4^{th} orbit is four times larger than that of 2^{nd} orbit.

Q2. For electron in ' 2 s ' and ' 2 p ' orbitals, the orbital angular momentum values, respectively are :

(1) $\sqrt{2}\frac{h}{2\pi}$ and 0

(2) $\frac{h}{2\pi}$ and $\sqrt{2}\frac{h}{2\pi}$

(3) 0 and $\sqrt{6}\frac{h}{2\pi}$

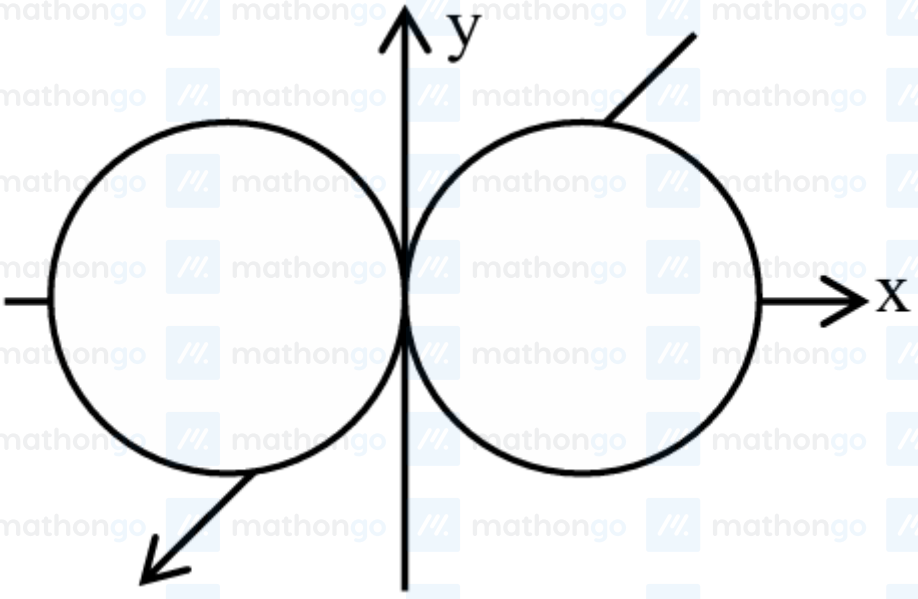
(4) 0 and $\sqrt{2}\frac{h}{2\pi}$

Q3. The energy of an electron in first Bohr orbit of H -atom is -13.6 eV. The magnitude of energy value of electron in the first excited state of Be^{3+} is _____ eV. (nearest integer value)

Q4. Which of the following statements are true?

(A) The subsidiary quantum number l describes the shape of the orbital occupied by the electron.

(B)



is the boundary surface diagram of the $2p_x$ orbital.

(C) The + and - signs in the wave function of the $2p_x$ orbital refer to charge.

(D) The wave function of $2p_x$ orbital is zero everywhere in the xy plane.

(1) (B) and (D) only

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

(3) (C) and (D) only

(4) (A) and (B) only

Q5. Which of the following postulate of Bohr's model of hydrogen atom in not in agreement with quantum mechanical model of an atom ?

(1) An atom in a stationary state does not emit electromagnetic radiation as long as it stays in the same state

(2) An atom can take only certain distinct energies $\mathrm{E}_1, \mathrm{E}_2, \mathrm{E}_3$, etc. These allowed states of constant energy are called the stationary states of atom

(3) When an electron makes a transition from a higher energy stationary state to a lower energy stationary state, then it emits a photon of light

(4) The electron in a H atom's stationary state moves in a circle around the nucleus

Q6. Which one of the following about an electron occupying the 1 s orbital in a hydrogen atom is incorrect ? (Bohr's radius is represented by a a_0)

(1) The probability density of finding the electron is maximum at the nucleus

(2) The electron can be found at a distance $2\mathrm{a}_0$ from the nucleus

(3) The 1 s orbital is spherically symmetrical

(4) The total energy of the electron is maximum when it is at a distance a_0 from the nucleus

Q7. Consider the ground state of chromium atom $(\mathrm{Z}=24)$. How many electrons are with Azimuthal quantum number $l=1$ and $l=2$ respectively ?

(1) 12 and 4

(2) 16 and 4

(3) 12 and 5

(4) 16 and 5

Q8. Correct statements for an element with atomic number 9 are

A. There can be 5 electrons for which $\mathrm{m}_\mathrm{s}=+\frac{1}{2}$ and 4 electrons for which $\mathrm{m}_\mathrm{s}=-\frac{1}{2}$

B. There is only one electron in p_z orbital

C. The last electron goes to orbital with $\mathrm{n}=2$ and $l=1$

4. The sum of angular nodes of all the atomic orbitals is 1.

Choose the correct answer from the options given below:

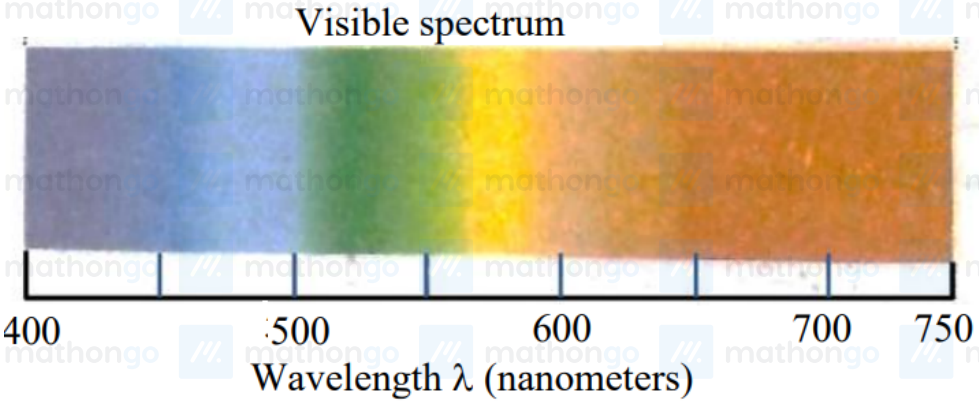
(1) C and D Only

(2) A and C Only

(3) A, C and D Only

(4) A and B Only

Q9.



Which of the following statements are correct, if the threshold frequency of caesium is 5.16×10^{14} Hz ?

A. When Cs is placed inside a vacuum chamber with an ammeter connected to it and yellow light is focused on Cs the ammeter shows the presence of current.

B. When the brightness of the yellow light is dimmed, the value of the current in the ammeter is reduced.

C. When a red light is used instead to the yellow light, the current produced is higher with respect to the yellow light.

D. When a blue light is used, the ammeter shows the formation of current.

E. When a white light is used, the ammeter shows formation of current.

Choose the correct answer from the options given below :

(1) A, D and E Only

(2) B, C and D Only

(3) A, C, D and E Only

(4) A, B, D and E Only

Q10. The extra stability of half-filled subshell is due to

(A) Symmetrical distribution of electrons

(B) Smaller coulombic repulsion energy

(C) The presence of electrons with the same spin in non-degenerate orbitals

(D) Larger exchange energy

(E) Relatively smaller shielding of electrons by one another

Identify the correct statements

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

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

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

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

Q1. At the sea level, the dry air mass percentage composition is given as nitrogen gas : 70.0, oxygen gas : 27.0 and argon gas : 3.0. If total pressure is 1.15 atm , then calculate the ratio of followings respectively :

(i) partial pressure of nitrogen gas to partial pressure of oxygen gas

(ii) partial pressure of oxygen gas to partial pressure of argon gas

(Given : Molar mass of N, O and Ar are 14, 16, and 40 g mol^{-1} respectively)

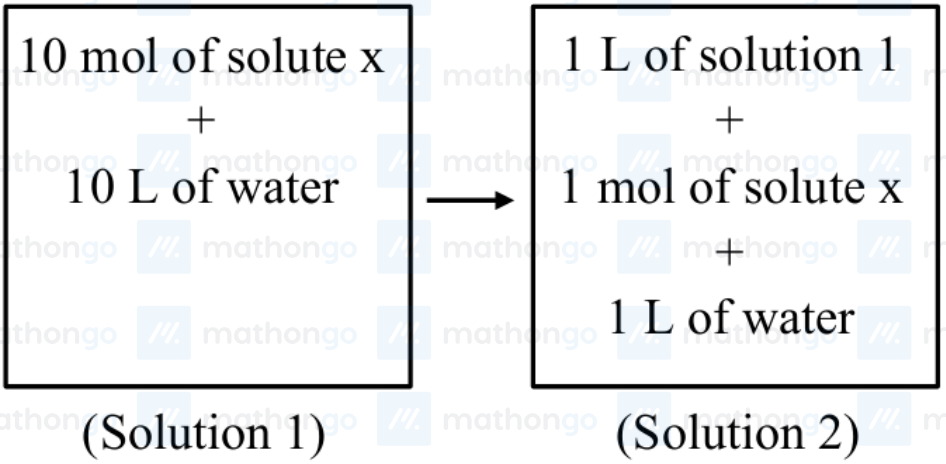
(1) $4.26, 19.3$

(2) $2.59, 11.85$

(3) $5.46, 17.8$

(4) $2.96, 11.2$

Q1. Which of the following properties will change when system containing solution 1 will become solution 2?



(1) Molar heat capacity

(2) Density

(3) Concentration

(4) Gibbs free energy

Q2. The hydration energies of K^+ and Cl^- are -x and -y kJ/mol respectively. If lattice energy of KCl is -z kJ/mol, then the heat of solution of KCl is :

(1) $+x-y-z$

(2) $x+y+z$

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

(4) $-z-(x+y)$

Q3. Arrange the following in order of magnitude of work done by the system / on the system at constant temperature :

(a) $|w_{reversible}|$ for expansion in infinite stage.

(b) $|w_{irreversible}|$ for expansion in single stage.

(c) $|w_{reversible}|$ for compression in infinite stage.

(d) $|w_{irreversible}|$ for compression in single stage.

Choose the correct answer from the options given below:

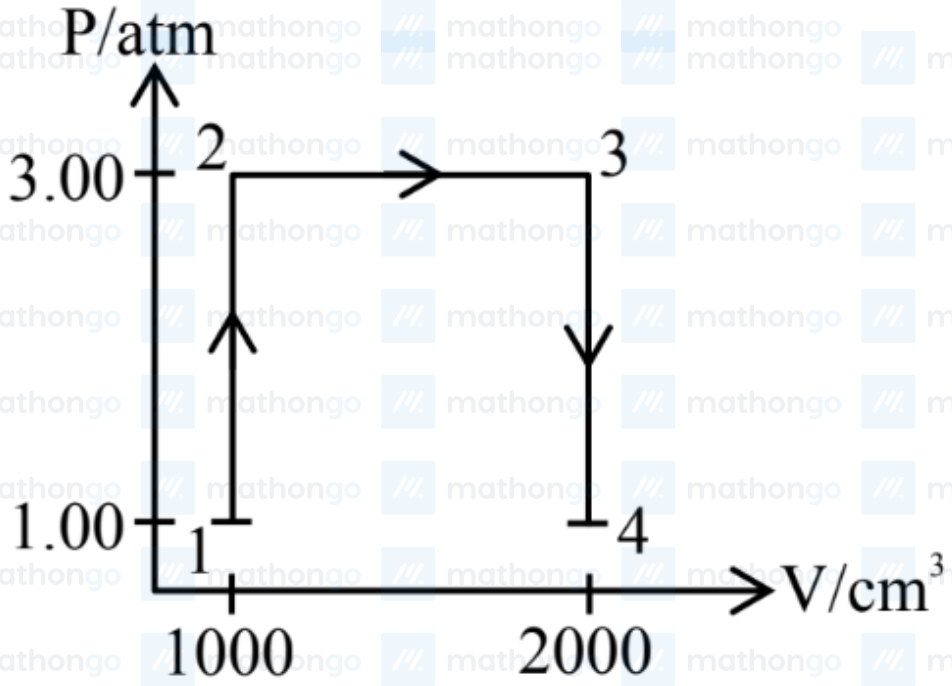
(1) $a > b > c > d$

(2) $d > c = a > b$

(3) $c = a > d > b$

(4) $a > c > b > d$

Q4.



A perfect gas (0.1 mol) having $\overline{C}_v = 1.50R$ (independent of temperature) undergoes the above transformation from point 1 to point 4. If each step is reversible, the total work done (w) while going from point 1 to point 4 is $(-)$ _____ J (nearest integer) [Given : $R = 0.082$ L atm K^{-1} mol^{-1}]

Q5. One mole of an ideal gas expands isothermally and reversibly from $10dm^3$ to $20dm^3$ at 300 K. ΔU, q and work done in the process respectively are :

Given : $R = 8.3JK^{-1}$ and mol^{-1}

$\ln 10 = 2.3$

$\log 2 = 0.30$

$\log 3 = 0.48$

(1) $0, 21.84$ kJ, -1.26 kJ

(2) $0, -17.18$ kJ, 1.718 J

(3) $0, 21.84$ kJ, $21, 84$ kJ

(4) $0, 178$ kJ, -1.718 kJ

Q6. Let us consider a reversible reaction at temperature, T.

In this reaction, both ΔH and ΔS were observed to have positive values. If the equilibrium temperature is Te , then the reaction becomes spontaneous at :

(1) $T = Te$

(2) $Te > T$

(3) $T > Te$

(4) $Te = 5\ T$

Q7. Given :
$\Delta H_{sub}^{\ominus}[C(\text{ graphite })] = 710 \text{ kJ mol}^{-1}$
$\Delta_{C-H}H^{\ominus} = 414 \text{ kJ mol}^{-1}$
$\Delta_{H-H}H^{\Theta} = 436 \text{ kJ mol}^{-1}$
$\Delta_{C=C}H^{\Theta} = 611 \text{ kJ mol}^{-1}$
The $\Delta H_f^{\ominus}$ for $CH_2 = CH_2$ is _____ kJmol^{-1} (nearest integer value)

Q8. Given below are two statements :
Statement I : When a system containing ice in equilibrium with water (liquid) is heated, heat is absorbed by the system and there is no change in the temperature of the system until whole ice gets melted.
Statement II : At melting point of ice, there is absorption of heat in order to overcome intermolecular forces of attraction within the molecules of water in ice and kinetic energy of molecules is not increased at melting point.
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

Q9. A sample of n-octane (1.14 g) was completely burnt in excess of oxygen in a bomb calorimeter, whose heat capacity is 5 kJ K^{-1}. As a result of combustion reaction, the temperature of the calorimeter is increased by 5 K. The magnitude of the heat of combustion of octane at constant volume is _____ kJmol^{-1} (nearest integer).

Q10. Consider the given data :
(a) $HCl(g) + 10H_2O(l) \rightarrow HCl.10H_2O$
$\Delta H = -69.01 \text{ kJ mol}^{-1}$
(b) $HCl(g) + 40H_2O(l) \rightarrow HCl.40H_2O$
$\Delta H = -72.79 \text{ kJ mol}^{-1}$
Choose the correct statement :

(1) Dissolution of gas in water is an endothermic process

(2) The heat of solution depends on the amount of solvent.

(3) The heat of dilution for the $HCl\,(HCl \cdot 10H_2O \text{ to } HCl.40H_2O)$ is 3.78 kJ mol^{-1}.

(4) The heat of formation of HCl solution is represented by both (a) and (b)

Q11. Total enthalpy change for freezing of 1 mol of water at $10^{\circ}C$ to ice at $-10^{\circ}C$ is ____
(Given : $\Delta_{fus} H = x \text{ kJ/mol}$)
$C_p[H_2O(l)] = y\text{Jmol}^{-1} \text{ K}^{-1}$
$C_p[H_2O(s)] = z\text{Jmol}^{-1} \text{ K}^{-1}$

(1) $-x-10y-10z$

(2) $-10(100x+y+z)$

(3) $10(100x+y+z)$

(4) $x-10y-10z$

Q12. The correct statement amongst the following is :

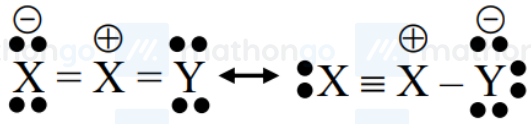
(1) The term 'standard state' implies that the temperature is $0^{\circ}C$

(2) The standard state of pure gas is the pure gas at a pressure of 1 bar and temperature 273 K

(3) $\Delta_f H^{\theta}_{298}$ is zero for $O(g)$

(4) $\Delta_f H^{\theta}_{500}$ is zero for $O_2(g)$

Q13. Resonance in X_2Y can be represented as



The enthalpy of formation of

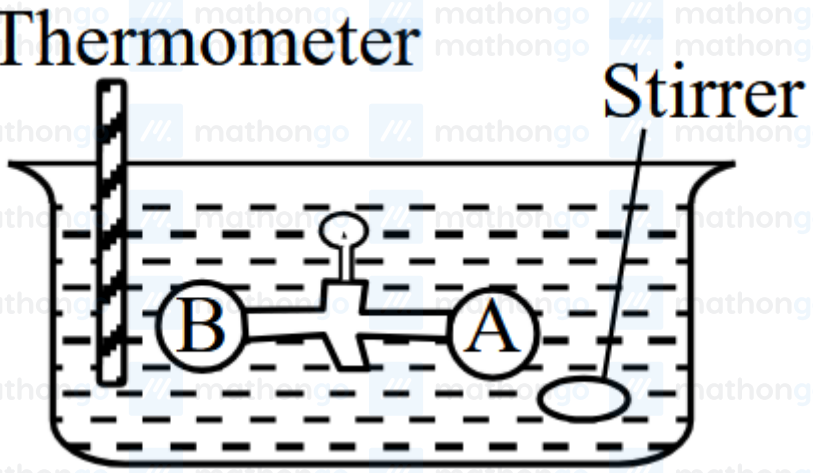
$X_2Y\left(X\equiv X(g)+\frac{1}{2}Y=Y(g)\rightarrow X_2Y(g)\right)$ is 80 kJ mol^{-1}.

The magnitude of resonance energy of X_2Y is _____ kJ mol^{-1} (nearest integer value)

Given : Bond energies of $X\equiv X$, $X=X$, $Y=Y$ and $X=Y$ are 940, 410, 500 and 602 kJ mol^{-1} respectively.

valence X : 3, Y : 2

Q14.



Two vessels A and B are connected via stopcock. The vessel A is filled with a gas at a certain pressure. The entire assembly is immersed in water and is allowed to come to thermal equilibrium with water. After opening the stopcock the gas from vessel A expands into vessel B and no change in temperature is observed in the thermometer. Which of the following statement is true?

(1) $dw = 0$

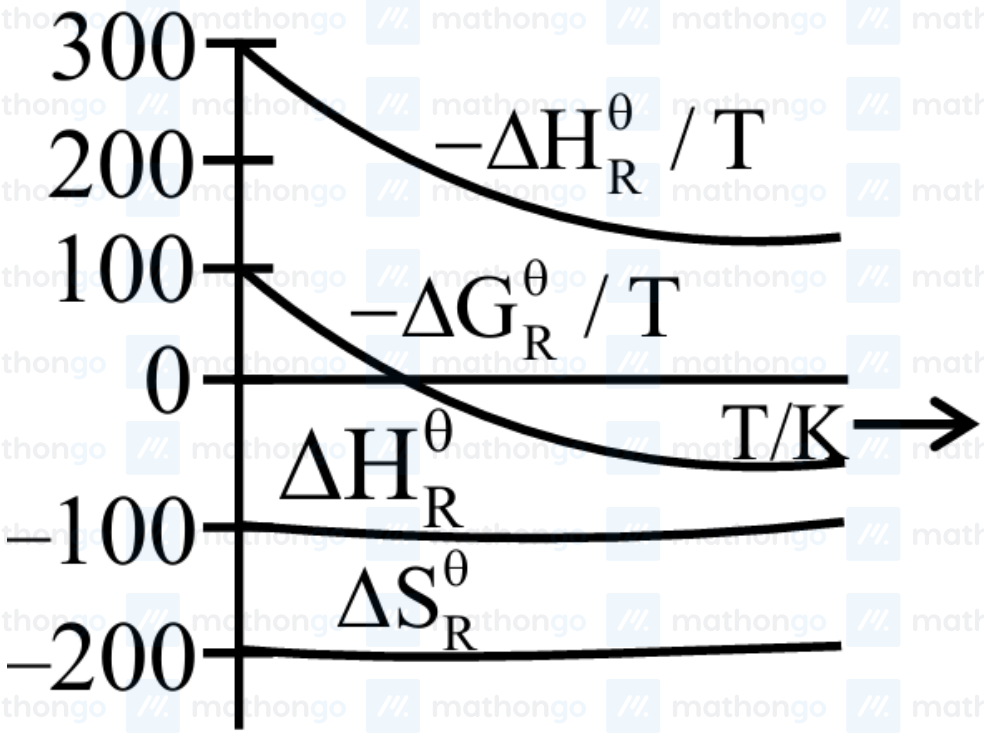
(2) $dq = 0$

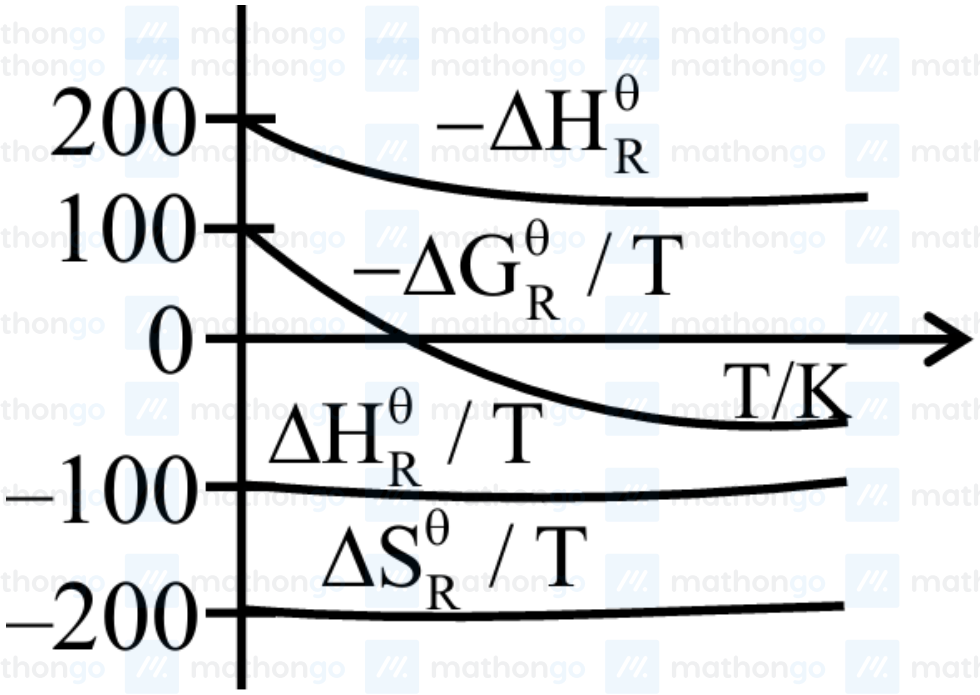
(3) $dU = 0$

(4) The pressure in the vessel B before opening the stopcock is zero.

Q15. Which of the following graphs correctly represents the variation of thermodynamic properties of Haber's process?

(1)

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−100
−200
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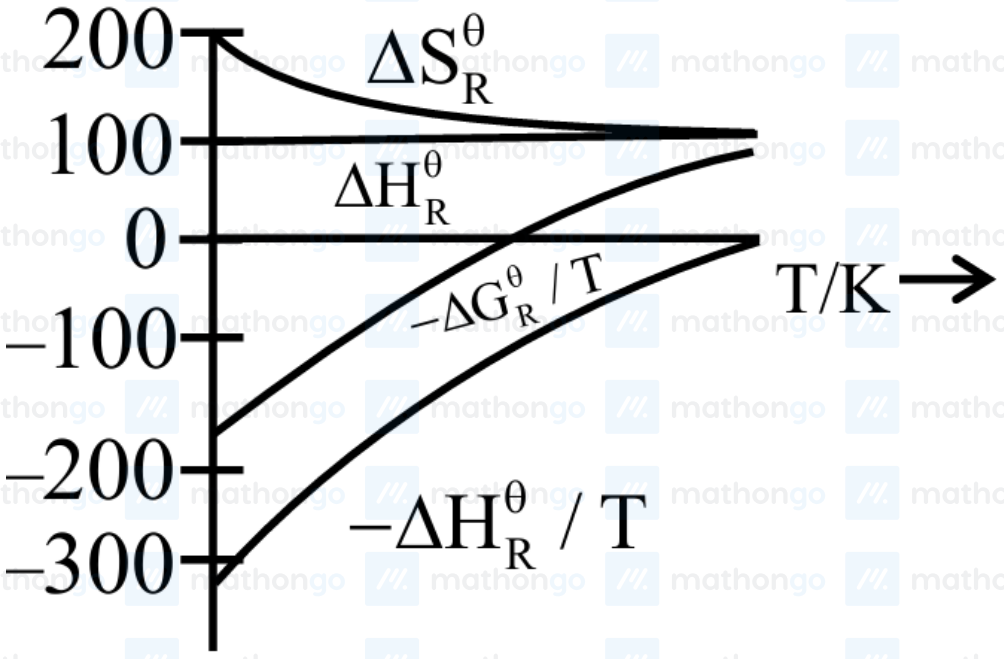
$-\Delta G_R^\theta / T$
T/K
$\Delta H_R^\theta / T$
$\Delta S_R^\theta / T$

(2)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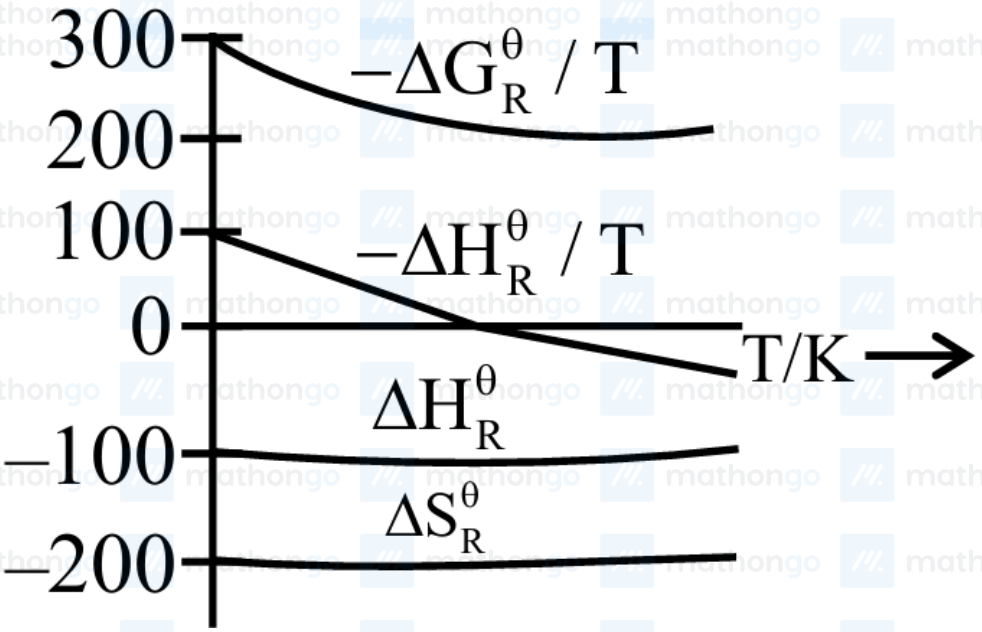
$-\Delta H_R^\theta / T$

(3)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100
0
–100
–200
$-\Delta G_R^\theta / T$
$-\Delta H_R^\theta / T$
T/K
ΔH_R^θ
ΔS_R^θ

(4)

Q1. Given below are two statements
Statement I : A catalyst cannot alter the equilibrium constant (K_c) of the reaction, temperature remaining constant
Statement II : A homogenous catalyst can change the equilibrium composition of a system temperature remaining constant
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 true

(3) Both Statement I and Statement II is false

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

Q2. In the following system, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ at equilibrium, upon addition of xenon gas at constant T&p, the concentration of

(1) PCl_5 will increase

(2) Cl_2 will decrease

(3) $PCl_5, PCl_3 \& Cl_2$ remain constant

(4) PCl_3 will increase

Q3. Consider the following equilibrium,
$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$
0.1 mol of CO along with a catalyst is present in a $2dm^3$ flask maintained at 500 K. Hydrogen is introduced into the flask until the pressure is 5 bar and 0.04 mol of CH_3OH is formed. The K_p^0 is _____ $\times 10^{-3}$ (nearest integer).
Given : $R = 0.08 dm^3$ bar K^{-1} mol^{-1}
Assume only methanol is formed as the product and the system follows ideal gas behaviour.

Q4. Consider the following chemical equilibrium of the gas phase reaction at a constant temperature :
$A(g) \rightleftharpoons B(g) + C(g)$
If p being the total pressure, K_p is the pressure equilibrium constant and α is the degree of dissociation, then which of the following is true at equilibrium?

(1) If p value is extremely high compared to $K_p, \alpha \approx 1$

(2) When p increases α decreases

(3) If k_p value is extremely high compared to p, α becomes much less than unity

(4) When p increases α increases

Q1. x mg of $Mg(OH)_2$(molar mass $= 58$) is required to be dissolved in 1.0 L of water to produce a pH of 10.0 at 298 K. The value of x is _____ mg. (Nearest integer)
(Given : $Mg(OH)_2$ is assumed to dissociate completely in H_2O)

Q2. An aqueous solution of HCl with pH 1.0 is diluted by adding equal volume of water (ignoring dissociation of water). The pH of HCl solution would
(Given $\log 2 = 0.30$)

(1) reduce to 0.5

(2) increase to 1.3

(3) remain same

(4) increase to 2

Q3. The equilibrium constant for decomposition of $H_2O(g)$
$H_2O(g) \rightleftharpoons H_2(g) + \frac{1}{2}O_2(g)$ $\left(\Delta G^\circ = 92.34 \text{ kJ mol}^{-1}\right)$
is 8.0×10^{-3} at 2300 K and total pressure at equilibrium is 1 bar. Under this condition, the degree of dissociation (α) of water is _____ $\times 10^{-2}$ (nearest integer value).
[Assume α is negligible with respect to 1]

Q4. 10 mL of 2 M NaOH solution is added to 20 mL of 1 M HCl solution kept in a beaker. Now, 10 mL of this mixture is poured into a volumetric flask of 100 mL containing 2 moles of HCl and made the volume upto the mark with distilled water. The solution in this flask is :

(1) 0.2 M NaCl solution

(2) 20 M HCl solution

(3) 10 M HCl solution

(4) Neutral solution

Q5. The pH of a 0.01 M weak acid HX $\left(K_a = 4 \times 10^{-10}\right)$ is found to be 5. Now the acid solution is diluted with excess of water so that the pH of the solution changes to 6. The new concentration of the diluted weak acid is given as $x \times 10^{-4}$M. The value of x is _____ (nearest integer)

Q6. Only litre buffer solution was prepared by adding 0.10 mol each of NH_3 and NH_4Cl in deionised water. The change in pH on addition of 0.05 mol of HCl to the above solution is _____ $\times 10^{-2}$, (Nearest integer) (Given : pK_b of $NH_3 = 4.745$ and $\log_{10} 3 = 0.477$)

Q7. If equal volumes of AB_2 and XY (both are salts) aqueous solutions are mixed, which of the following combination will give a precipitate of AY_2 at 300 K ?
(Given K_{sp} (at 300 K) for $AY_2 = 5.2 \times 10^{-7}$)

(1) $3.6 \times 10^{-3}\,\mathrm{M}\ \mathrm{AB}_2\ , 5.0 \times 10^{-4}\,\mathrm{M}\ \mathrm{XY}$

(2) $2.0 \times 10^{-4}\,\mathrm{M}\ \mathrm{AB}_2\ , 0.8 \times 10^{-3}\,\mathrm{M}\ \mathrm{XY}$

(3) $2.0 \times 10^{-2}\,\mathrm{M}\ \mathrm{AB}_2\ , 2.0 \times 10^{-2}\,\mathrm{M}\ \mathrm{XY}$

(4) $1.5 \times 10^{-4}\,\mathrm{M}\ \mathrm{AB}_2\ , 1.5 \times 10^{-3}\,\mathrm{M}\ \mathrm{XY}$

Q1. Compounds that should not be used as primary standards in titrimetric analysis are :

A. $Na_2Cr_2O_7$

B. Oxalic acid

C. NaOH

D. $FeSO_4 \cdot 6H_2O$

E. Sodium tetraborate

Choose the most appropriate answer from the options given below:

(1) B and D Only

(2) D and E Only

(3) C, D and E Only

(4) A, C and D Only

Q1. The percentage dissociation of a salt (MX_3) solution at given temperature (van't Hoff factor i = 2) is _____ % (Nearest integer)

Q2. Sea water, which can be considered as a 6 molar (6M) solution of NaCl , has a density of 2 g mL^{-1}. The concentration of dissolved oxygen (O_2) in sea water is 5.8 ppm. Then the concentration of dissolved oxygen (O_2) in sea water, is $x \times 10^{-4}$ m. x = _____. (Nearest integer)
Given: Molar mass of NaCl is 58.5 g mol^{-1} Molar mass of O_2 is 32 g mol^{-1}

Q3. A solution is made by mixing one mole of volatile liquid A with 3 moles of volatile liquid B. The vapour pressure of pure A is 200 mm Hg and that of the solution is 500 mm Hg. The vapour pressure of pure B and the least volatile component of the solution, respectively, are :

(1) $1400\ \text{mmHg, A}$

(2) $1400\ \text{mmHg, B}$

(3) $600\ \text{mmHg, B}$

(4) $600\ \text{mmHg, A}$

Q4. Liquid A and B form an ideal solution. The vapour pressure of pure liquids A and B are 350 and 750 mm Hg respectively at the same temperature. If x_A and x_B are the mole fraction of A and B in solution while y_A and y_B are the mole fraction of A and B in vapour phase then :

(1) $\frac{x_A}{x_B} < \frac{y_A}{y_B}$

(2) $\frac{x_A}{x_B} = \frac{y_A}{y_B}$

(3) $\frac{x_A}{x_B} > \frac{y_A}{y_B}$

(4) $(x_A - y_A) < (x_B - y_B)$

Q5. Which of the following binary mixture does not show the behaviour of minimum boiling azeotropes?

(1) $H_2O + CH_3COC_2H_5$

(2) $C_6H_5OH + C_6H_5NH_2$

(3) $CS_2 + CH_3COCH_3$

(4) $CH_3OH + CHCl_3$

Q6. When 1 g each of compounds AB and AB_2 are dissolved in 15 g of water separately, they increased the boiling point of water by 2.7 K and 1.5 K respectively. The atomic mass of A (in amu) is ____ $\times 10^{-1}$ (Nearest integer)
(Given : Molal boiling point elevation constant is 0.5 K kg mol^{-1})

Q7. 2 moles each of ethylene glycol and glucose are dissolved in 500 g of water. The boiling point of the resulting solution is :

(Given : Ebullioscopic constant of water $= 0.52$ K kg mol^{-1})

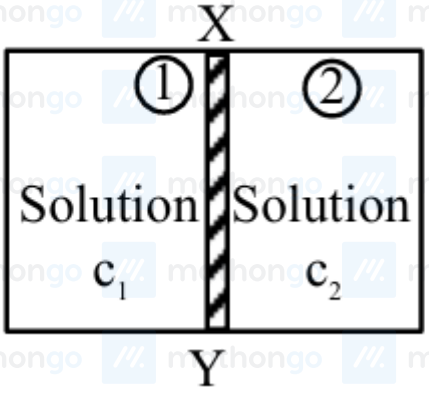
(1) 379.2 K

(2) 377.3 K

(3) 375.3 K

(4) 277.3 K

Q8. XY is the membrane / partition between two chambers 1 and 2 containing sugar solutions of concentration c_1 and c_2 $(c_1 > c_2)$ molL^{-1}. For the reverse osmosis to take place identify the correct condition
(Here p_1 and p_2 are pressures applied on chamber 1 and 2)



(A) Membrane/Partition; Cellophane, $p_1 > \pi$
(B) Membrane/Partition ; Porous. $p_2 > \pi$
(C) Membrane/Partition ; Parchment paper, $p_1 > \pi$
(D) Membrane/Partition : Cellophane, $p_2 > \pi$
Choose the correct answer from the option given below :

(1) B and D only

(2) A and D only

(3) A and C only

(4) C only

Q9. Given below are two statements :

Statement (I) : Molal depression constant K_f is given by $\frac{M_1 R T_f}{\Delta S_{fus}}$, where symbols have their usual meaning.

Statement (II) : K_f for benzene is less than the K_f for water.

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 incorrect

(3) Both Statement I and Statement II are correct

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

Q10. $HA(aq) \rightleftharpoons H^+(aq) + A^-(aq)$

The freezing point depression of a 0.1 m aqueous solution of a monobasic weak acid HA is 0.20°C. The dissociation constant for the acid is

Given :

$K_f(H_2O) = 1.8\ K\ kg\ mol^{-1}$, molality $\equiv$ molarity

(1) 1.38×10^{-3}

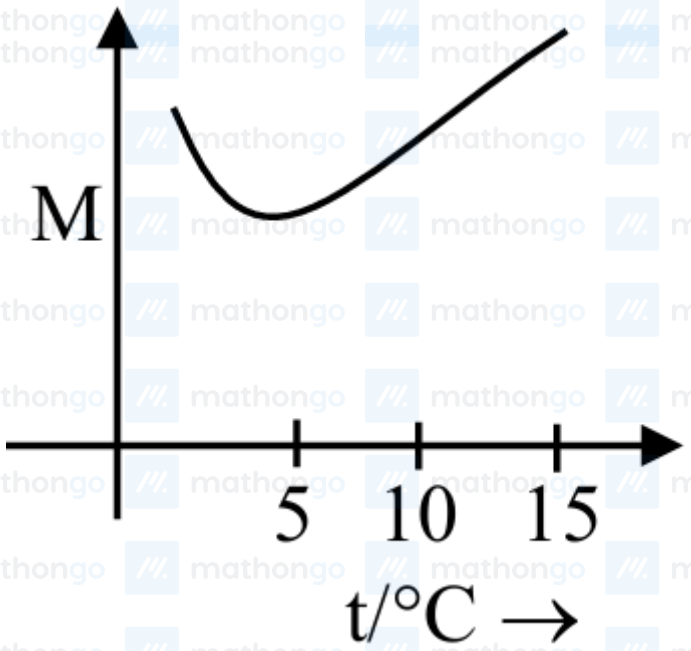
(2) 1.1×10^{-2}

(3) 1.90×10^{-3}

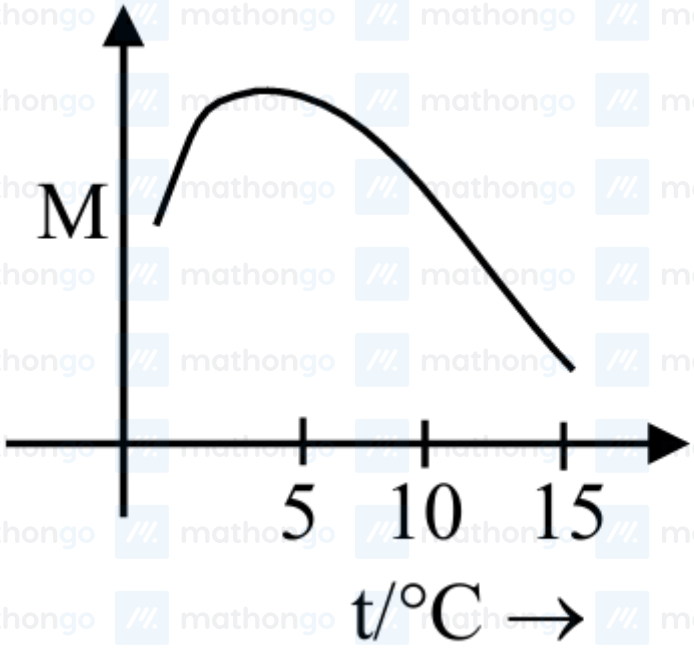
(4) 1.89×10^{-1}

Q11. ' x ' g of NaCl is added to water in a beaker with a lid. The temperature of the system is raised from $1^{\circ}C$ to $25^{\circ}C$. Which out of the following plots, is best suited for the change in the molarity (M) of the solution with respect to temperature?

[Consider the solubility of NaCl remains unchanged over the temperature range]



(1)



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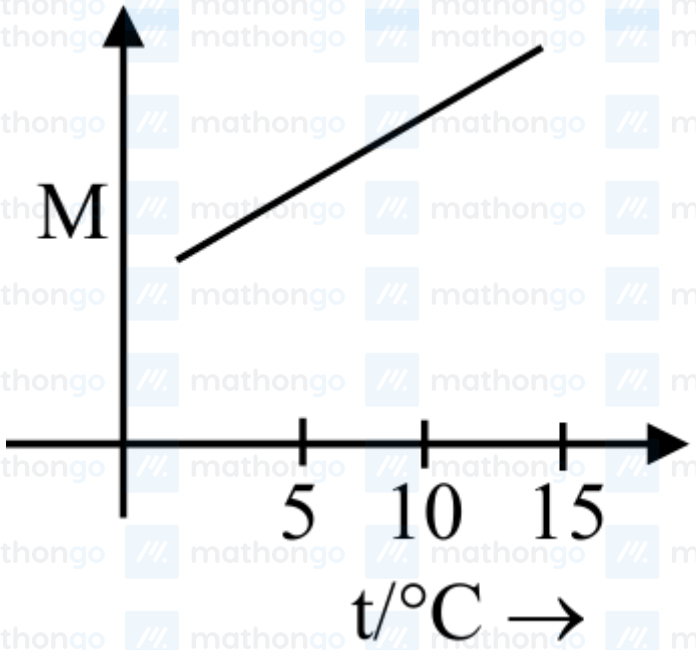

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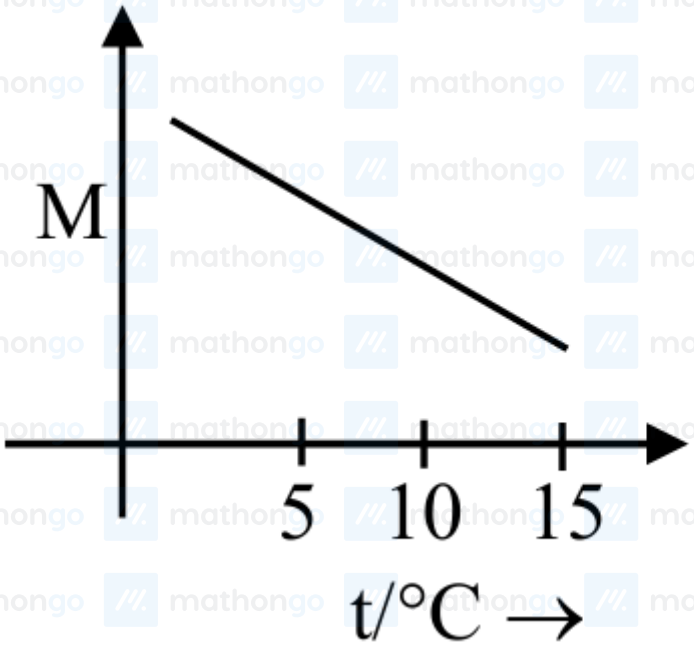


(4)

Q12. Match List-I with List-II

	List-I		List-II
(A)	Solution of chloroform and acetone	(I)	Minimum boiling azeotrope
(B)	Solution of ethanol and water	(II)	Dimerizes
(C)	Solution of benzene and toluene	(III)	Maximum boiling azeotrope
(D)	Solution of acetic acid in benzene	(IV)	$\Delta V_{mix} = 0$

Choose the correct answer from the options given below :

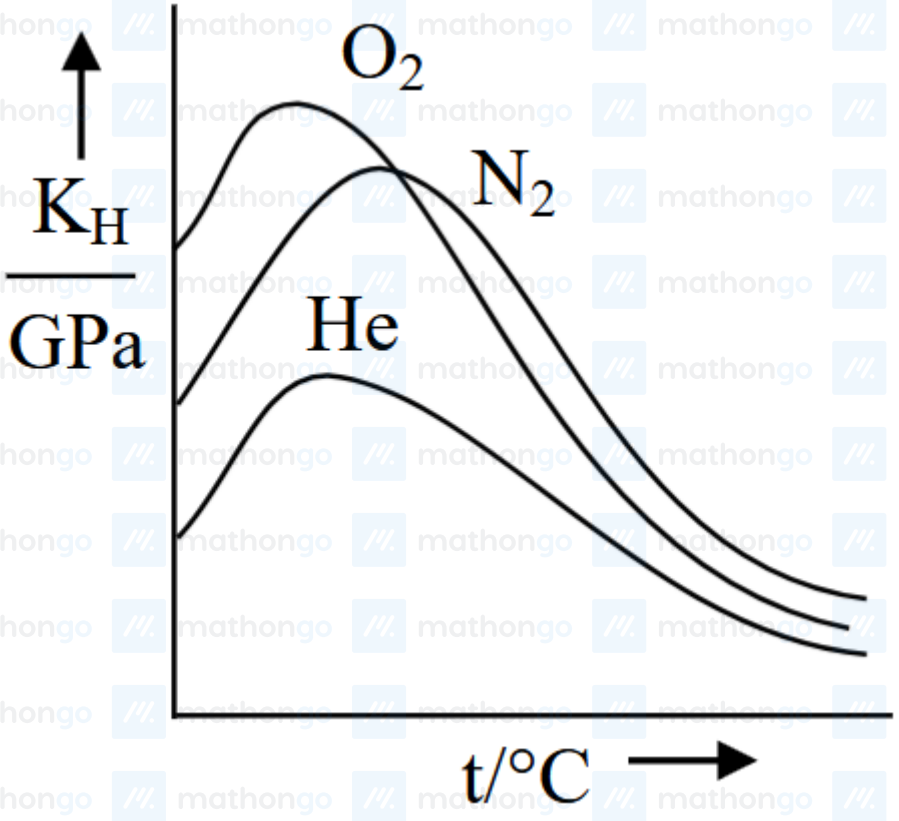
(1) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

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

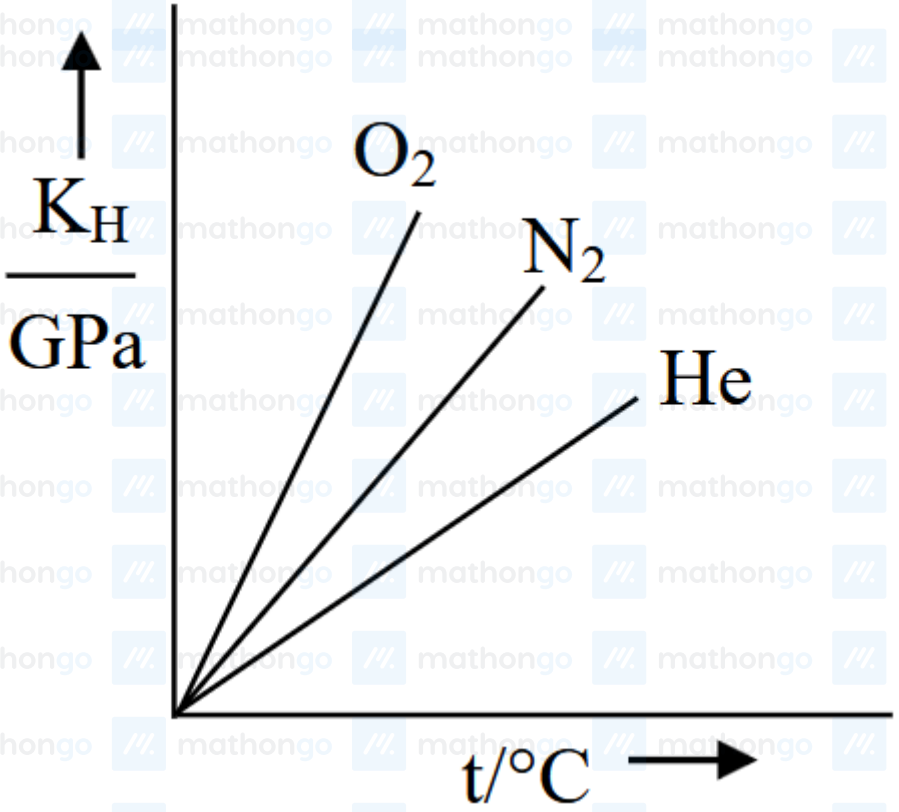
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

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

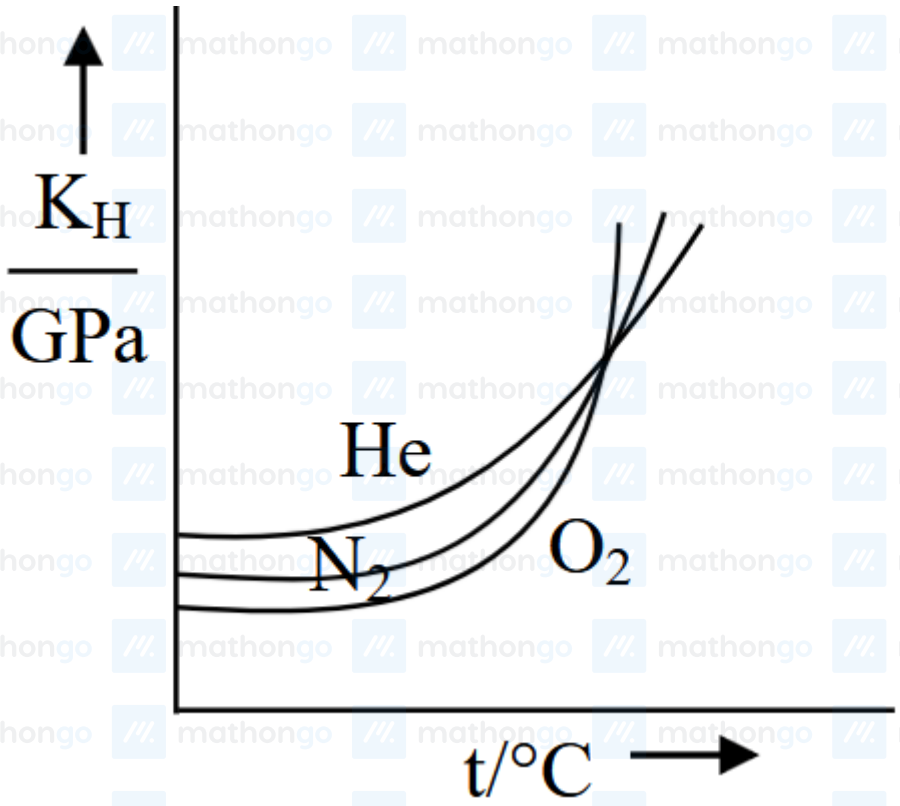
Q13. Which of the following graph correctly represents the plots of K_H at 1 bar gases in water versus temperature?



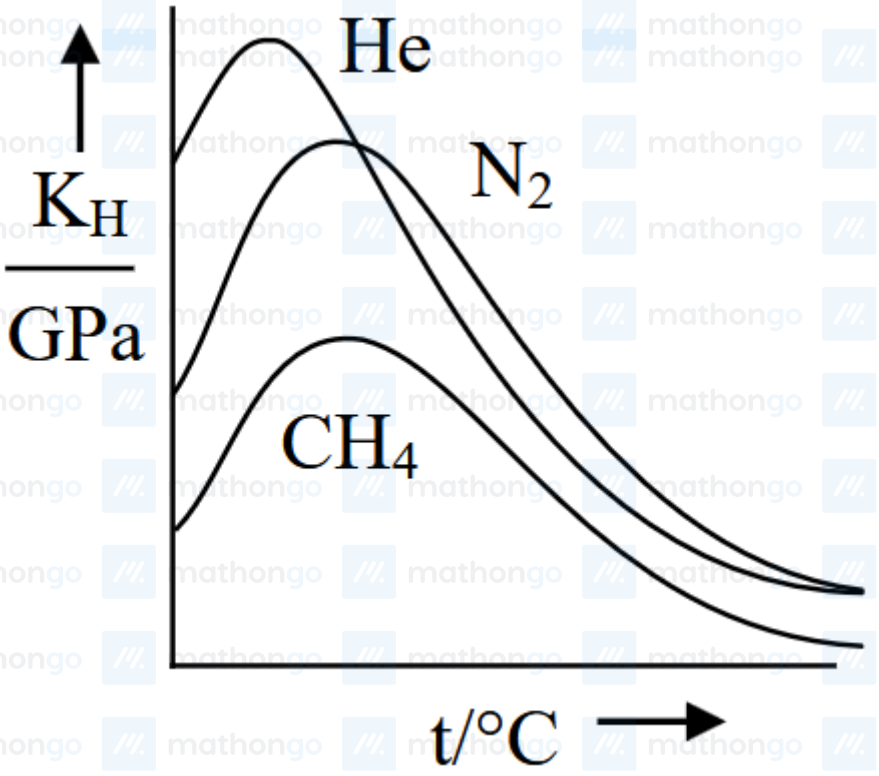
(1)



(2)



(3)



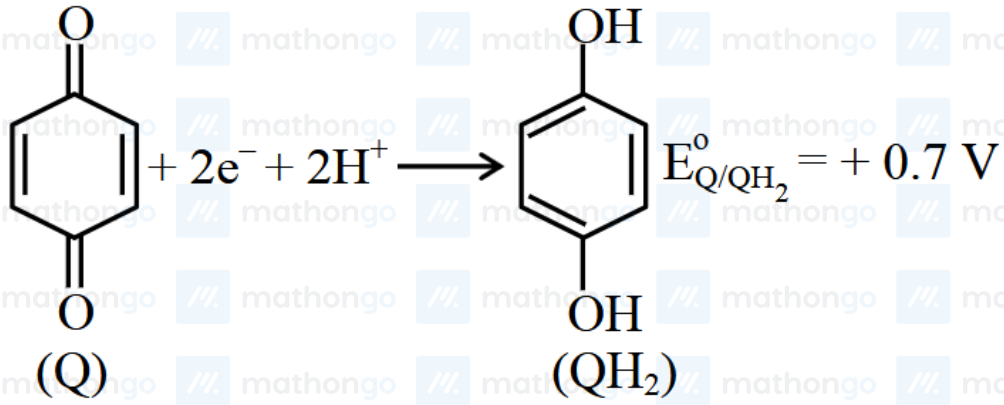
(4)

Q1. Consider the following electrochemical cell at standard condition.

$Au(s)\,|QH_2, Q|\,NH_4X(0.01M)||Ag^+(1M)\,|\,Ag(s)$

$E_{cell} = +0.4\ V$

The couple $QH_2\ /Q$ represents quinhydrone electrode, the half cell reaction is given below



The pK_b value of the ammonium halide salt $(NH_4\ X)$ used here is _____. (nearest integer)

Q2. The standard cell potential $(E^{\ominus}_{cell})$ of a fuel cell based on the oxidation of methanol in air that has been used to power television relay station is measured as 1.21 V. The standard half cell reduction potential for O_2 $\left(E^{O}_{O_2/H_2O}\right)$ is 1.229 V.

Choose the correct statement:

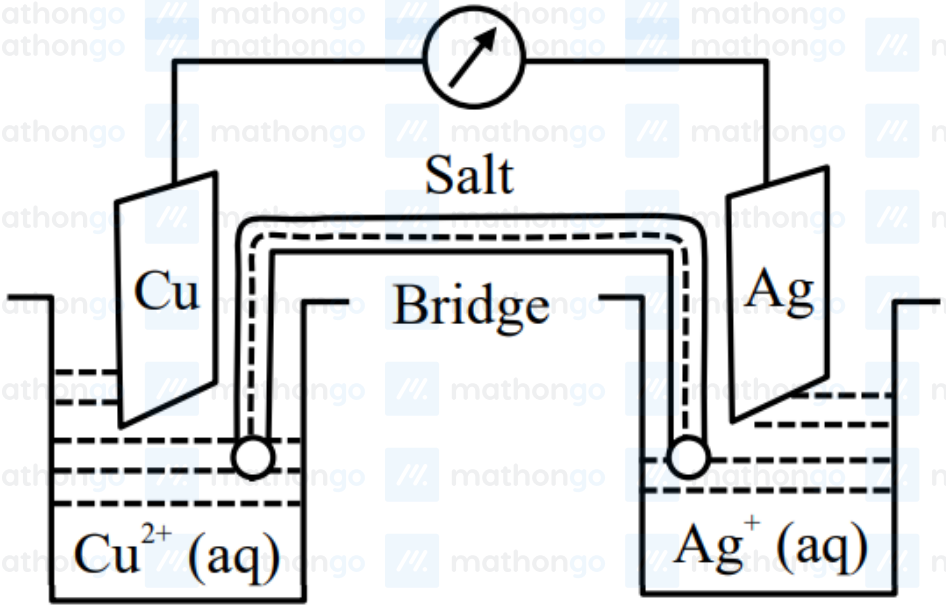
(1) The standard half cell reduction potential for the reduction of CO_2 $\left(E^{0}_{CO_2/CH_3OH}\right)$ is 19 mV

(2) Oxygen is formed at the anode.

(3) Reactants are fed at one go to each electrode.

(4) Reduction of methanol takes place at the cathode.

Q3. 1 Faraday electricity was passed through $Cu^{2+}(1.5\ M, 1\ L)/Cu$ and 0.1 Faraday was passed through $Ag^+(0.2M, 1\ L)/Ag$ electrolytic cells. After this the two cells were connected as shown below to make an electrochemical cell. The emf of the cell thus formed at 298 K is-



Given: $E^{o}_{Cu^{2+}/Cu} = 0.34$ V

$E^{0}_{Ag^{+}/Ag} = 0.8$ V

$\frac{2.303RT}{F} = 0.06$ V

Q4. Given below are two statements :

1 M aqueous solution of each of $Cu(NO_3)_2$, $AgNO_3$, $Hg_2(NO_3)_2$; $Mg(NO_3)_2$ are electrolysed using inert electrodes,

Given : $E^{\theta}_{Ag^{+}/Ag} = 0.80$ V, $E^{\theta}_{Hg_2^{2+}/Hg} = 0.79$ V,

$E^{\theta}_{Cu^{2+}/Cu} = 0.24$ V and $E^{\theta}_{Mg^{2+}/Mg} = -2.37$ V

Statement (I) : With increasing voltage, the sequence of deposition of metals on the cathode will be Ag, Hg and Cu

Statement (II) : Magnesium will not be deposited at cathode instead oxygen gas will be evolved at the cathode.

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

(1) Both statement I and statement II are incorrect

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

(3) Both statement I and statement II are correct

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

Q5. Consider the following half cell reaction

$Cr_2O_7^{2-}(aq) + 6e^{-} + 14H^{+}(aq) \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$

The reaction was conducted with the ratio of $\frac{\left[Cr^{3+}\right]^2}{\left[Cr_2O_7^{2-}\right]} = 10^{-6}$. The pH value at which the EMF of the half cell will become zero is _____. (nearest integer value)

[Given : standard half cell reduction potential $E^{o}_{Cr_2O_7^{2-},H^+/Cr^{3+}} = 1.33\ V, \frac{2.303RT}{F} = 0.059\ V$]

Q6. On charging the lead storage battery, the oxidation state of lead changes from x_1 to y_1 at the anode and from x_2 to y_2 at the cathode. The values of x_1, y_1, x_2, y_2 are respectively :

(1) $+4, +2, 0, +2$

(2) $+2, 0, +2, +4$

(3) $0, +2, +4, +2$

(4) $+2, 0, 0, +4$

Q7. $0.2\%(w/v)$ solution of NaOH is measured to have resistivity 870.0 $m\Omega$ m. The molar conductivity of the solution will be _____ $\times 10^2 mSdm^2\ mol^{-1}$. (Nearest integer)

Q8. Correct order of limiting molar conductivity for cations in water at 298 K is :

(1) $H^+ > Na^+ > K^+ > Ca^{2+} > Mg^{2+}$

(2) $H^+ > Ca^{2+} > Mg^{2+} > K^+ > Na^+$

(3) $Mg^{2+} > H^+ > Ca^{2+} > K^+ > Na^+$

(4) $H^+ > Na^+ > Ca^{2+} > Mg^{2+} > K^+$

Q9. The molar conductance of an infinitely dilute solution of ammonium chloride was found to be 185 S $cm^2\ mol^{-1}$ and the ionic conductance of hydroxyl and chloride ions are 170 and 70 S $cm^2\ mol^{-1}$, respectively. If molar conductance of 0.02 M solution of ammonium hydroxide is 85.5 S $cm^2\ mol^{-1}$, its degree of dissociation is given by $x \times 10^{-1}$. The value of x is _____ (Nearest integer)

Q10. Given below are two statements :

Statement I : Mohr's salt is composed of only three types of ions-ferrous, ammonium and sulphate.

Statement II : If the molar conductance at infinite dilution of ferrous, ammonium and sulphate ions are x_1, x_2 and x_3 S $cm^2\ mol^{-1}$, respectively then the molar conductance for Mohr's salt solution at infinite dilution would be given by $x_1 + x_2 + 2x_3$

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

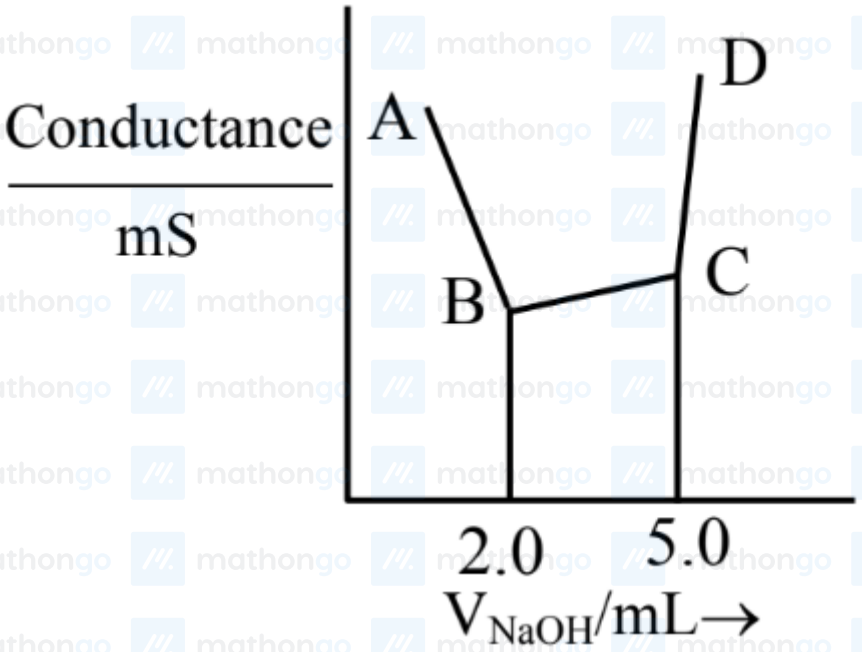
(1) Both statements I and Statement II are false

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

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

(4) Both statements I and Statement II are true

Q11. 40 mL of a mixture of CH_3COOH and HCl (aqueous solution) is titrated against 0.1 M NaOH solution conductometrically. Which of the following statement is correct?



(1) The concentration of CH_3COOH in the original mixture is 0.005 M

(2) The concentration of HCl in the original mixture is 0.005 M

(3) CH_3COOH is neutralised first followed by neutralisation of HCl

(4) Point ' C ' indicates the complete neutralisation HCl

Q1. Rate law for a reaction between A and B is given by

$R = k[A]^n[B]^m$

If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction $\left(\frac{r_2}{r_1}\right)$ is

(1) $2^{(n-m)}$

(2) $(n-m)$

(3) $(m+n)$

(4) $\frac{1}{2^{m+n}}$

Q2. Reaction $A(g) \rightarrow 2\,B(g) + C(g)$ is a first order reaction. It was started with pure A

t/min	Pressure of system at time t/mm Hg
10	160
∞	240

Which of the following option is <u>incorrect</u>?

(1) Initial pressure of A is 80 mm Hg

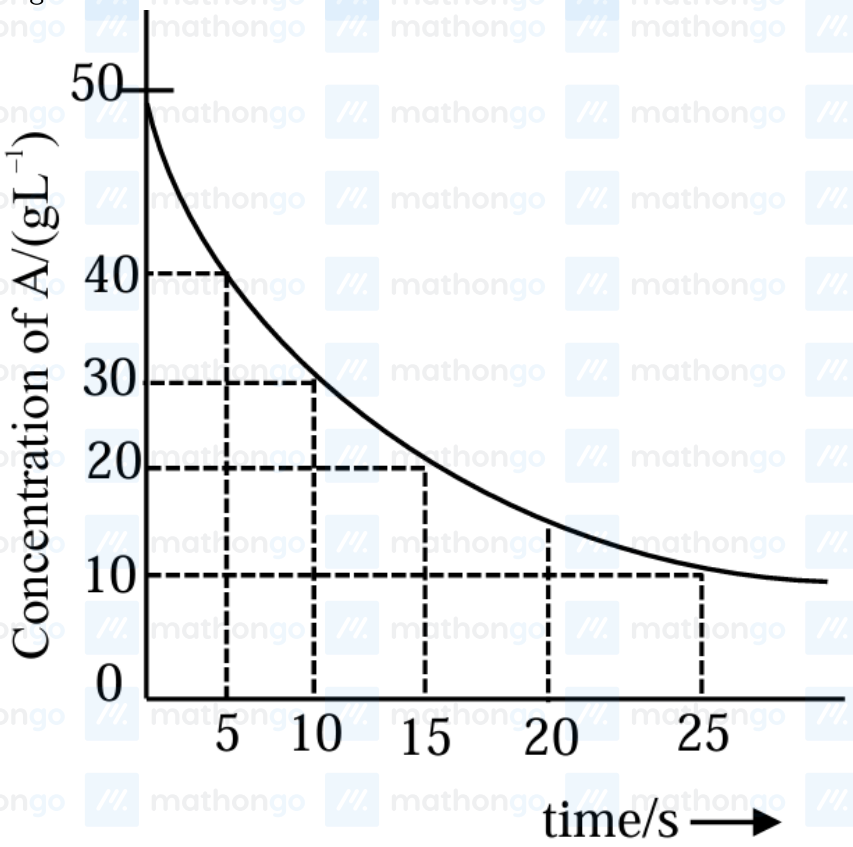
(2) The reaction never goes to completion

(3) Rate constant of the reaction is 1.693 min^{-1}

(4) Partial pressure of A after 10 minute is 40 mm Hg

Q3. For the reaction $A \rightarrow B$ the following graph was obtained. The time required (in seconds) for the concentration of A to reduce to 2.5 g L^{-1} (if the initial concentration of A was 50 g L^{-1}) is _____ (Nearest integer)

Given : $\log 2 = 0.3010$



Q4. $A(g) \rightarrow B(g) + C(g)$ is a first order reaction.

Time	T	∞
$\mathbf{P}_{\text{system}}$	P_t	P_∞

The reaction was started with reactant A only. Which of the following expression is correct for rate constant k ?

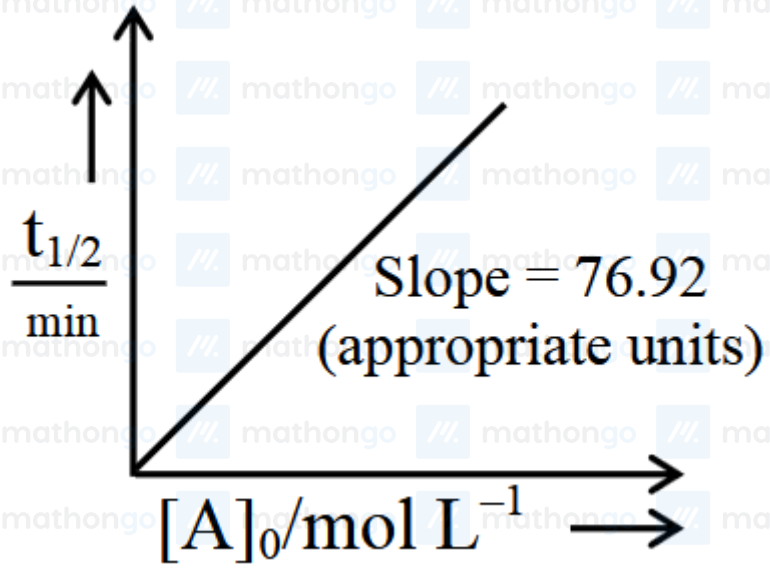
(1) $k = \frac{1}{t}\ln\frac{2(p_\infty - P_t)}{P_t}$

(2) $k = \frac{1}{t}\ln\frac{p_\infty}{P_t}$

(3) $k = \frac{1}{t}\ln\frac{p_\infty}{2(p_\infty - P_t)}$

(4) $k = \frac{1}{t}\ln\frac{p_\infty}{(p_\infty - P_t)}$

Q5. For the reaction $A \rightarrow$ products.



The concentration of A at 10 minutes is _____ $\times 10^{-3}$ mol L^{-1} (nearest integer).
The reaction was started with 2.5 mol L^{-1} of A.

Q6. In a reaction $A + B \rightarrow C$, initial concentrations of A and B are related as $[A]_0 = 8[B]_0$. The half lives of A and B are 10 min and 40 min. respectively. If they start to disappear at the same time, both following first order kinetics, after how much time will the concentration of both the reactants be same?

(1) 60 min

(2) 80 min

(3) 20 min

(4) 40 min

Q7. Half life of zero order reaction A $\rightarrow$ product is 1 hour, when initial concentration of reaction is 2.0 mol L L^{-1}. The time required to decrease concentration of A from 0.50 to 0.25 mol L^{-1} is:

(1) 0.5 hour

(2) 4 hour

(3) 15 min

(4) 60 min

Q8. In a first order decomposition reaction, the time taken for the decomposition of reactant to one fourth and one eighth of its initial concentration are t_1 and $t_2(s)$, respectively. The ratio t_1/t_2 will :

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

(2) $\frac{3}{2}$

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

(4) $\frac{2}{3}$

Q9. Consider the following statements related to temperature dependence of rate constants.

Identify the correct statements,

A. The Arrhenius equation holds true only for an elementary homogenous reaction.

B. The unit of A is same as that of k in Arrhenius equation.

C. At a given temperature, a low activation energy means a fast reaction.

D. A and Ea as used in Arrhenius equation depend on temperature.

E. When $Ea \gg RT$. A and Ea become interdependent.

Choose the correct answer from the options given below :

(1) A, C and D Only

(2) B , D and E Only

(3) B and C Only

(4) A and B Only

Q10. For $A_2 + B_2 \rightleftharpoons 2AB$

E_a for forward and backward reaction are 180 and 200 kJ mol^{-1} respectively

If catalyst lowers E_a for both reaction by 100 kJ mol^{-1}.

Which of the following statement is correct?

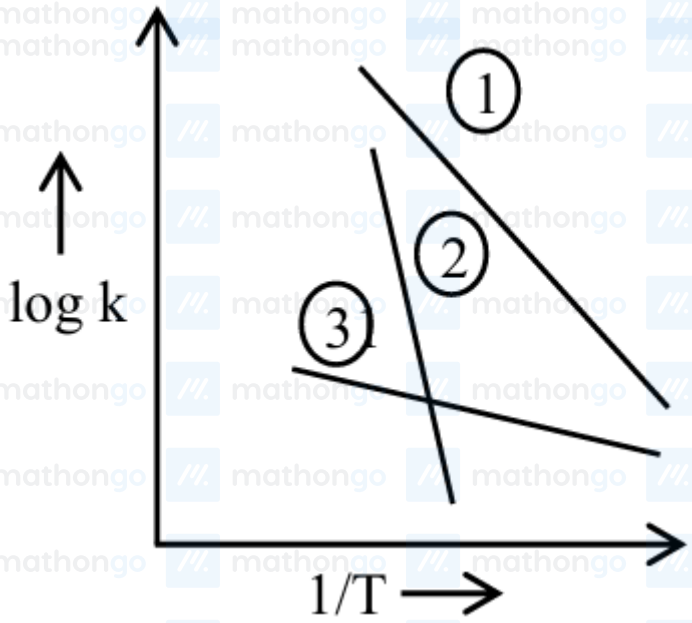
(1) Catalyst does not alter the Gibbs energy change of a reaction.

(2) Catalyst can cause non-spontaneous reactions to occur.

(3) The enthalpy change for the reaction is $+20$ kJ mol^{-1}.

(4) The enthalpy change for the catalysed reaction is different from that of uncatalysed reaction.

Q11. Consider the following plots of log of rate constant $k(\log k)$ vs $\frac{1}{T}$ for three different reactions. The correct order of activation energies of these reactions is



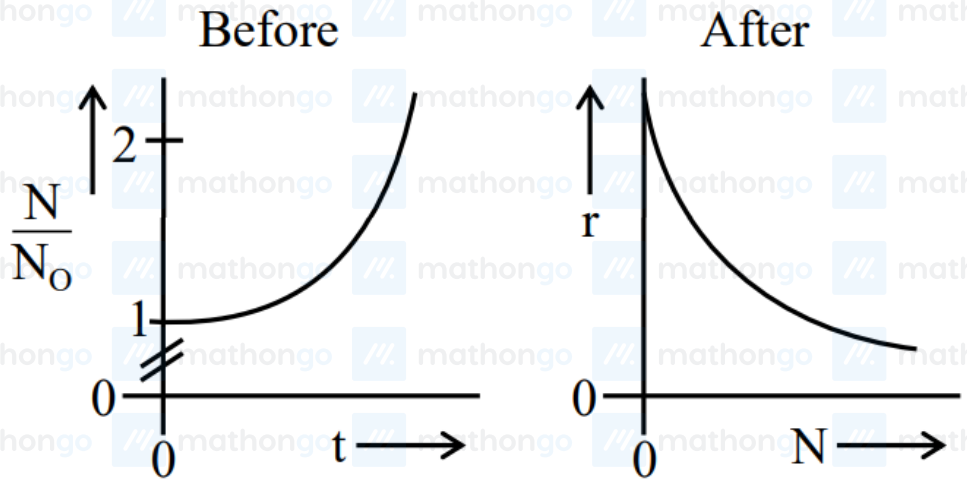
(1) $Ea_2 > Ea_1 > Ea_3$

(2) $Ea_1 > Ea_3 > Ea_2$

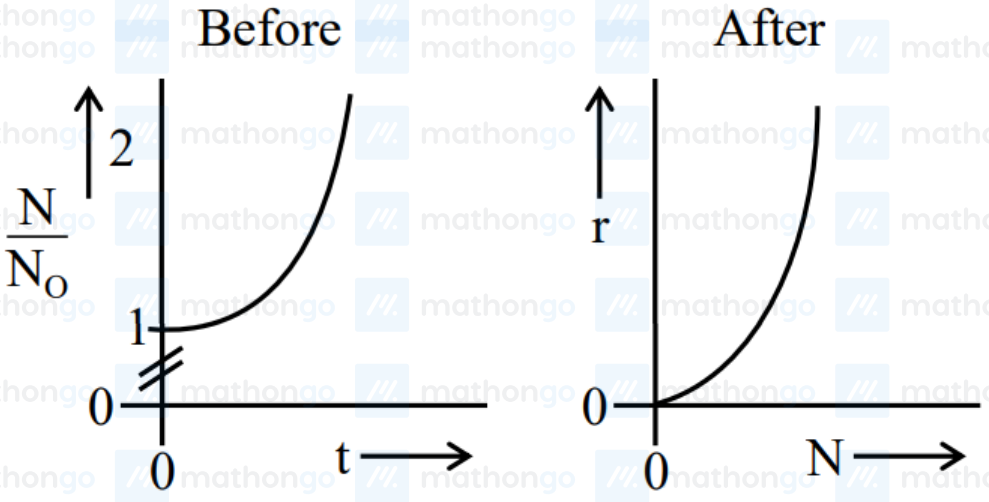
(3) $Ea_1 > Ea_2 > Ea_3$

(4) $Ea_3 > Ea_2 > Ea_1$

Q12. A person's wound was exposed to some bacteria and then bacteria growth started to happen at the same place. The wound was later treated with some antibacterial medicine and the rate of bacterial decay (r) was found to be proportional with the square of the existing number of bacteria at any instance. Which of the following set of graphs correctly represents the 'before' and 'after' situation of the application of the medicine?
[Given : N = No. of bacteria, t = time, bacterial growth follows I^{st} order kinetics.]



(1)



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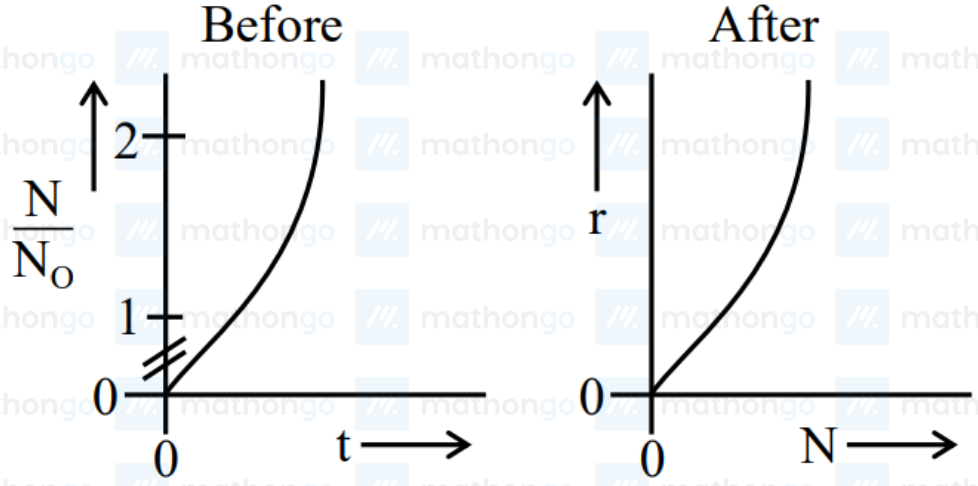
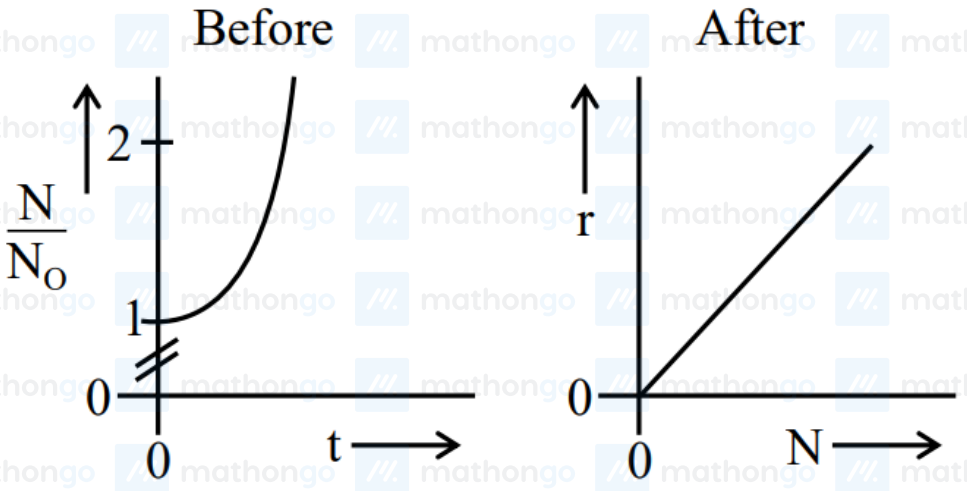


(3)



(4)

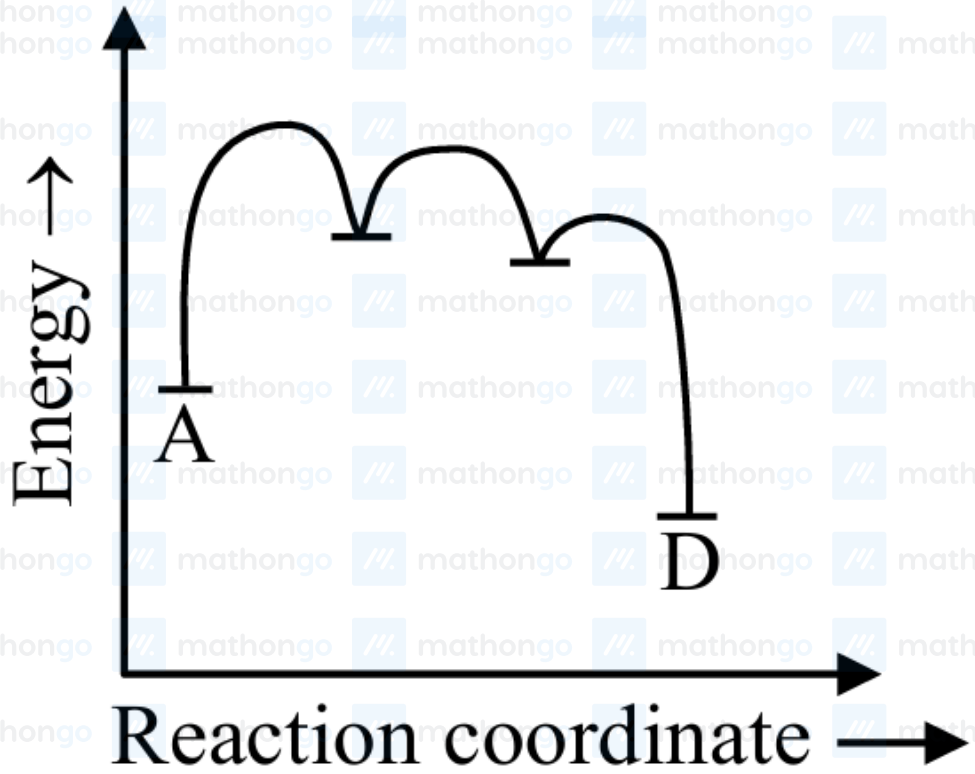
Q13. Reactant A converts to product D through the given mechanism (with the net evolution of heat) :

$A \rightarrow B$ slow ; $\Delta H = +ve$

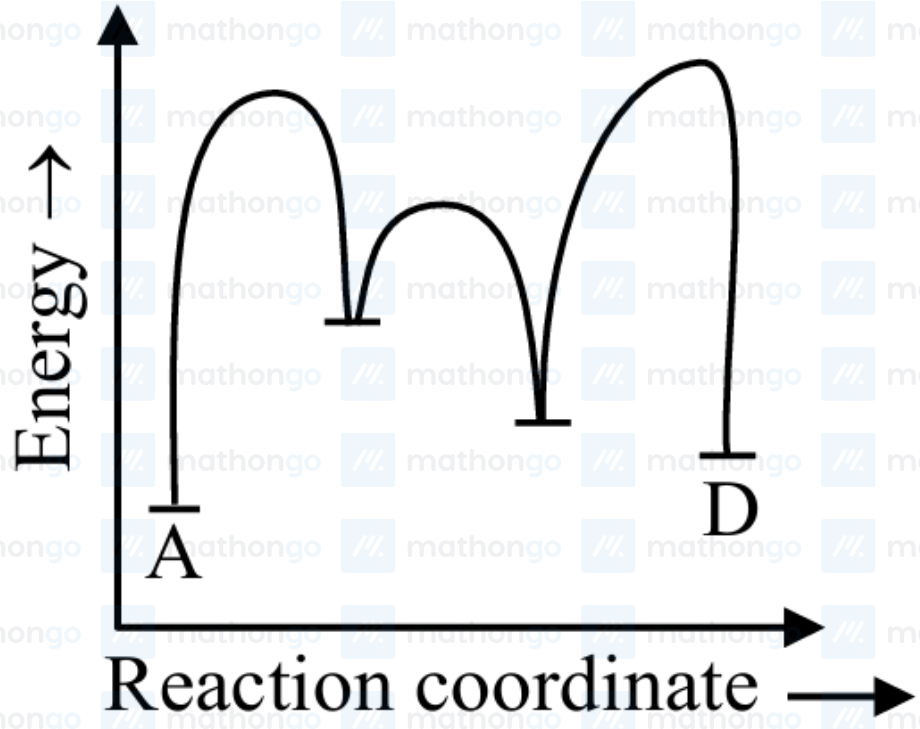
$B \rightarrow C$ fast; $\Delta H = -ve$

$C \rightarrow D$ fast ; $\Delta H = -ve$

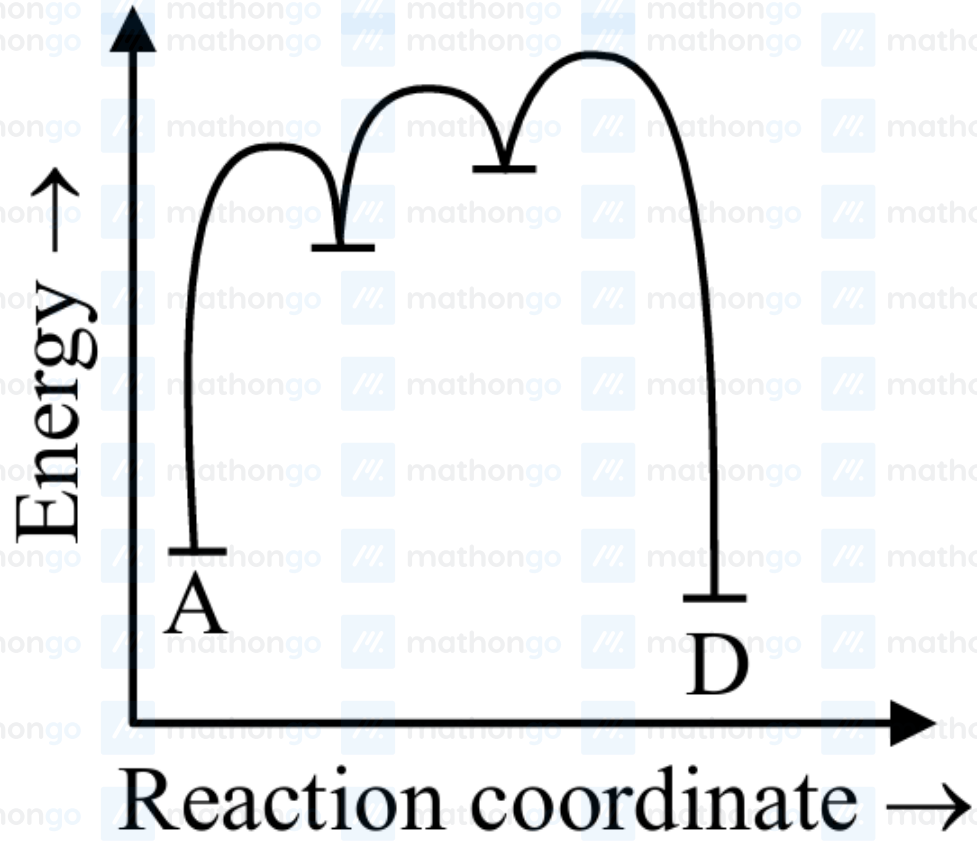
Which of the following represents the above reaction mechanism?


Energy
A
D
Reaction coordinate

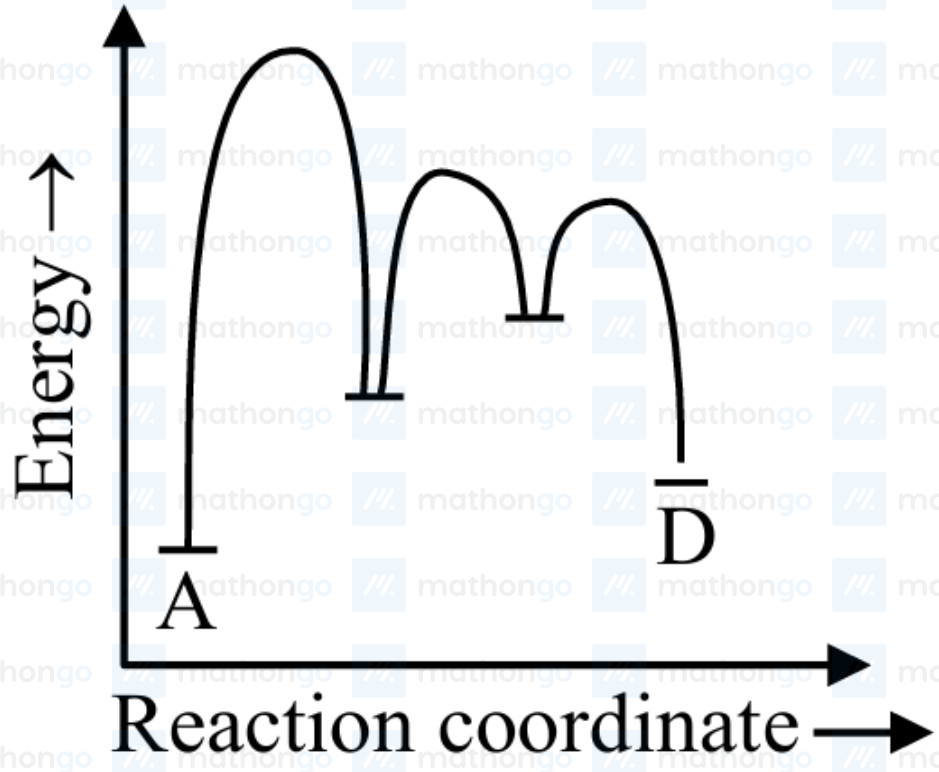
(1)


Energy
A
D
Reaction coordinate

(2)


Energy →
A
D
Reaction coordinate →

(3)


Energy →
A
D
Reaction coordinate →

(4)

Q1. Match the LIST-I with LIST-II.

	LIST-I (Family)		LIST-II (Symbol of Element)
A.	Pnicogen (group 15)	I.	Ts
B.	Chalcogen	II.	Og
C.	Halogen	III.	Lv
D.	Noble gas	IV.	Mc

Choose the correct answer from the options given below :

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

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

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

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

Q2. Given below are two statements :

Statement (I): The metallic radius of Al is less than that of Ga.

Statement (II) : The ionic radius of Al^{3+} is less than that of Ga^{3+}.

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) Statement I is incorrect but Statement II is correct

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

(4) Both Statement I and Statement II are correct

Q3. Given below are the pairs of group 13 element showing their relation in terms of atomic radius.

$(B < Al), (Al < Ga), (Ga < In)$ and $(In < Tl)$

Identify the elements present in the incorrect pair and in that pair find out the element (X) that has higher ionic radius $\left(M^{3+}\right)$ that the other one. The atomic number of the element (X) is

(1) 31

(2) 49

(3) 13

(4) 81

Q4. The atomic number of the element from the following with lowest 1^{st} ionisation enthalpy is :

(1) 32

(2) 35

(3) 87

(4) 19

Q5. The property/properties that show irregularity in first four elements of group-17 is/are :

(A) Covalent radius

(B) Electron affinity

(C) Ionic radius

(D) First ionization energy

Choose the correct answer from the options given below:

(1) B and D only

(2) A and C only

(3) B only

(4) A, B, C and D

Q6. The correct statements from the following are :

(A) Tl^{3+} is a powerful oxidising agent

(B) Al^{3+} does not get reduced easily

(C) Both Al^{3+} and Tl^{3+} are very stable in solution

(D) $Tl^{+}$is more stable than Tl^{3+}

(E) Al^{3+} and $Tl^{+}$are highly stable

Choose the correct answer from the options given below :

(1) (A), (B), (C), (D) and (E)

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

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

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

Q7. Electronic configuration of four elements A, B, C and D are given below :

(A) $1\ s^2 2\ s^2 2p^3$

(B) $1\ s^2 2\ s^2 2p^4$

(C) $1\ s^2 2\ s^2 2p^5$

(D) $1\ s^2 2\ s^2 2p^2$

Which of the following is the correct order of increasing electronegativity (Pauling's scale)?

(1) A < D < B < C

(2) A < C < B < D

(3) A < B < C < D

(4) D < A < B < C

Q8. Which of the following statements are correct?

A. The process of the addition an electron to a neutral gaseous atom is always exothermic

B. The process of removing an electron from an isolated gaseous atom is always endothermic

C. The 1^{st} ionization energy of the boron is less than that of the beryllium

D. The electronegativity of C is 2.5 in CH_4 and CCl_4

E. Li is the most electropositive among elements of group I

Choose the correct answer from the options gives below

(1) B & C only

(2) A, C and d only

(3) B and D only

(4) B,C and E only

Q9. The correct orders among the following are

Atomic radius : B < Al < Ga < In < Tl

Electronegativity : Al < Ga < In < Tl < B

Density : Tl < In < Ga < Al < B

1st Ionisation Energy : In < Al < Ga < Tl < B

Choose the correct answer from the options given below :

(1) B and D Only

(2) A and C Only

(3) C and D Only

(4) A and B Only

Q10. The elements of Group 13 with highest and lowest first ionisation enthalpies are respectively:

(1) B & Ga

(2) B & Tl

(3) Tl & B

(4) B & In

Q11. Choose the incorrect trend in the atomic radii (r) of the elements :

(1) $r_{Br} < r_K$

(2) $r_{Mg} < r_{Al}$

(3) $r_{Rb} < r_{Cs}$

(4) $r_{Rb} < r_{Cs}$

Q1. In 3, 3-dimethylhex-1-ene-4-yne, there are _____ sp^3, _____ sp^2 and _____ sp hybridised carbon atoms respectively :

(1) 4,2,2

(2) 3,3,2

(3) 2,4,2

(4) 2,2,4

Q2. Among SO_2, NF_3, NH_3, XeF_2, ClF_3 and SF_4, the hybridization of the molecule with non-zero dipole moment and highest number of lone-pairs of electrons on the central atom is

(1) sp^3

(2) dsp^2

(3) $sp^3 d^2$

(4) $sp^3 d$

Q3. A molecule with the formula AX_4Y has all it's elements from p-block. Element A is rarest, monoatomic, non-radioactive from its group and has the lowest ionization enthalpy value among A, X and Y. Elements X and Y have first and second highest electronegativity values respectively among all the known elements. The shape of the molecule is :

(1) Square pyramidal

(2) Octahedral

(3) Pentagonal planar

(4) Trigonal bipyramidal

Q4. Which among the following molecules is (a) involved in $sp^3 d$ hybridization, (b) has different bond lengths and (c) has lone pair of electrons on the central atom?

(1) PF_5

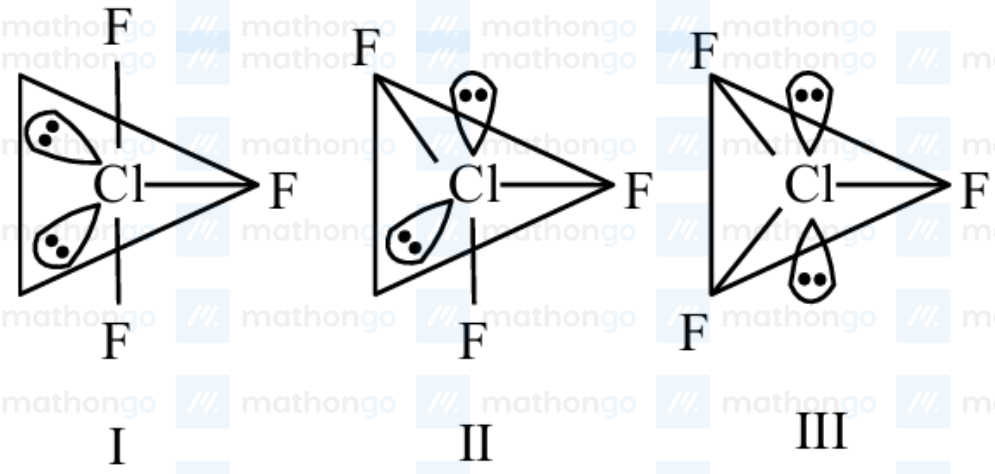
(2) XeF_4

(3) SF_4

(4) XeF_2

Q5. Given below are two statements:

Statement (I) : for F_3, all three possible structures may be drawn as follows.



Statement (II) : Structure III is most stable, as the orbitals having the lone pairs are axial, where the $\ell p - bp$ repulsion is minimum.

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.

Q6.

LIST-I Molecule/ion		**LIST-II Bond pair : lone pair (on the central atom)**	
A.	ICl_2^-	I.	4 : 2
B.	H_2O	II.	4 : 1
C.	SO_2	III.	2 : 3
D.	XeF_4	IV.	2 : 2

Match the **LIST-I** with**LIST-II**.

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-II, B-I, C-IV, D-III

Q7. In SO_2, NO_2^- and N_3^- the hybridizations at the central atom are respectively :

(1) sp^2, sp^2 and sp

(2) sp^2, sp and sp

(3) sp^2, sp^2 and sp^2

(4) sp, sp^2 and sp

Q8. Which of the following molecules(s) show/s paramagnetic behavior?

(A) O_2
(B) N_2
(C) F_2
(D) S_2
(E) Cl_2

Choose the correct answer from the options given below :

(1) B only

(2) A & C only

(3) A & E only

(4) A & D only

Q9. A metal complex with a formula $MC\ell_4 \cdot 3NH_3$ is involved in $sp^3\ d^2$ hybridisation. It upon reaction with excess of $AgNO_3$ solution gives ' x ' moles of AgCl. Consider ' x ' is equal to the number of lone pairs of electron present in central atom of BrF_5. Then the number of geometrical isomers exhibited by the complex is _____.

Q1. Given below are two statements :
Statement (I) : The first ionisation enthalpy of group 14 elements is higher than the corresponding elements of group 13.
Statement (II) : Melting points and boiling points of group 13 elements are in general much higher than those of the corresponding elements of group 14. In the light of the above statements, choose the most appropriate answer from the options given below :

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

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

(3) Both Statement I and Statement II are incorrect

(4) Both Statement I and Statement II are correct

Q2. The group 14 elements A and B have the first ionisation enthalpy values of 708 and 715 kJ mol^{-1} respectively. The above values are lowest among their group members. The nature of their ions A^{2+} B^{4+} respectively is

(1) both reducing

(2) both oxidising

(3) reducing and oxidising

(4) oxidising and reducing

Q1. Given below are two statements
Statement I : The N-N single bond is weaker and longer than that of $P-P$ single bond
Statement II : Compounds of group 15 elements in +3 oxidation states readily undergo disproportionation reactions.
In the light of 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

Q2. Given below are two statements :
Statement I : Nitrogen forms oxides with +1 to +5 oxidation states due to the formation of $p\pi - p\pi$ bond with oxygen.
Statement II : Nitrogen does not form halides with +5 oxidation state due to the absence of d-orbital in it.
In the light of given 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

Q3. The nature of oxide (TeO_2) and hydride (TeH_2) formed by Te , respectively are :

(1) Oxidising and acidic

(2) Reducing and basic

(3) Reducing and acidic

(4) Oxidising and basic

Q4. Given below are two statements :
Statement I: H_2Se is more acidic than H_2Te.
Statement II : H_2Se has higher bond enthalpy for dissociation than H_2Te.
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 true but Statement II is false.

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

Q1. Pair of transition metal ions having the same number of unpaired electrons is :

(1) V^{2+}, Co^{2+}

(2) Ti^{i+}, Co^{2+}

(3) Fe^{3+}, Cr^{2+}

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

Q2. The metal ions that have the calculated spin only magnetic moment value of 4.9 B.M. are

A. Cr^{2+}

B. Fe^{2+}

C. Fe^{3+}

D. Co^{2+}

E. Mn^{3+}

Choose the correct answer from the options given below

(1) A, C and E only

(2) A, D and E only

(3) B and E only

(4) A, B and E only

Q3. Given below are two statements :

Statement I : CrO_3 is a stronger oxidizing agent than MoO_3

Statement II : Cr(VI) is more stable than Mo(VI)

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

Q4. Among, Sc, Mn, Co and Cu , identify the element with highest enthalpy of atomisation. The spin only magnetic moment value of that element in its +2 oxidation state is _____ BM (in nearest integer).

Q5. The number of valence electrons present in the metal among Cr, Co, Fe and Ni which has the lowest enthalpy of atomisation is

(1) 8

(2) 9

(3) 6

(4) 10

Q6. The first transition series metal ' M ' has the highest enthalpy of atomisation in its series. One of its aquated ion $\left(M^{n\dagger}\right)$ exists in green colour. The nature of the oxide formed by the above M^{n-} ion is :

(1) neutral

(2) acidic

(3) basic

(4) amphoteric

Q7. ' X ' is the number of acidic oxides among $VO_2, V_2O_3, CrO_3, V_2O_5$ and Mn_2O_7. The primary valency of cobalt in $\left[Co(H_2NCH_2CH_2NH_2)_3\right]_2(SO_4)_3$ is Y. The value of $X + Y$ is :

(1) 5

(2) 4

(3) 2

(4) 3

Q8. The correct decreasing order of spin only magnetic moment values (BM) of Cu^+, Cu^{2+}, Cr^{2+} and Cr^{3+} ions is :

(1) $Cu^+ > Cu^{2+} > Cr^{3+} > Cr^{2+}$

(2) $Cu^{2+} > Cu^+ > Cr^{2+} > Cr^{3+}$

(3) $Cr^{2+} > Cr^{3+} > Cu^{2+} > Cu^+$

(4) $Cr^{3+} > Cr^{2+} > Cu^+ > Cu^{2+}$

Q9. Consider the following reactions

$$A + \underset{\text{Little amount}}{NaCl} + H_2SO_4 \rightarrow CrO_2Cl_2 + \text{Side Products}$$

$$CrO_2Cl_{2(\text{Vapour})} + NaOH \rightarrow B + NaCl + H_2O$$

$$B + H^+ \rightarrow C + H_2O$$

The number of terminal ' O ' present in the compound ' C ' is _____.

Q10. The incorrect relationship in the following pairs in relation to ionisation enthalpies is :

(1) $Mn^{+} < Cr^{+}$

(2) $Mn^{+} < Mn^{2+}$

(3) $Fe^{2+} < Fe^{3+}$

(4) $Mn^{2+} < Fe^{2+}$

Q11. $KMnO_4$ acts as an oxidising agent in acidic medium. ' X ' is the difference between the oxidation states of Mn in reactant and product. ' Y ' is the number of ' d ' electrons present in the brown red precipitate formed at the end of the acetate ion test with neutral ferric chloride. The value of $X + Y$ is _____.

Q1. The d-orbital electronic configuration of the complex among $[Co(en)_3]^{3+}$, $[CoF_6]^{3-}$, $[Mn(H_2O)_6]^{2+}$ and $[Zn(H_2O)_6]^{2+}$ that has the highest CFSE is :

(1) $t_2^6 g_g^0$

(2) $t_2^6 e_g^4$

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

(4) $t_2^4 e_g^2$

Q2. The correct order of $[FeF_6]^{3-}$, $[CoF_6]^{3-}$, $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ complex species based on the number of unpaired electrons present is :

(1) $[FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CN)_4]^{2-} > [Ni(CO)_4]$

(2) $[Ni(CN)_4]^{2-} > [FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CO)_4]$

(3) $[CoF_6]^{3-} > [FeF_6]^{3-} > [Ni(CO)_4] > [Ni(CN)_4]^{2-}$

(4) $[FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CN)_4]^{2-} = [Ni(CO)_4]$

Q3. Match List-I with List-II

List-I Complex		**List-II Primary valency and Secondary valency**	
(A)	$[Co(en)_2Cl_2]Cl$	(I)	3 6
(B)	$[Pt(NH_3)_2Cl(NO_2)]$	(II)	3 4
(C)	$Hg[Co(SCN)_4]$	(III)	2 6
(D)	$[Mg(EDTA)]^{2-}$	(IV)	2 4

Choose the correct answer from the options given below :

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

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

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

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

Q4. Given below are two statements :

Statement I : A homolepitc octahedral complex, formed using monodentate ligands, will not show

stereoisomerism.
Statement II : cis- and trans- platin are heteroleptic complexes of Pd.
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) Both statement I and Statement II are true.

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

Q5. The number of optical isomers exhibited by the iron complex (A) obtained from the following reaction is

$$\underline{\qquad\qquad}$$
$$FeCl_3 + KOH + H_2C_2O_4 \rightarrow A$$

Q6. Number of stereoisomers possible for the complexes, $[CrCl_3(py)_3]$ and $[CrCl_2(ox)_2]^{3-}$ are respectively
(py = pyridine, ox = oxalate)

(1) 3&3

(2) 2&2

(3) 2&3

(4) 1&2

Q7. An octahedral complex having molecular composition Co. $5NH_3$. Cl. SO_4 has two isomers A and B. The solution of A gives a white precipitate with $AgNO_3$ solution and the solution of B gives white precipitate with $BaCl_2$ solution. The type of isomerism exhibited by the complex is,

(1) Co-ordinate isomerism

(2) Linkage isomerism

(3) Ionisation isomerism

(4) Geometrical isomerism

Q8. The type of hybridization and the magnetic property of $[MnCl_6]^{3-}$ are :

(1) d^2sp^3, paramagnetic with four unpaired electrons

(2) $sp^3\ d^2$, paramagnetic with four unpaired electrons

(3) d^2sp^3, paramagnetic with two unpaired electrons

(4) $sp^3\ d^2$, paramagnetic with two unpaired electrons

Q9. The spin-only magnetic moment value of M^{n+-} ion formed among Ni, ZnMn and Cu that has the least enthalpy of atomisation is _____. (in nearest integer)

Here n is equal to the number of diamagnetic complexes among $K_2[NiCl_4]$, $[Zn(H_2O)_6]Cl_2$, $K_3[Mn(CN)_6]$ and $[Cu(PPh_3)_3I]$

Q10. Match the LIST-I with LIST-II

LIST-I (Molecules/ion)		LIST-II (Hybridisation of central atom)	
A.	PF_5	I	dsp^2
B.	SF_6	II.	sp^3d
C.	$Ni(CO)_4$	III.	sp^3d^2
D.	$[PtCl_4]^{2-}$	IV.	sp^3

Choose the correct answer from the options given below :

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

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

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

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

Q11. Which one of the following complexes will have $\Delta_0 = 0$ and $\mu = 5.96$ B.M.?

(1) $[Fe(CN)_6]^4$

(2) $[CO(NH_3)_6]^{3+}$

(3) $[FeF_6]^4$

(4) $[Mn(SCN)_6]^4$

Q12. The number of paramagnetic complex among $[FeF_6]^{3-}$, $[Fe(CN)_6]^{3-}$, $[Mn(CN)_6]^{3-}$, $[Co(C_2O_4)_3]^{3-}$, $[MnCl_6]^{3-}$ and $[CoF_6]^{3-}$, which involved d^2sp^3 hybridization is ____

Q13. The number of unpaired electrons responsible for the paramagnetic nature of the following complex species are respectively:

$[Fe(CN)_6]^{3-}, [FeF_6]^{3-}, [CoF_6]^{3-}, [Mn(CN)_6]^{3-}$

(1) 1, 5, 4, 2

(2) 1, 5, 5, 2

(3) 1, 1, 4, 2

(4) 1.4.4.2

Q14. The number of paramagnetic metal complex species among $[Co(NH_3)_6]^{3+}$, $[Co(C_2O_4)_3]^{3-}$, $[MnCl_6]^{3-}$, $[Mn(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Fe(CN)_6]^{3^{3-}}$ and $[FeF_6]^{3-}$ with same number of unpaired electrons is _____.

Q15. The number of species from the following that are involved in sp^3d^2 hybridization is

$[Co(NH_3)_6]^{3+}$, SF_6, $[CrF_6]^{3-}$, $[CoF_6]^{3-}$, $[Mn(CN)_6]^{3-}$ and $[MnCl_6]^{3-}$

(1) 5

(2) 6

(3) 4

(4) 3

Q16. Match the LIST-I with LIST-II

	LIST-I (Complex/ Species)		LIST-II (Shape & magnetic moment)
A.	$[Ni(CO)_4]$	I.	Tetrahedral, 2.8 BM
B.	$[Ni(CN)_4]^{2-}$	II.	Square planar, 0 BM
C.	$[NiCl_4]^{2-}$	III.	Tetrahedral, 0 BM
D.	$[MnBr_4]^{2-}$	IV.	Tetrahedral, 5.9 BM

Choose the correct answer from the options given below :

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

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

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

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

Q17. Given below are two statements :

Statement (I) : In octahedral complexes, when $\Delta_o < P$ high spin complexes are formed. When $\Delta_o > P$ low spin complexes are formed.

Statement (II) : In tetrahedral complexes because of $\Delta_t < P$, low spin complexes are rarely formed.

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

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

(2) Both Statement I and Statement II are incorrect

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

(4) Both Statement I and Statement II are correct

Q18. A transition metal (M) among Mn, Cr, Co and Fe has the highest standard electrode potential $\left(M^{3+}/M^{2+}\right)$. It forms a metal complex of the type $[M(CN)_6]^{4-}$. The number of electrons present in the e_g orbital of the complex is _____.

Q19. The correct order of the complexes $\left[Co(NH_3)_5(H_2O)\right]^{3+}$ (A), $\left[Co(NH_3)_6\right]^{3+}$ (B), $[Co(CN)_6]^{3-}$ (C) and $\left[CoCl(NH_3)_5\right]^{2+}$ (D) in terms wavelength of light absorbed is :

(1) D>A>B>C

(2) C>B>D>A

(3) D>C>B>A

(4) C>B>A>D

Q20. Identify the diamagnetic octahedral complex ions from below ;

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

B. $\left[Co(NH_3)_6\right]^{3+}$

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

D. $\left[Co(H_2O)_3F_3\right]$

Choose the correct answer from the options given below :

(1) B and D Only

(2) A and D Only

(3) A and C Only

(4) B and C Only

Q21. ' X ' is the number of electrons in t_{2g} orbitals of the most stable complex ion among $\left[\mathrm{Fe}(\mathrm{NH_3})_6\right]^{3+}$, $\left[\mathrm{Fe}\left(\mathrm{Cl}_6\right)\right]^{3-}$, $\left[\mathrm{Fe}(\mathrm{C_2O_4})_3\right]^{3-}$ and $\left[\mathrm{Fe}(\mathrm{H_2O})_6\right]^{3+}$. The nature of oxide of vanadium of the type $\mathrm{V_2O_X}$ is:

(1) Acidic

(2) Neutral

(3) Basic

(4) Amphoteric

Q1. Formation of $Na_4[Fe(CN)_5NOS]$, a purple coloured complex formed by addition of sodium nitroprusside in sodium carbonate extract of salt indicates the presence of :

(1) Sodium ion

(2) Sulphate ion

(3) Sulphide ion

(4) Sulphite ion

Q2. When a salt is treated with sodium hydroxide solution it gives gas X. On passing gas X through reagent Y a brown coloured precipitate is formed. X and Y respectively, are

(1) $X = NH_3$ and $Y = HgO$

(2) $X = NH_3$ and $Y = K_2HgI_4 + KOH$

(3) $X = NH_4Cl$ and $Y = KOH$

(4) $X = HCl$ and $Y = NH_4Cl$

Q3. Choose the correct tests with respective observations.

(A) $CuSO_4$ (acidified with acetic acid) $+K_4[Fe(CN)_6] \rightarrow$ Chocolate brown precipitate.

(B) $FeCl_3 + K_4[Fe(CN)_6] \rightarrow$ Prussian blue precipitate.

(C) $ZnCl_2 + K_4[Fe(CN)_6]$, neutralised with $NH_4OH \rightarrow$ White or bluish white precipitate.

(D) $MgCl_2 + K_4[Fe(CN)_6] \rightarrow$ Blue precipitate.

(E) $BaCl_2 + K_4[Fe(CN)_6]$, neutralised with NaOH $\rightarrow$ White precipitate.

Choose the correct answer from the options given below :

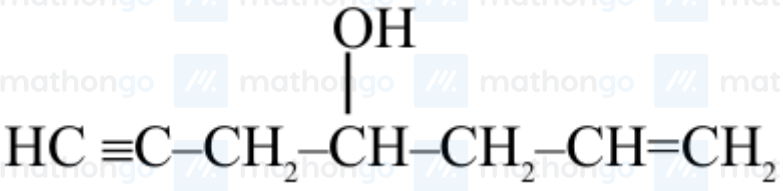
(1) A, D and E only

(2) B, D and E only

(3) A, B and C only

(4) C, D and E only

Q1. The IUPAC name of the following compound is -



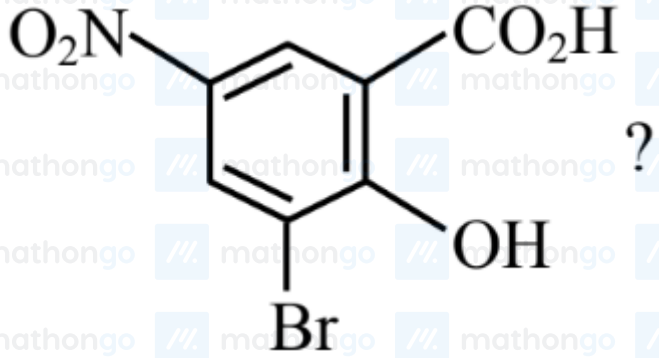
(1) 4-Hydroxyhept-1-en-6-yne

(2) 4- Hydroxyhept-6-en-1-yne

(3) Hept-6-en-1-yn-4-ol

(4) Hept-1-en-6-yn-4-ol

Q2. What is the correct IUPAC name of



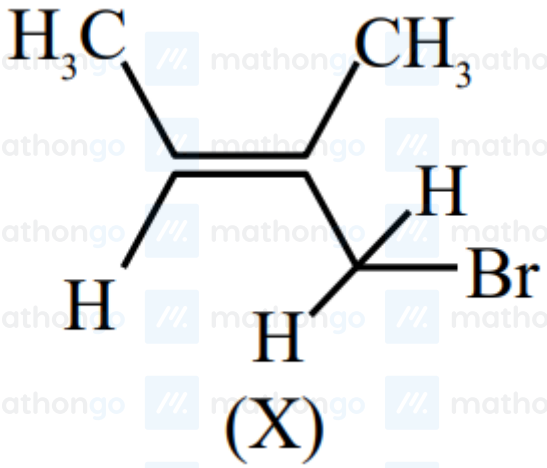
(1) 3-Bromo-2-hydroxy-5-nitrobenzoic acid

(2) 3-Bromo-4-hydroxy-1-nitrobenzoic acid

(3) 2-Hydroxy-3-bromo-5-nitrobenzoic acid

(4) 5-Nitro-3-bromo-2-hydroxybenzoic acid

Q3. Which of the following is the correct IUPAC name of given organic compound (X) ?



(X)

(1) 2-Bromo-2-methylbut-2-ene

(2) 3-Bromo-3-methylprop-2-ene

(3) 1-Bromo-2-methylbut-2-ene

(4) 4-Bromo-3-methylbut-2-ene

Q4. What is the correct IUPAC name of

?

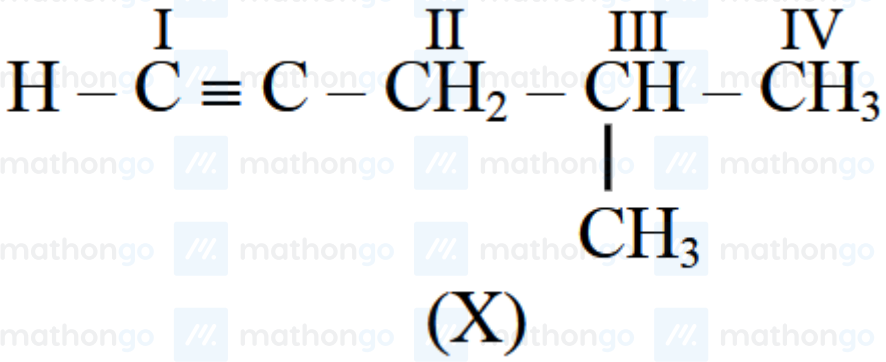
(1) 4-Ethyl-1-hydroxycyclopent-2-ene

(2) 1-Ethyl-3-hydroxycyclopent-2-ene

(3) 1-Ethylcyclopent-2-en-3-ol

(4) 4-Ethylcyclopent-2-en-1-ol

Q5. Consider the following compound (X)



(X)

The most stable and least stable carbon radicals, respectively, produced by homolytic cleavage of corresponding $C-H$ bond are :

(1) II, IV

(2) III, II

(3) I, IV

(4) II, I

Q6. Given below are two statements:

Statement I : Hyperconjugation is not a permanent effect.

Statement II : In general, greater the number of alkyl groups attached to a positively charged C -atom, greater is the hyperconjugation interaction and stabilization of the cation.

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

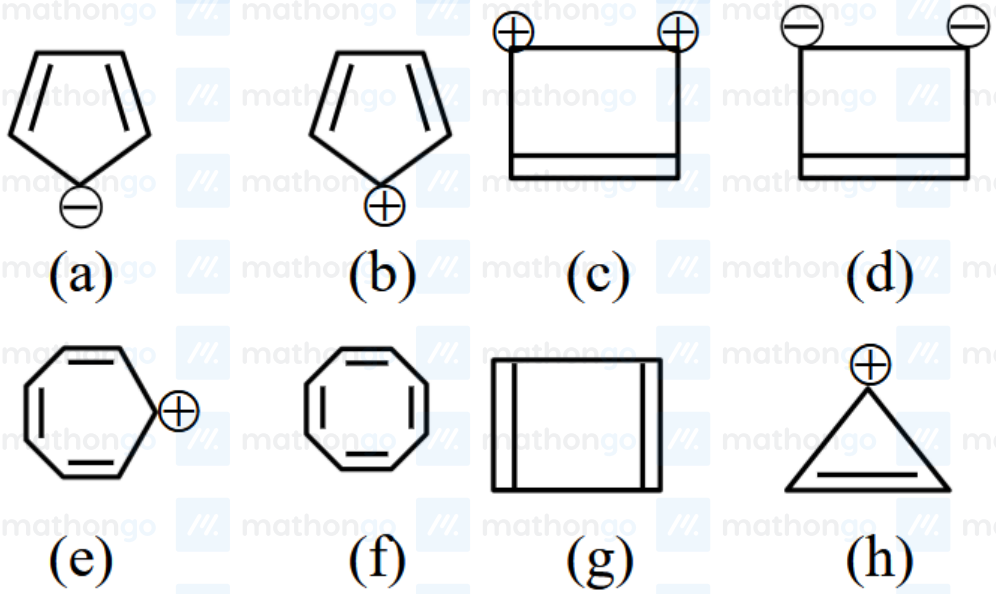
(1) Statement I is true but Statement II is false

(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

Q7. Designate whether each of the following compounds is aromatic or not aromatic.



(1) e, g aromatic and a, b, c, d, f, h not aromatic

(2) b, e, f, g aromatic and a, c, d, h not aromatic

(3) a, b, c, d aromatic and e, f, g, h not aromatic

(4) a, c, d, e, h aromatic and b, f, g not aromatic

Q8. Given below are two statements.

Statement I : The dipole moment of $\overset{4}{C}H_3-\overset{3}{C}H=\overset{2}{C}-\overset{1}{H}-O=O$ is greater than $\overset{4}{C}H_3-\overset{3}{C}H_2-\underset{C}{\overset{H}{C}}-2-\overset{1}{C}H=O$

Statement II : C_1-C_2 bond length of $\underset{4}{CH_3}-\underset{3}{CH}=\underset{2}{CH}-CH=O$ is greater than C_1-C_2 bond length of

$$\underset{4}{CH_3}-\underset{3}{CH_2}-\underset{2}{CH_2}-\underset{1}{CH}=O$$

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) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

Q9. Match the LIST-I with LIST-II

	LIST-I		LIST-II
A.	Carbocation	I.	Species that can supply a pair of electrons.
B.	C-Free radical	II.	Species that can receive a pair of electrons.
C.	Nucleophile	III.	sp^2 hybridized carbon with empty p-orbital.
D.	Electrophile	IV.	sp^2/sp^3 hybridized carbon with one unpaired electron.

Choose the correct answer from the options given below :

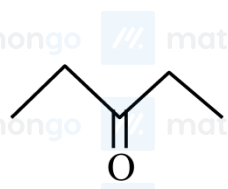
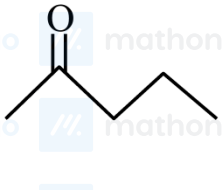
(1) A-IV, B-II, C-III, D-I

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

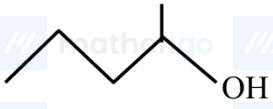
(3) A-III, B-IV, C-II, D-I

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

Q10. Identify the correct statements from the following

A.  and  are metamers

B.  and  are functional isomers

C.  and  are position isomers

D.  and  are homologous

Choose the correct answer from the options given below

(1) C & D only

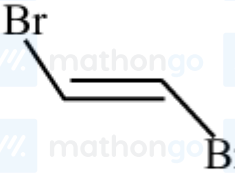
(2) B & C only

(3) A & B only

(4) A,B & C only

Q11. Given below are two statements :

Statement (I) :  is more polar than 

Statement (II) : Boiling point of  is lower than  but it is more polar than 

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

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

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

(3) Both statement I and statement II are incorrect

(4) Both statement I and statement II are correct

Q12. Match List-I with List-II

List-I (Purification technique)		List-II (Mixture of organic compounds)	
(A)	Distillation (simple)	(I)	Diesel + Petrol
(B)	Fractional distillation	(II)	Aniline + Water
(C)	Distillation under reduced pressure	(III)	Chloroform + Aniline
(D)	Steam distillation	(IV)	Glycerol + Spent-lye

Choose the correct answer from the options given below :

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

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

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

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

Q13. Match List-I with List-II -

	List-I (Separation of)		List-II (Separation Technique)
(A)	Aniline from aniline-water mixture	(I)	Simple distillation
(B)	Glycerol from spent-lye in soap industry	(II)	Fractional distillation
(C)	Different fractions of crude oil in petroleum industry	(III)	Distillation at reduced pressure
(D)	Chloroform-Aniline mixture	(IV)	Steam distillation

Choose the correct answer from the options given below :

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

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

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

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

Q14. In Dumas' method for estimation of nitrogen, 0.5 gram of an organic compound gave 60 mL of nitrogen collected at 300 K temperature and 715 mm Hg pressure. The percentage composition of nitrogen in the compound (Aqueous tension at 300 K = 15 mmHg) is

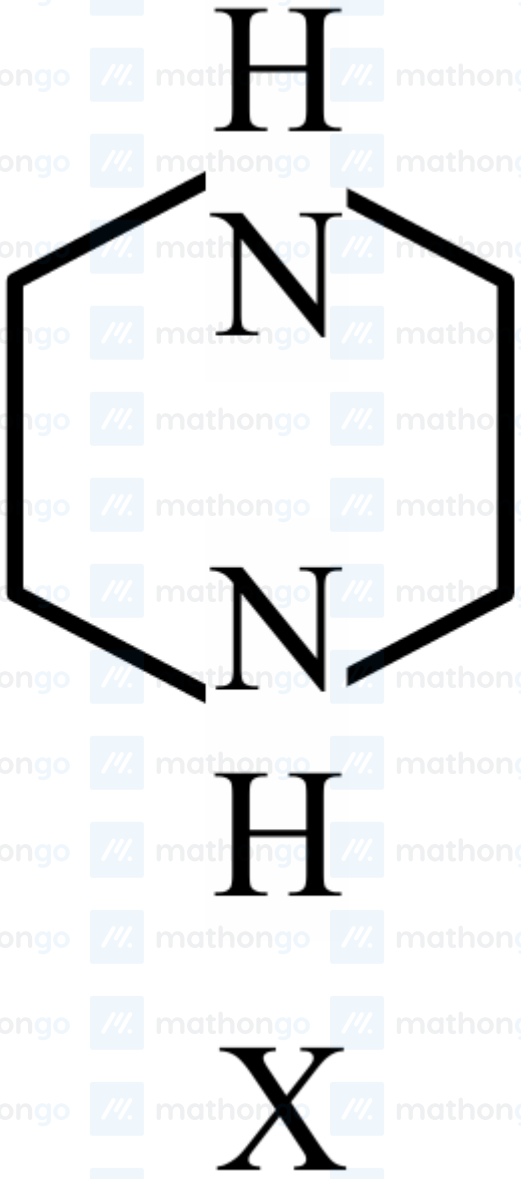
(1) 1.257

(2) 20.87

(3) 18.67

(4) 12.57

Q15. During estimation of nitrogen by Dumas' method of compound X(0.42 g) :



X

_____ mL of N_2 gas will be liberated at STP. (nearest integer)
(Given molar mass in $gmol^{-1}$: C : 12, H : 1, N : 14)

Q16. In Dumas' method for estimation of nitrogen 0.4 g of an organic compound gave 60 mL of nitrogen collected at 300 K temperature and 715 mm Hg pressure. The percentage composition of nitrogen in the compound is
(Given : Aqueous tension at 300 K = 15 mmHg)

(1) 15.71%

(2) 20.95%

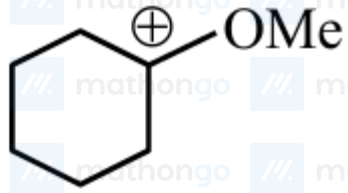
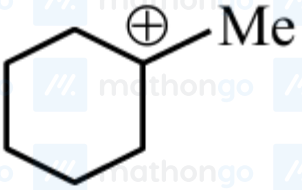
(3) 17.46%

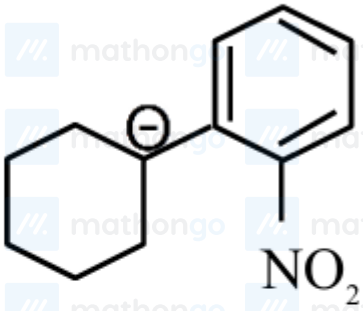
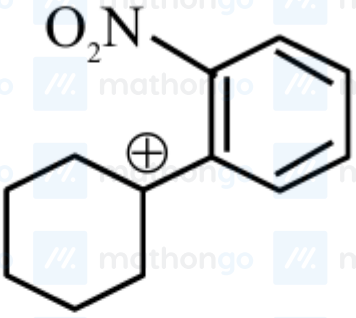
(4) 7.85%

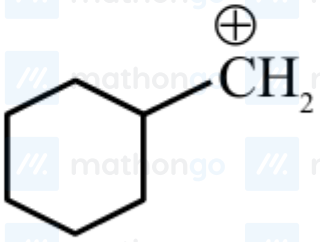
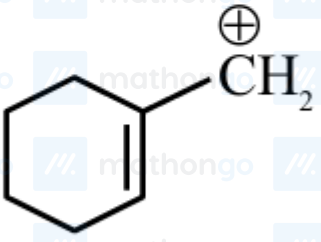
Q17. In Dumas' method for estimation of nitrogen 1 g of an organic compound gave 150 mL of nitrogen collected at 300 K temperature and 900 mm Hg pressure. The percentage composition of nitrogen in the compound is _____ % (nearest integer).
(Aqueous tension at 300 K = 15 mmHg)

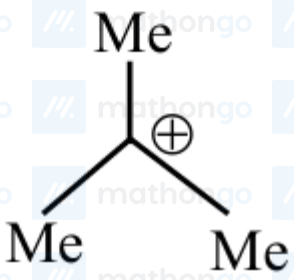
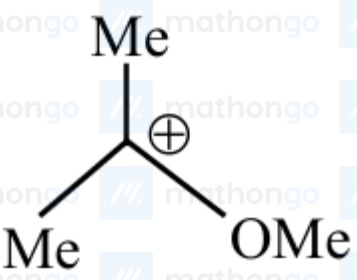
Q18. In Dumas' method 292 mg of an organic compound released 50 mL of nitrogen gas (N_2) at 300 K temperature and 715 mm Hg pressure. The percentage composition of ' N ' in the organic compound is _____ % (Nearest integer)
(Aqueous tension at 300 K = 15 mmHg)

Q19. In which pairs, the first ion is more stable than the second?

(A)  & 

(B)  & 

(C)  & 

(D)  & 

(1) (B) & (D) only

(2) (A) & (B) only

(3) (B) & (C) only

(4) (A) & (C) only

Q20. The total number of structural isomers possible for the substituted benzene derivatives with the molecular formula C_9H_{12} is _____.

Q1. 0.5 g of an organic compound on combustion gave 1.46 g of CO_2 and 0.9 g of H_2O. The percentage of carbon in the compound is _____. (Nearest integer) [Given : Molar mass (in $gmol^{-1}$) C : 12, H : 1, O: 16]

Q2. Given below are two statements :

Statement (I) : Neopentane forms only one monosubstituted derivative.

Statement (II) : Melting point of neopentane is higher than n-pentane

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

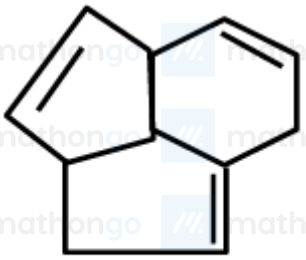
(1) Statement I is correct but Statement II is incorrect

(2) Both Statement I and Statement II are correct

(3) Both Statement I and Statement II are incorrect

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

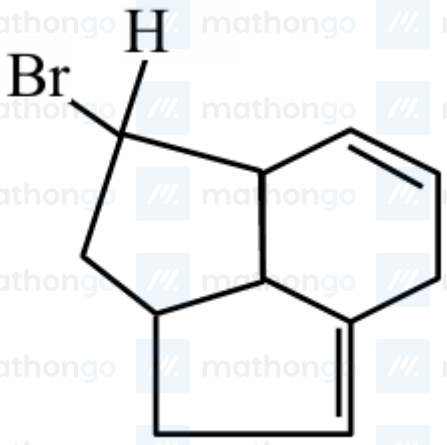
Q3. Consider the following molecule (X).

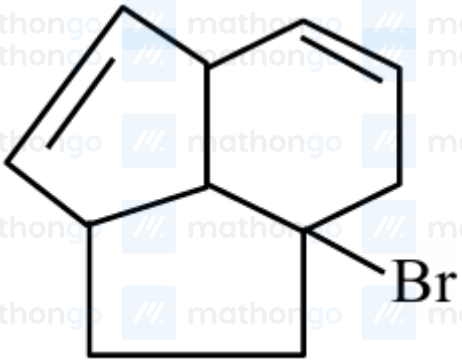


(X)

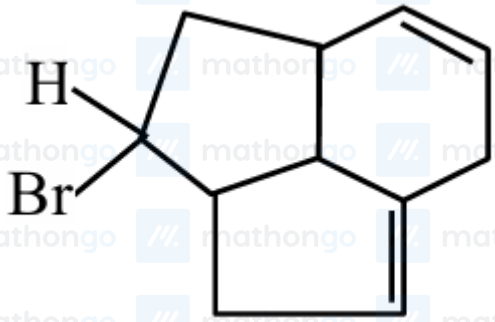
The structure of X is

(1)

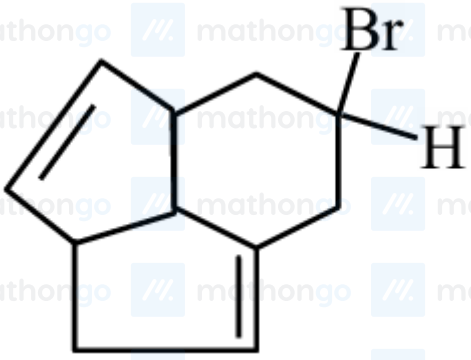




(2)

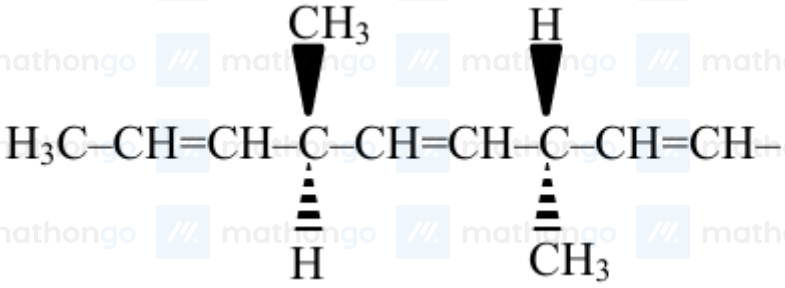


(3)



(4)

Q4. The number of optically active products obtained from the complete ozonolysis of the given compound is :



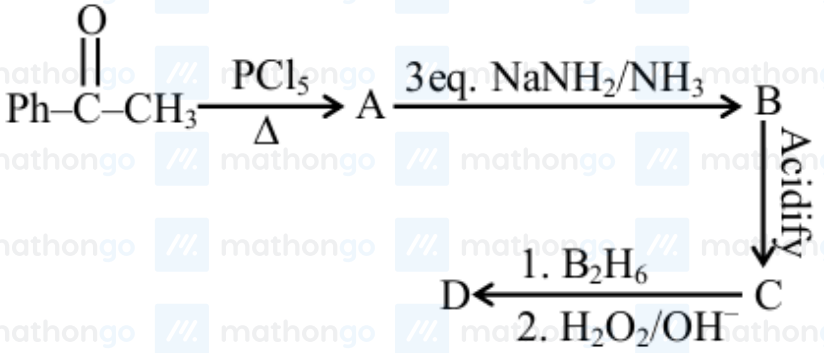
(1) 2

(2) 0

(3) 1

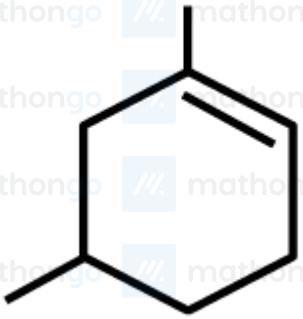
(4) 4

Q5. Identify the structure of the final product (D) in the following sequence of the reactions :



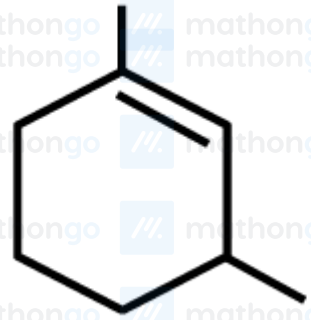
Total number of sp^2 hybridised carbon atoms in product D is.

Q6. Which compound would give 3-methyl-6oxoheptanal upon ozonolysis?

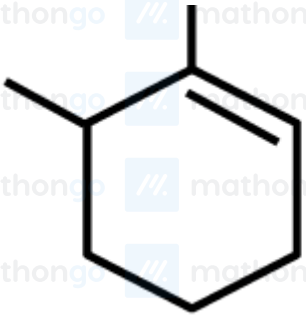


(1)

(2)



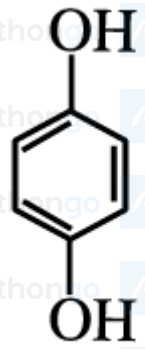
(3)



(4)

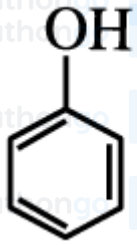
Q7. X g of nitrobenzene on nitration gave 4.2 g of m-dinitrobenzene.
X =_____ g. (nearest integer)
[Given : molar mass (in $gmol^{-1}$) C : 12, H : 1, O : 16, N : 14]

Q8. Benzene is treated with oleum to produce compound (X) which when further heated with molten sodium hydroxide followed by acidification produces compound (Y).The compound Y is treated with zinc metal to produce compound (Z). Identify the structure of compound (Z) from the following option.

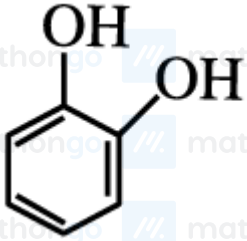


(1)

(2)

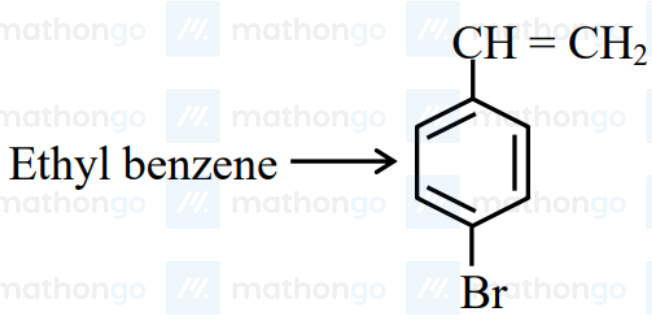


(3)



(4)

Q9. Choose the correct set of reagents for the following conversion.



(1) $Br_2/Fe; Cl_2, \Delta$; alc. KOH

(2) $Cl_2/Fe; Br_2/$ anhy. $AlCl_3$; aq. KOH

(3) $Br_2/$ anhy. $AlCl_3; Cl_2, \Delta$; aq. KOH

(4) $Cl_2/$ anhy. $AlCl_3; Br_2/Fe$; alc. KOH

Q10. Given below are two statements :

Statement I : Ozonolysis followed by treatment with Zn, H_2O of cis-2-butene gives ethanal.**Statement II :** The production obtained by ozonolysis followed by treatment with Zn, H_2O of 3, 6-dimethyloct-4-ene has no chiral carbon atom.

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

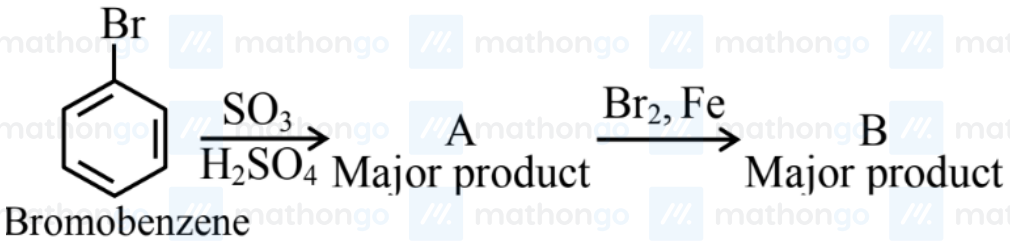
(1) Both Statement I and Statement II are true

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

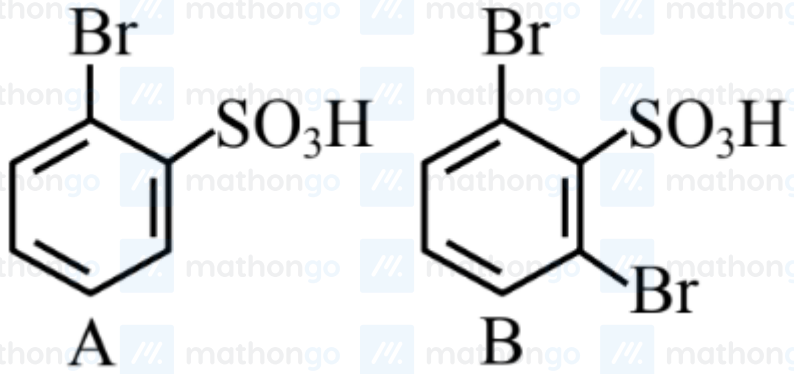
(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are false

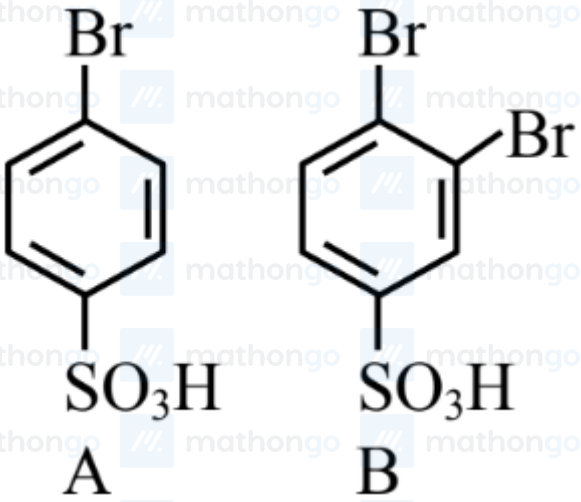
Q11. In the following series of reactions identify the major products A \& B respectively.



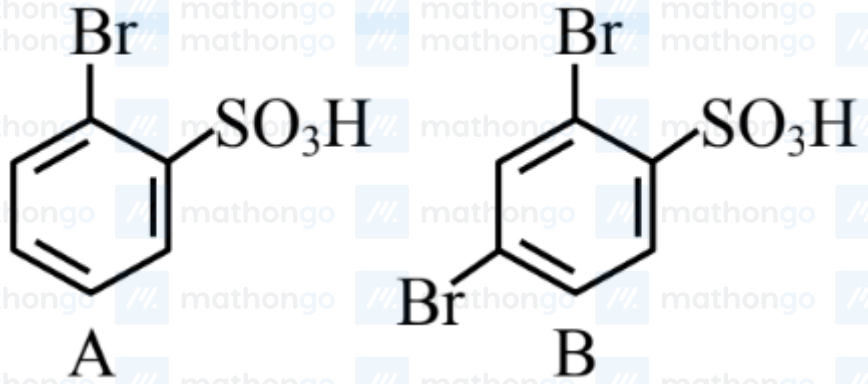
(1)



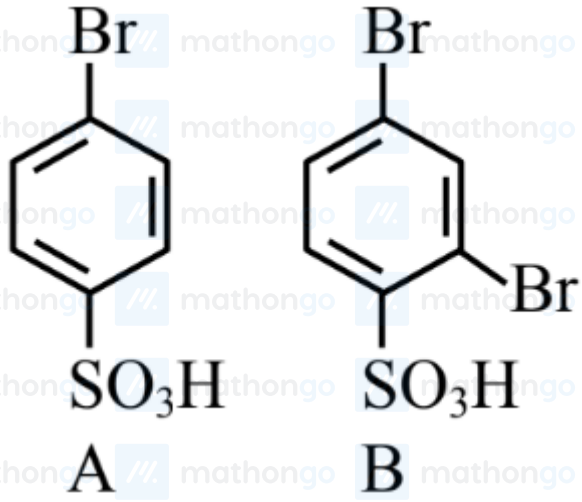
(2)



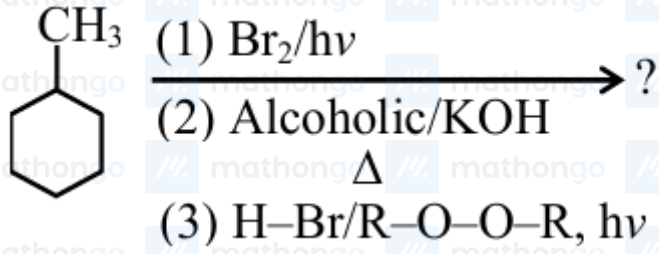
(3)

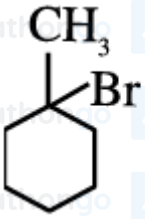


(4)

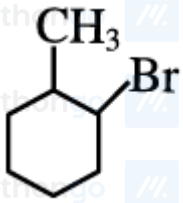


Q1. Predict the major product of the following reaction sequence :-

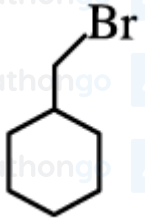




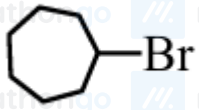
(1)



(2)



(3)



(4)

Q2. Given below are two statements :

Statement (I) : Alcohols are formed when alkyl chlorides are treated with aqueous potassium hydroxide by elimination reaction.

Statement (II) : In alcoholic potassium hydroxide, alkyl chlorides form alkenes by abstracting the hydrogen from the β-carbon.

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

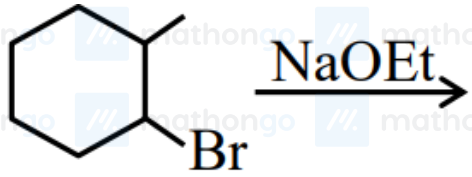
(1) Both Statement I and Statement II are incorrect

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

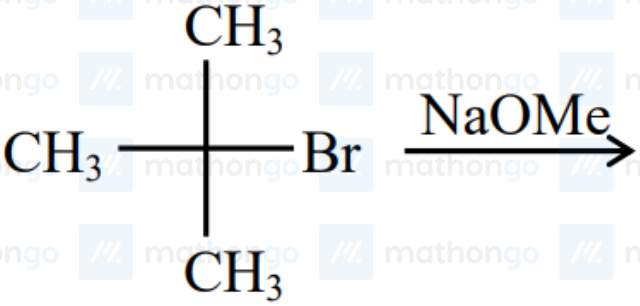
(3) Statement I is correct but Statement II is incorrect

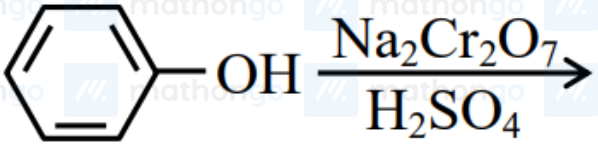
(4) Both Statement I and Statement II are correct

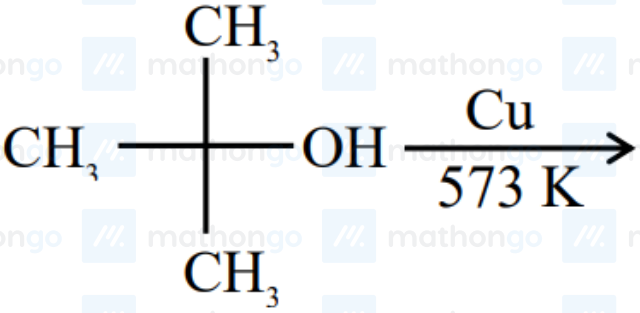
Q3. The reactions which cannot be applied to prepare an alkene by elimination, are

A. 

B. $CH_3 - CH_2 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3 \xrightarrow{KOH\ (aq.)}$

C. 

D. 

E. 

Choose the ***correct*** answer from the option given below :

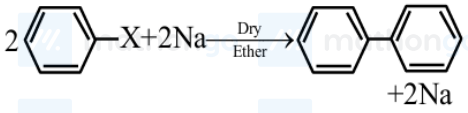
(1) B & E Only

(2) B, C & D Only

(3) A, C & D Only

(4) B & D Only

Q4. Match List-I with List-II

List-I (Reaction)		List-II (Name of reaction)	
(A)		(I)	Lucas reaction
(B)	$ArN_2^+X^- \xrightarrow[HCl]{Cu} ArCl + N_2\uparrow + CuX$	(II)	Finkelstein reaction
(C)	$C_2H_5Br + NaI \xrightarrow[Acetone]{Dry} C_2H_5I + NaBr$	(III)	Fittig reaction
(D)	$CH_3C(OH)(CH_3)CH_3 \xrightarrow[ZnCl_2]{HCl} CH_3C(Cl)(CH_3)CH_3$	(IV)	Gatterman reaction

Choose the correct answer from the options given below :

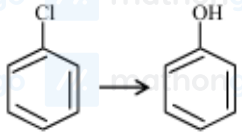
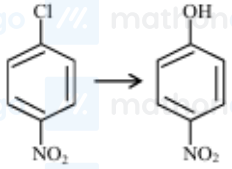
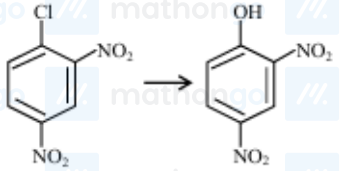
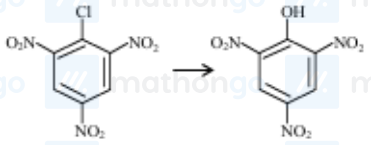
(1) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

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

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

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

Q5. Match List-I with List-II

List-I Conversion		List-II Reagents, Conditions used	
(A)		(I)	Warm, H_2O
(B)		(II)	(a) NaOH, 368 K ; (b) H_3O^+
(C)		(III)	(a) NaOH, 443 K; (b) H_3O^+
(D)		(IV)	(a) NaOH, 623 K, 300 atm ; (b) H_3O^+

Choose the correct answer from the options given below :

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

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

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

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

Q1. Given below are two statements :

Statement I : Dimethyl ether is completely soluble in water. However, diethyl ether is soluble in water to a very small extent.**Statement II :** Sodium metal can be used to dry diethyl ether and not ethyl alcohol.

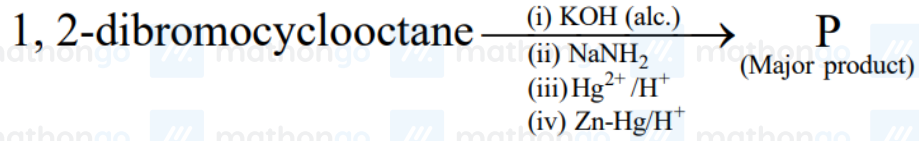
In the light of given statements, choose the ***correct*** answer from the options given below

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

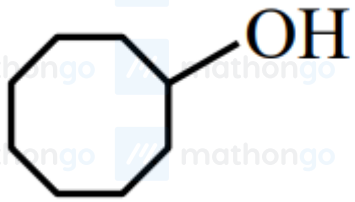
(2) Both Statement I and Statement II are false

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

(4) Both Statement I and Statement II are true

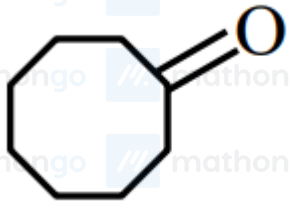
Q2. 

'P' is



(1)

(2)



(3)

(4)

Q3. Match the LIST-I with LIST-II

	LIST-I (Reagent)		LIST-II (Functional Group detected)
A.	Sodium bicarbonate solution	I.	double bond/unsaturation
B.	Neutral ferric chloride	II.	carboxylic acid
C.	ceric ammonium nitrate	III.	phenolic - OH
D.	alkaline KMnO	IV.	alcoholic - OH

Choose the correct answer from the options given below :

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

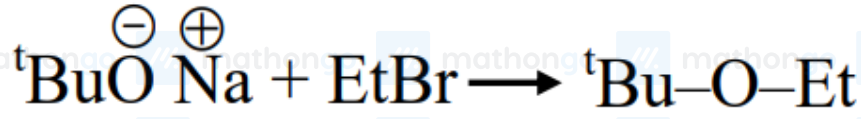
(2) A-II, B-III, C-I, D-IV

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

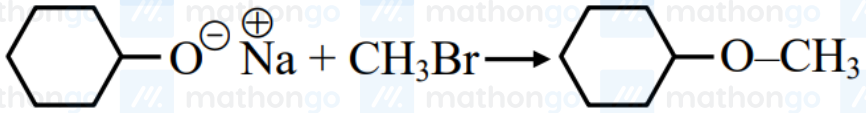
(4) A-II, B-IV, C-III, D-I

Q4. Which one of the following reactions will not lead to the desired ether formation in major proportion?

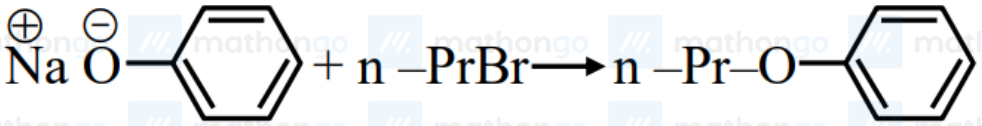
(iso-Bu $\Rightarrow$ isobutyl, sec-Bu $\Rightarrow$ sec-butyl, nPr $\Rightarrow$ n-propyl, ^{t}Bu $\Rightarrow$ tert-butyl, Et $\Rightarrow$ ethyl)



(1)



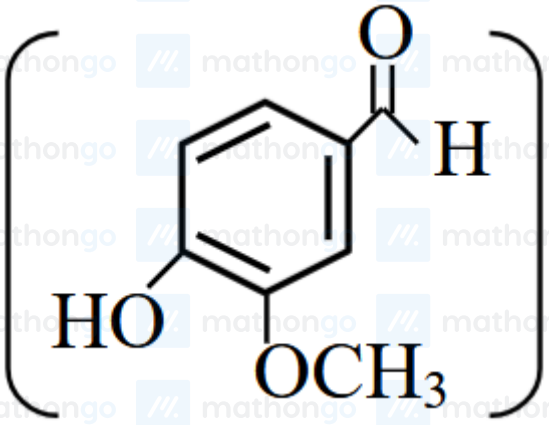
(2)



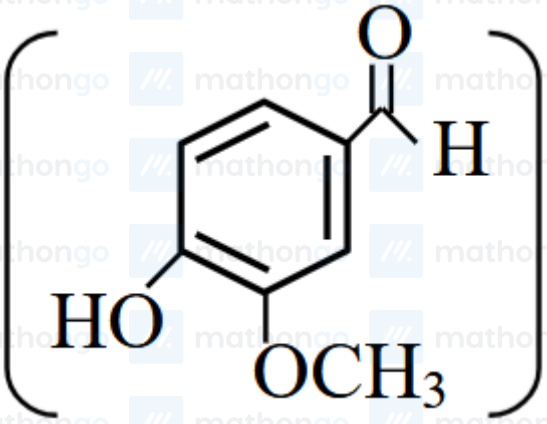
(3)

(4)

Q5. Given below are two statements :



Statement (I) : Vanillin
will react with NaOH and also with Tollen's reagent.



Statement (II) : Vanillin
will undergo self aldol condensation very easily.
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

Q6. An organic compound (X) with molecular formula C_3H_6O is not readily oxidised. On reduction it gives $C_3H_8O(Y)$ which reacts with HBr to give a bromide (Z) which is converted to Grignard reagent. This Grignard reagent on reaction with (X) followed by hydrolysis give 2,3-dimethylbutan-2-ol. Compounds (X), (Y) and (Z) respectively are :

(1) $CH_3COCH_3, CH_3CH_2CH_2OH, CH_3CH(Br)CH_3$

(2) $CH_3COCH_3, CH_3CH(OH)CH_3, CH_3CH(Br)CH_3$

(3) $CH_3CH_2CHO, CH_3CH_2CH_2OH, CH_3CH_2CH_2Br$

(4) $CH_3CH_2CHO, CH_3CH=CH_2, CH_3CH(Br)CH_3$

Q7. A toxic compound " A " when reacted with NaCN in aqueous acidic medium yields an edible cooking component and food preservative ' B '. " B " is converted to "C" by diborane and can be used as an additive to petrol to reduce emission. "C" upon reaction with oleum at $140^{\circ}C$ yields an inhalable anesthetic "D". Identify "A", "B", "C" and "D", respectively.

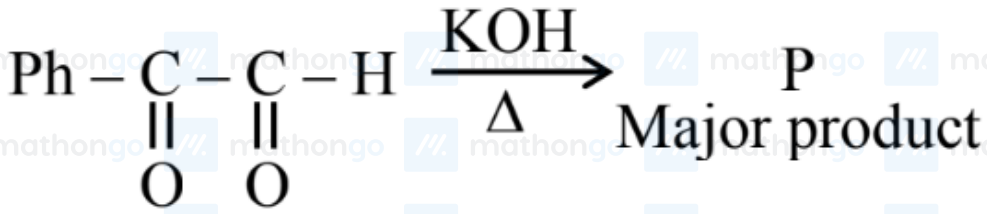
(1) Methanol; formaldehyde; methyl chloride; chloroform

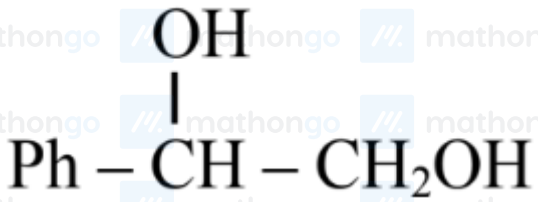
(2) Ethanol; acetonitrile; ethylamine; ethylene

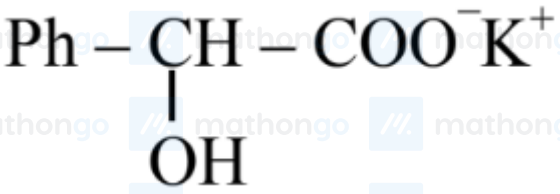
(3) Methanol; acetic acid; ethanol; diethyl ether

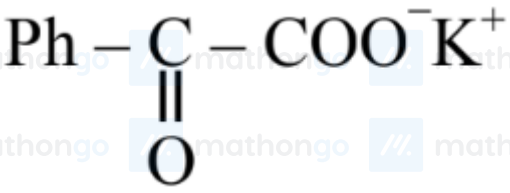
(4) Acetaldehyde;2- hydroxypropanoic acid; propanoic acid; dipropyl ether

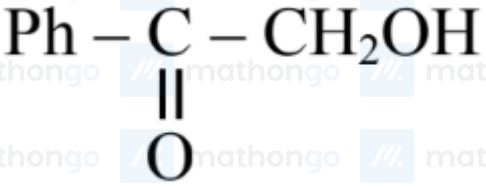
Q1. The major product (P) in the following reaction is :



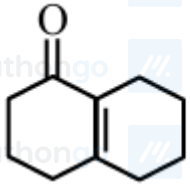
(1) 

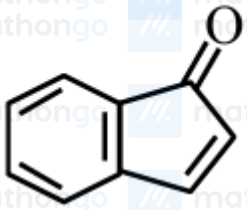
(2) 

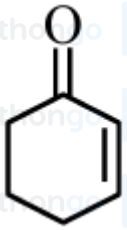
(3) 

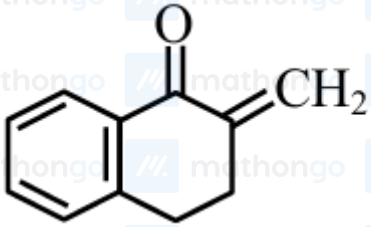
(4) 

Q2. Aldol condensation is a popular and classical method to prepare α, β-unsaturated carbonyl compounds. This reaction can be both intermolecular and intramolecular. Predict which one of the following is not a product of intramolecular aldol condensation?

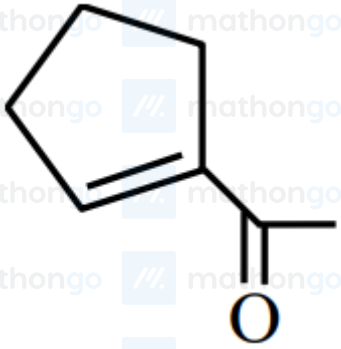
(1) 

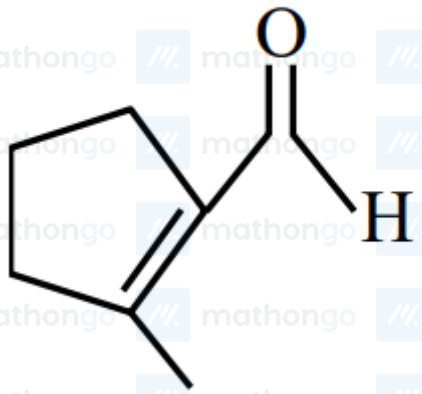
(2) 

(3) 

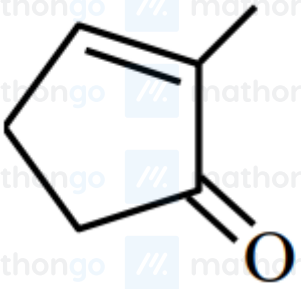
(4) 

Q3. When  undergoes intramolecular aldol condensation, the major product formed is :

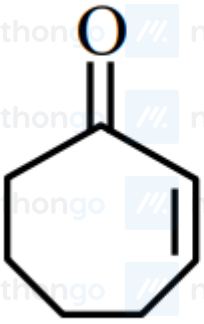
(1) 



(2)

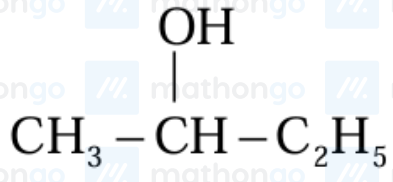


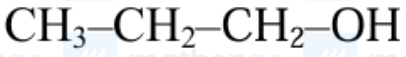
(3)

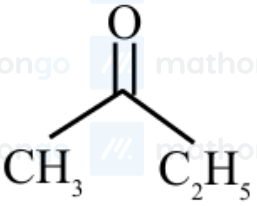


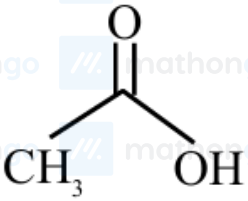
(4)

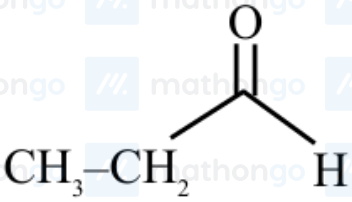
Q4. Which among the following compounds give yellow solid when reacted with NaOI/NaOH ?

(A) 

(B) 

(C) 

(D) 

(E) 

Choose the correct answer from the options given below :

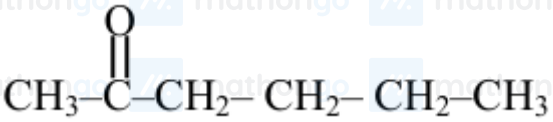
(1) (B), (C) and (E) Only

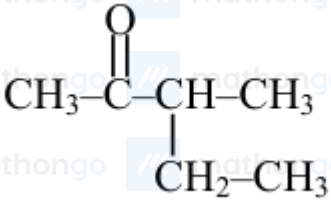
(2) (A) and (C) Only

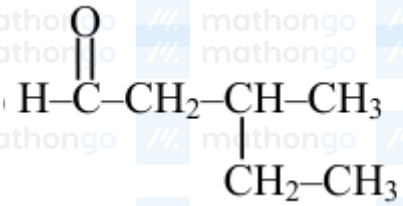
(3) (C) and (D) Only

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

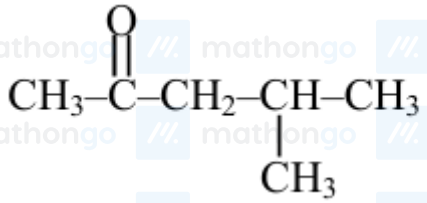
Q5. "P" is an optically active compound with molecular formula $C_6H_{12}O$. When " P " is treated with 2,4-dinitrophenylhydrazine, it gives a positive test. However, in presence of Tollens reagent, "P" gives a negative test. Predict the structure of "P".

(1) 

(2) 



(3)



(4)

Q6. An optically active alkyl halide C_4H_9Br [A] reacts with hot KOH dissolved in ethanol and forms alkene [B] as major product which reacts with bromine to give dibromide [C]. The compound [C] is converted into a gas [D] upon reacting with alcoholic $NaNH_2$. During hydration 18 gram of water is added to 1 mole of gas [D] on warming with mercuric sulphate and dilute acid at 333 K to form compound [E]. The IUPAC name of compound $[E]$ is :

(1) But-2-yne

(2) Butan-2-ol

(3) Butan-2-one

(4) Butan-1-al

Q7. Number of molecules from below which cannot give ioddoform reaction is :

Ethanol, Isopropyl alcohol, Bromoacetone, 2-Butanol, 2-Butanone, Butanal, 2-Pentanone, 3-Pentanone, Pentanal and 3-Pentanol

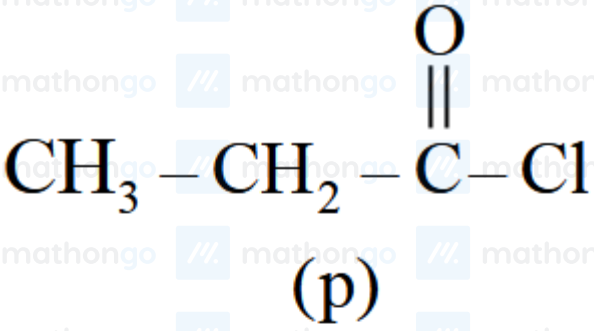
(1) 5

(2) 4

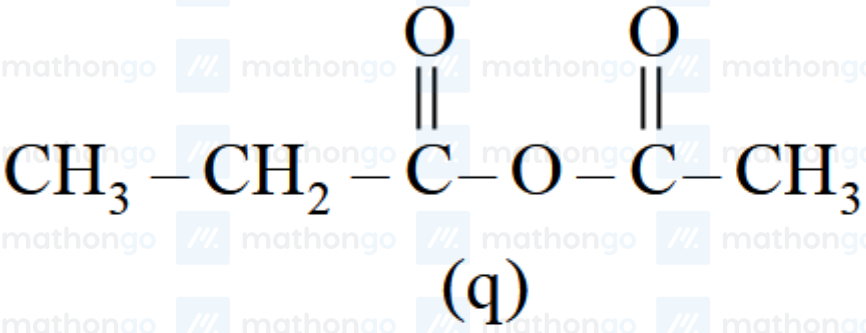
(3) 3

(4) 2

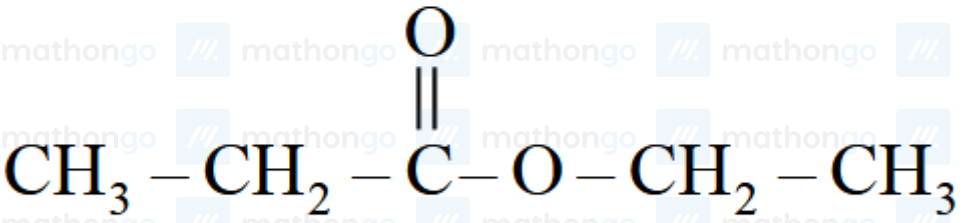
Q1. Consider the following molecules :



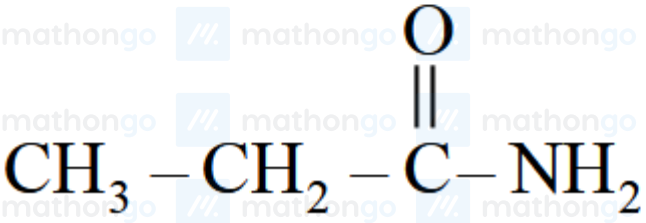
(p)



(q)



(r)



(s)

The correct order of rate of hydrolysis is :

(1) $r > q > p > s$

(2) $q > p > r > s$

(3) $p > r > q > s$

(4) $p > q > r > s$

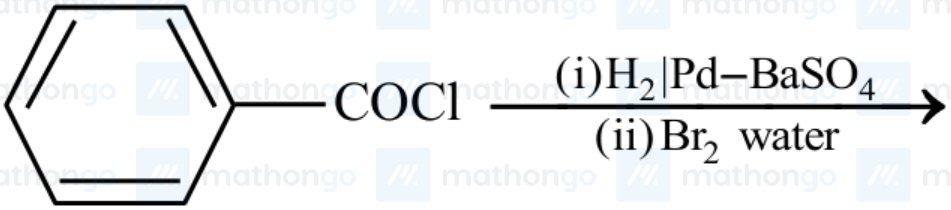
Q2. Consider the following reactions. From these reactions which reaction will give carboxylic acid as a major product ?

(A) $R-C\equiv N \xrightarrow[\text{mild condition}]{\text{(i) } H^+/H_2O}$

(B) $R-MgX \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } CO_2}$

(C) $R-C\equiv N \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } SnCl_2/HCl}$

(D) $R\cdot CH_2\cdot OH \xrightarrow[\text{PCC}]{}$

(E) 

Choose the correct answer from the options given below:

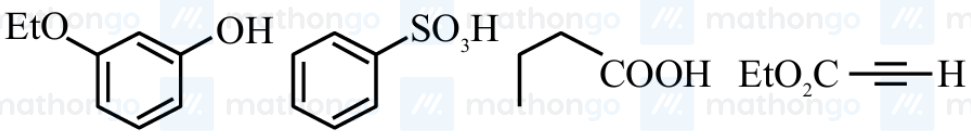
(1) A and D only

(2) A,B and E only

(3) B,C and E only

(4) B and E only

Q3. The least acidic compund, among the following is :



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

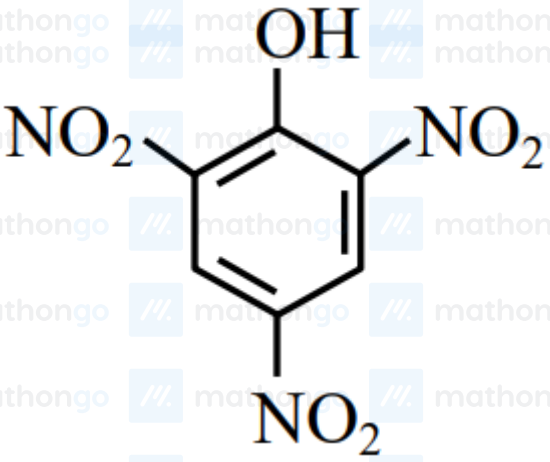
(1) D

(2) A

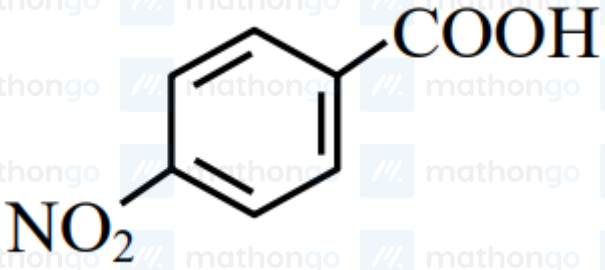
(3) B

(4) C

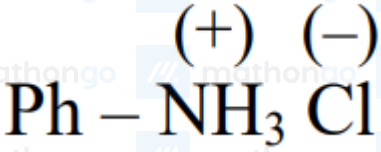
Q4. Which of the following compounds is least likely to give effervescence of CO_2 in presence of aq. $NaHCO_3$?



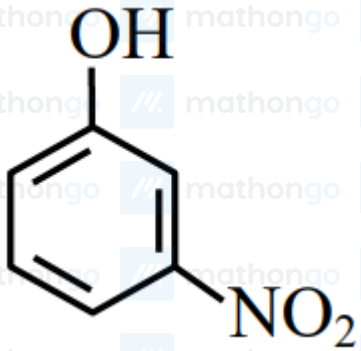
(1)



(2)



(3)



(4)

Q5. Mixture of 1 g each of chlorobenzene, aniline and benzoic acid is dissolved in 50 mL ethyl acetate and placed in a separating funnel, 5 M NaOH (30 mL) was added in the same funnel. The funnel was shaken vigorously and then kept aside. The ethyl acetate layer in the funnel contains :

(1) benzoic acid

(2) benzoic acid and aniline

(3) benzoic acid and chlorobenzene

(4) chlorobenzene and aniline

Q1. The correct order of basic nature on aqueous solution for the bases NH_3, H_2N-NH_2, $CH_3CH_2NH_2$, $(CH_3CH_2)_2NH$ and $(CH_3CH_2)_3N$ is :

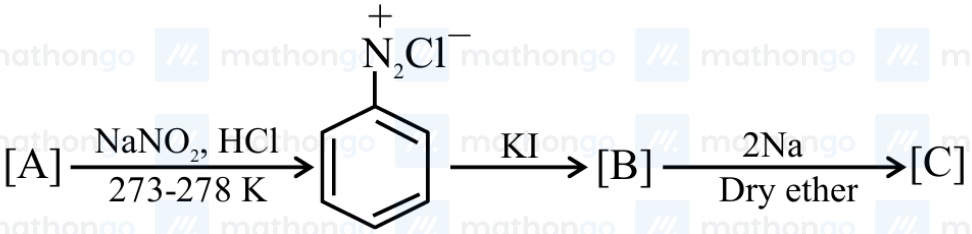
(1) $NH_3 < H_2N-NH_2 < (CH_3CH_2)_3N < CH_3CH_2NH_2 < (CH_3CH_2)_2NH$

(2) $NH_3 < H_2N-NH_2 < CH_3CH_2NH_2 < (CH_3CH_2)_2NH < (CH_3CH_2)_3N$

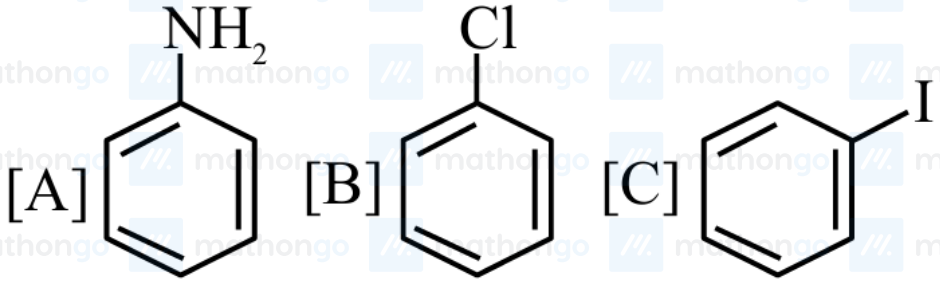
(3) $H_2N-NH_2 < NH_3 < (CH_3CH_2)_3N < CH_3CH_2NH_2 < (CH_3CH_2)_2NH$

(4) $NH_2-NH_2 < NH_3 < CH_3CH_2NH_2 < (CH_3CH_2)_3N < (CH_3CH_2)_2NH$

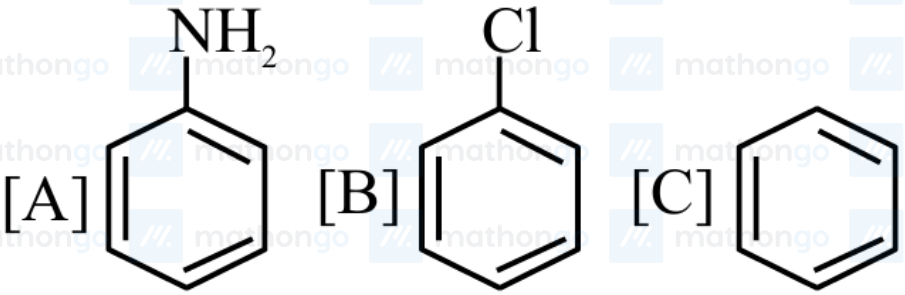
Q2. Identify [A], [B], and [C], respectively in the following reaction sequence :



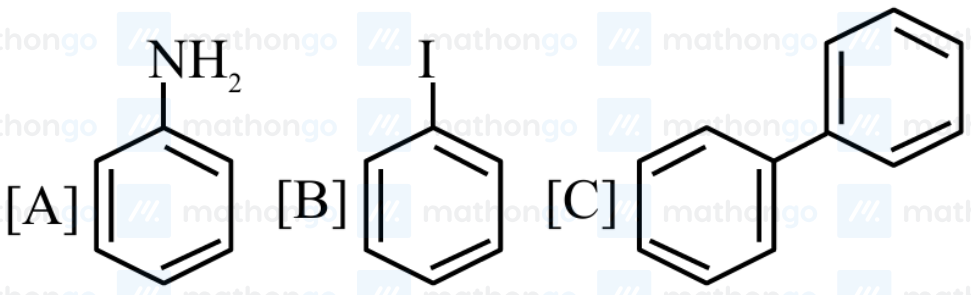
(1)

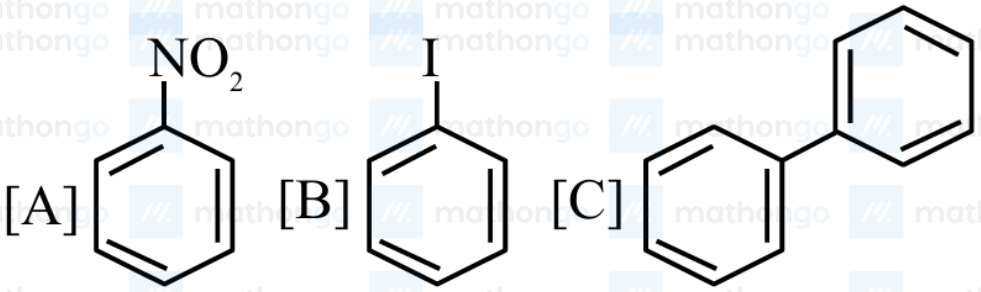


(2)



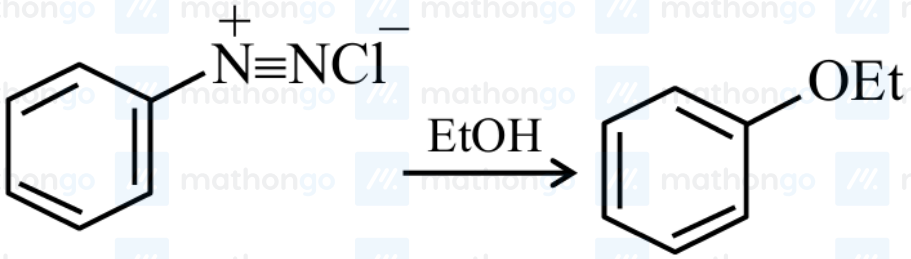
(3)



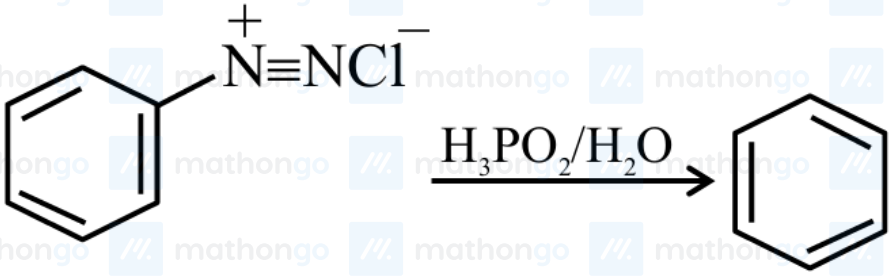


(4)

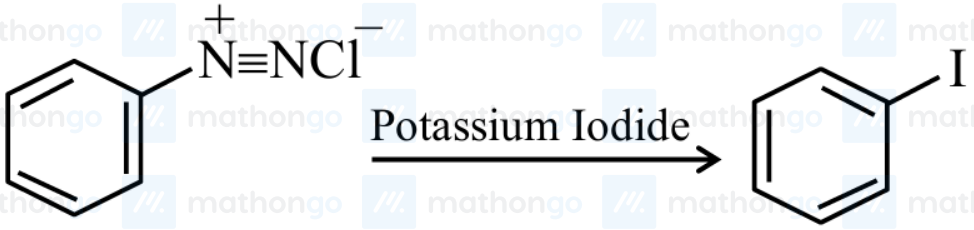
Q3. In the following reactions, which one is NOT correct?



(1)



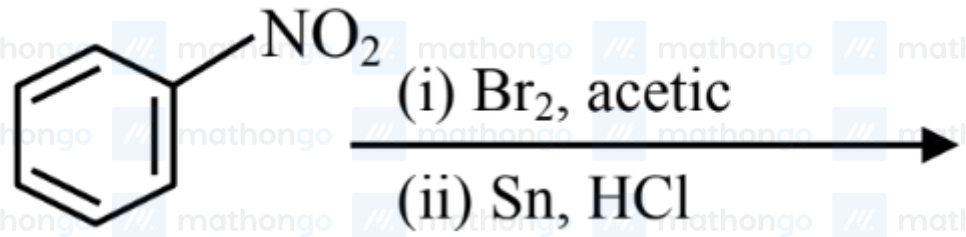
(2)

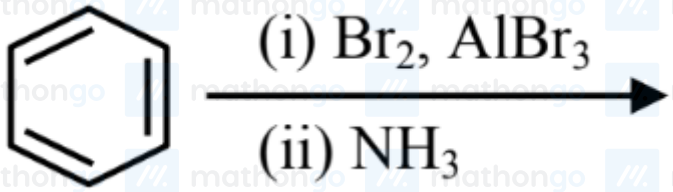


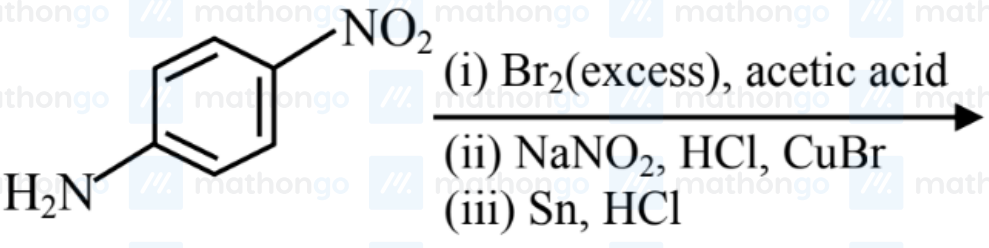
(3)

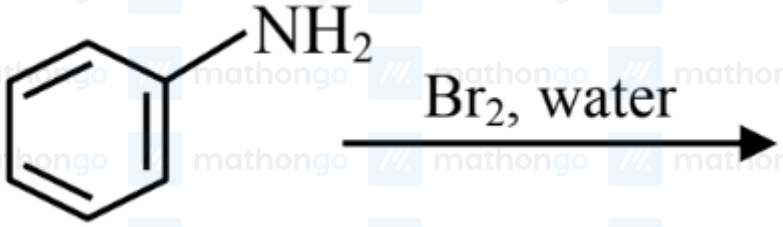
(4)

Q4. The sequence from the following that would result in giving predominantly 3, 4, 5-Tribromoaniline is :

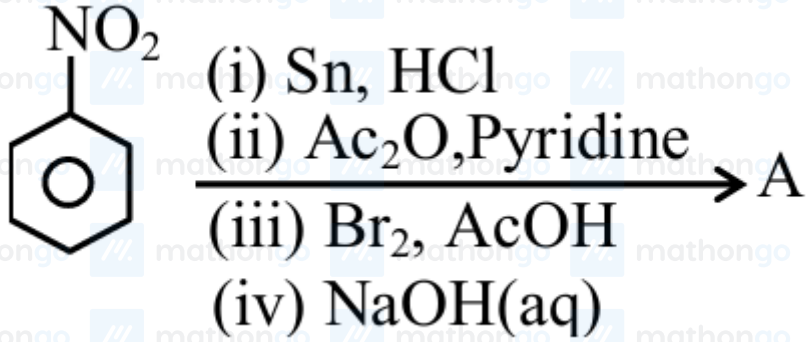
(1) 

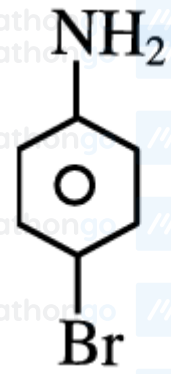
(2) 

(3) 

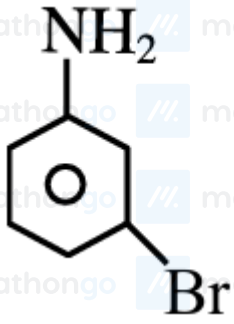
(4) 

Q5. The major product (A) formed in the following reaction sequence is

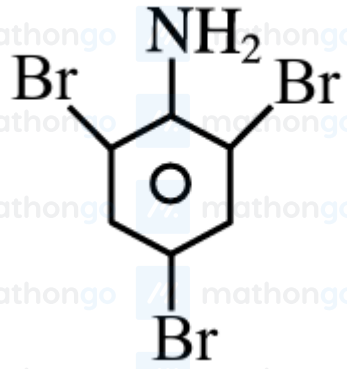




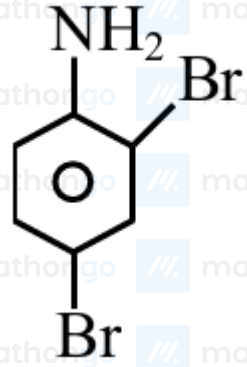
(1)



(2)

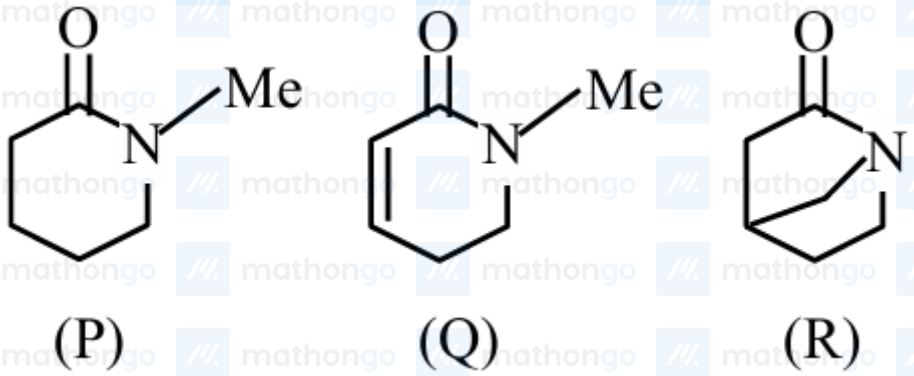


(3)



(4)

Q6. The correct order of basicity for the following molecules is:



(P) (Q) (R)

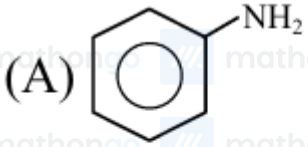
(1) P > Q > R

(2) R > P > Q

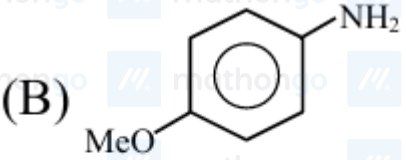
(3) Q > P > R

(4) R > Q > P

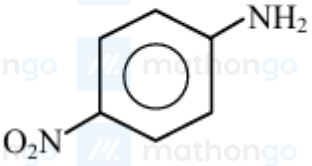
Q7. The descending order of basicity of following amines is:



(A)



(B)



(C)

(D) CH_3NH_2

(E) $(CH_3)_2NH$

Choose the correct answer from the options given below :

(1) B > E > D > A > C

(2) E > D > B > A > C

(3) E > D > A > B > C

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

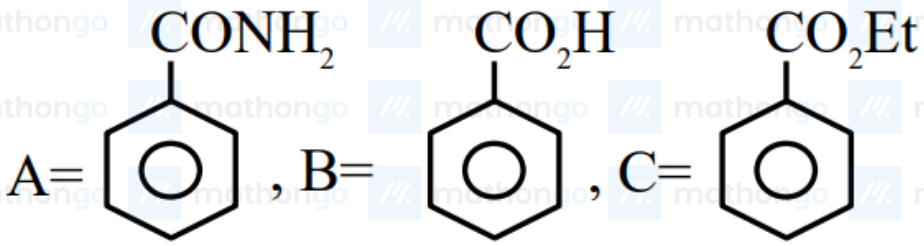
Q8. $A \xrightarrow[(ii)\ H_3O^+]{(i)\ NaOH} B \xrightarrow[(ii)\ H_2SO_4,\Delta]{(i)\ EtOH} C$

' A ' shows positive Lassaign's test for N and its molar mass is 121.

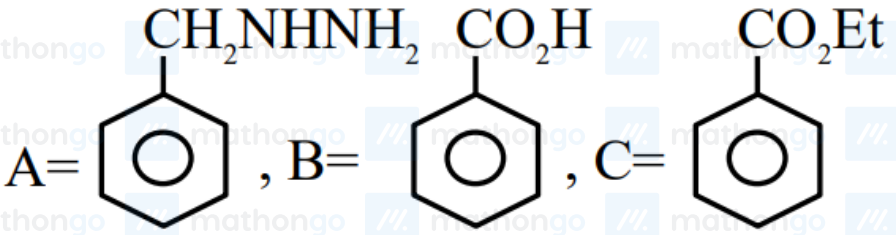
' B ' gives effervescence with aq. $NaHCO_3$.

'C' gives fruity smell.

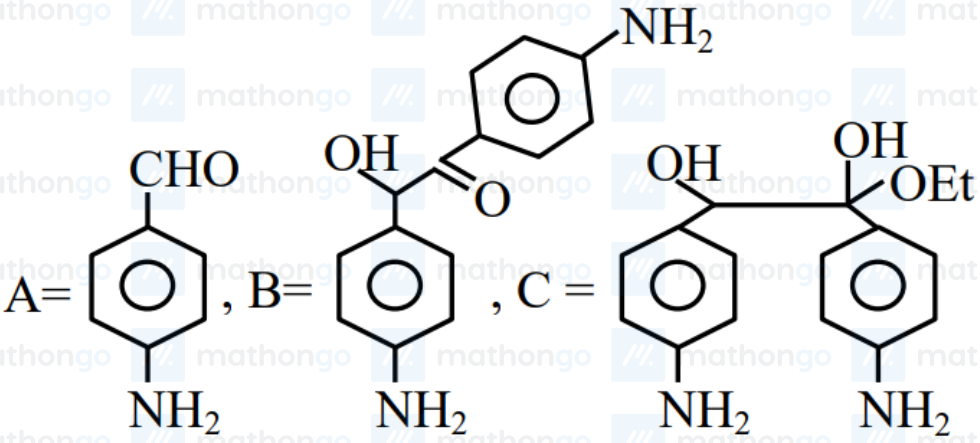
Identify A, B and C from the following.



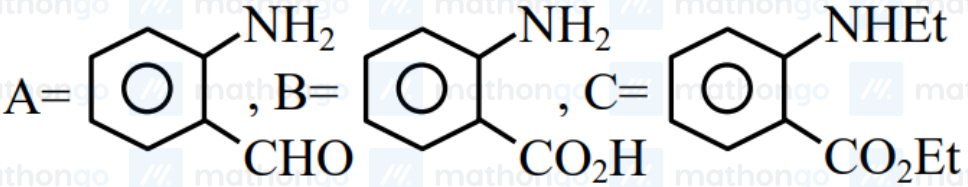
(1)



(2)

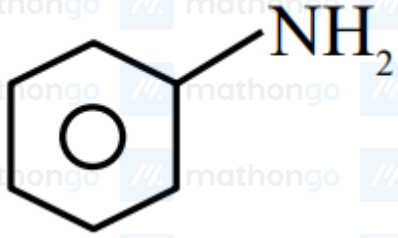


(3)



(4)

Q9. Which of the following amine (s) show (s) positive carbylamines test?

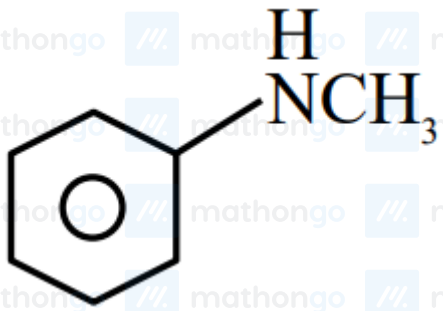


(A)

(B) $(CH_3)_2NH$

(C) CH_3NH_2

(D) $(CH_3)_3N$



(E)

(1) A and E Only

(2) C Only

(3) A and C Only

(4) B, C and D Only

Q10. When a concentrated solution of sulphanilic acid and 1-naphthylamine is treated with nitrous acid (273 K) and acidified with acetic acid, the mass (g) of 0.1 mole of product formed is :

(Given molar mass in $gmol^{-1}$ H : 1, C : 12, N : 14, O : 16, S : 32)

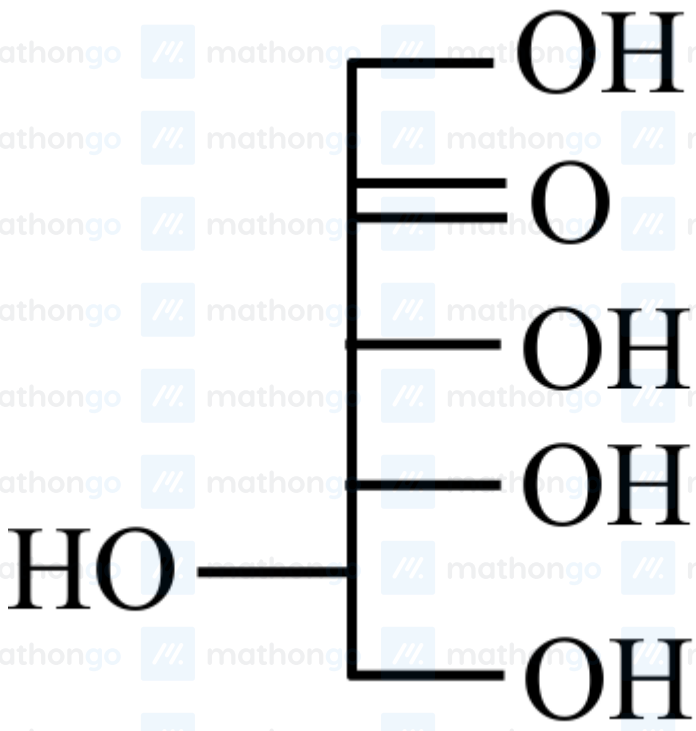
(1) 343

(2) 330

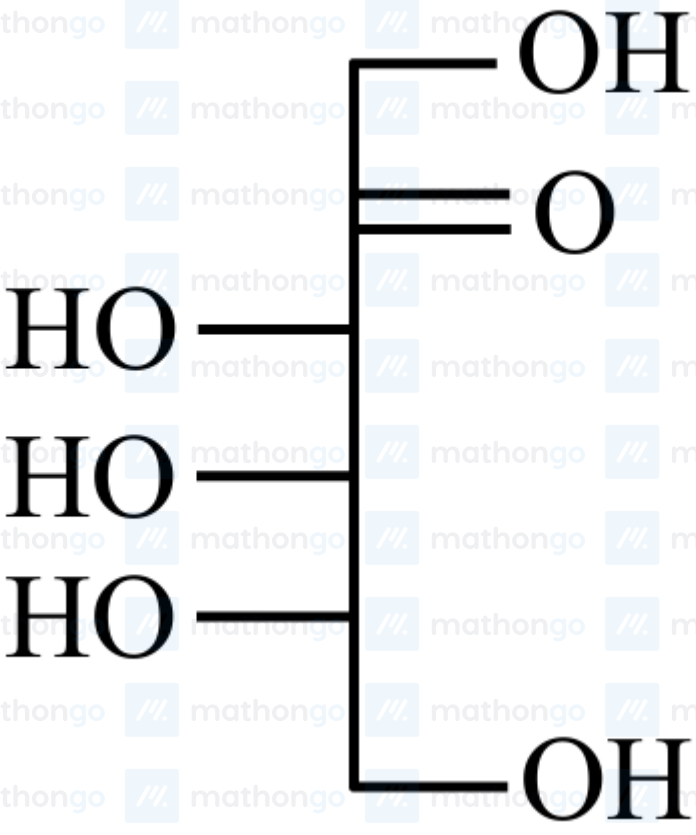
(3) 33

(4) 66

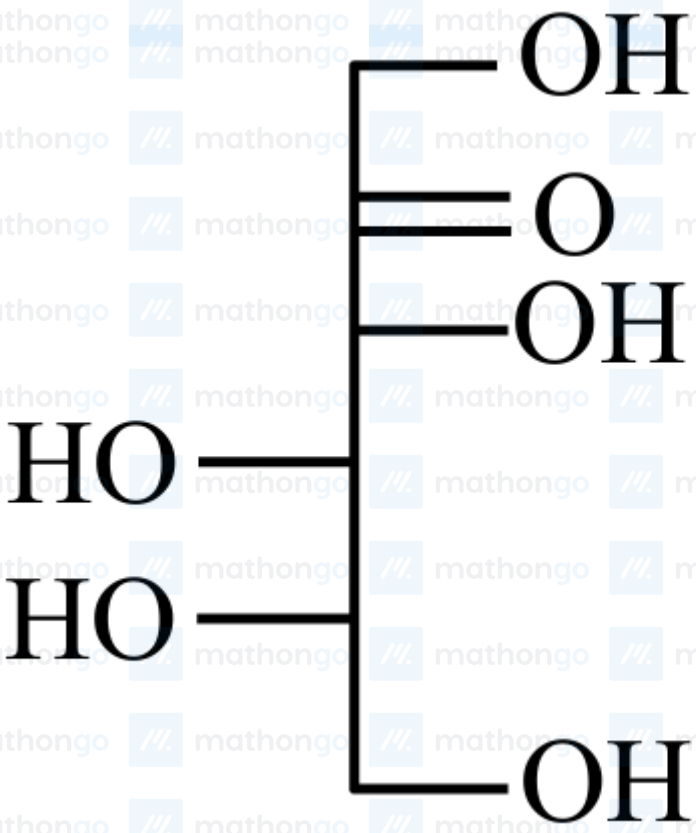
Q1. Which of the following is the correct structure of L-fructose?



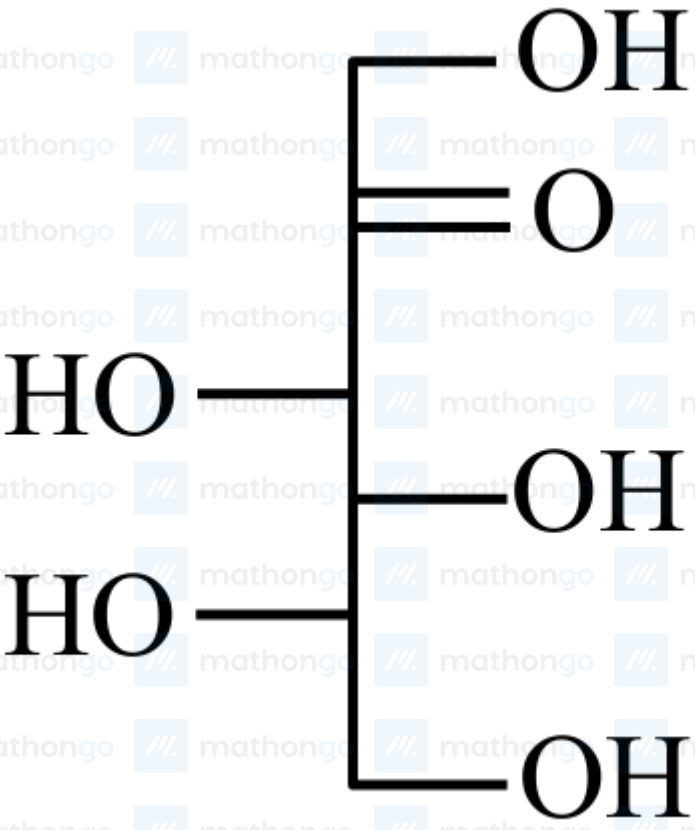
(1)



(2)



(3)



(4)

Q2. Given below are two statements:

Statement I : D-(+)-glucose $+\mathrm{D}-(+)$ fructose $\xrightarrow{-\mathrm{H_2O}}$

Statement II : Invert sugar is formed during sucrose hydrolysis.

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 are true.

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

(4) Both Statement I and Statement II are false.

Q3. Fat soluble vitamins are :

A. Vitamin B_1

B. Vitamin C

C. Vitamin E

D. Vitamin B_{12}

E. Vitamin K

Choose the correct answer from the options given below :

(1) C & D Only

(2) A & B Only

(3) B & C Only

(4) C & E Only

Q4. Given below are two statements :

Statement I : Wet cotton clothes made of cellulose based carbohydrate takes comparatively longer time to get dried than wet nylon polymer based clothes.

Statement II : Intermolecular hydrogen bonding with water molecule is more in nylon-based clothes than in the case of cotton clothes.

In the light of 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

Q5. Identify the correct statement among the following:

(1) All naturally occurring amino acids except glycine contain one chiral centre.

(2) All naturally occurring amino acids are optically active.

(3) Glutamic acid is the only amino acid that contains a-COOH group at the side chain.

(4) Amino acid, cysteine easily undergo dimerization due to the presence of free SH group.

Q6. A tetrapeptide " x " on complete hydrolysis produced glycine (Gly), alanine (Ala), valine (Val), leucine (Leu) in equimolar proportion each. The number of tetrapeptides (sequences) possible involving each of these amino acids is

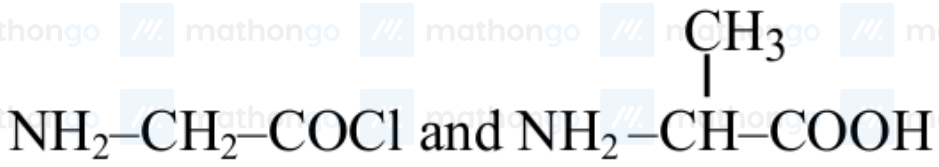
(1) 16

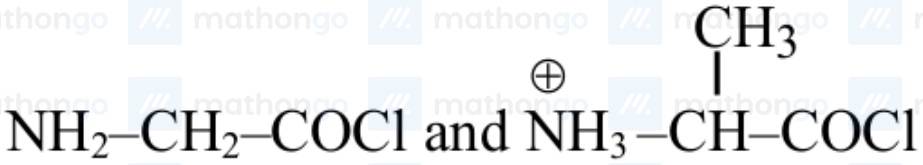
(2) 32

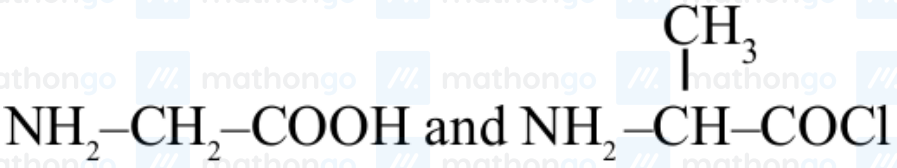
(3) 8

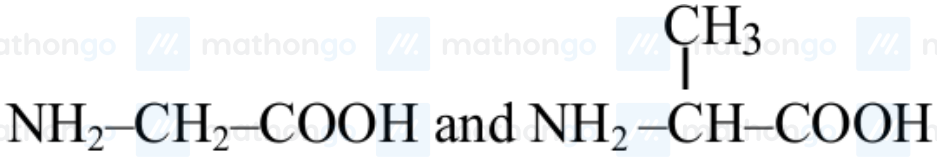
(4) 24

Q7. Identify the pair of reactants that upon reaction, with elimination of HCl will give rise to the dipeptide Gly-Ala.

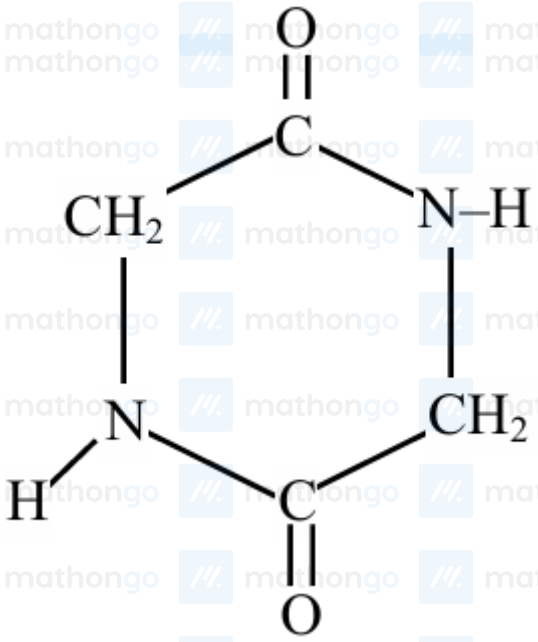
(1) 

(2) 

(3) 

(4) 

Q8. A dipeptide, " x " on complete hydrolysis gives " y " and " z ". " y " on treatment with aq. HNO_2 produces lactic acid. On the other hand " z " on heating gives the following cyclic molecule.



Based on the information given, the dipeptide X is:

(1) valine-glycine

(2) alanine-glycine

(3) valine-leucine

(4) alanine-alanine

Q9. Given below are two statements :

Statement (I) : On hydrolysis, oligo peptides give rise to fewer number of α-amino acids while proteins give rise to a large number of β-amino acids.

Statement (II) : Natural proteins are denatured by acids which convert the water soluble form of fibrous proteins to their water insoluble form.

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 correct

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

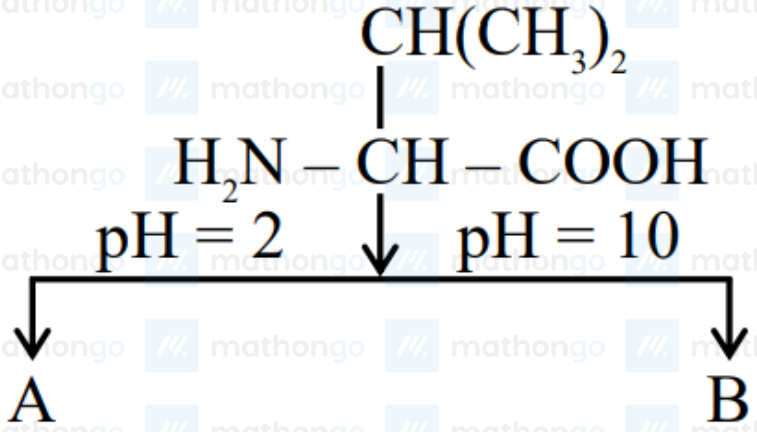
(3) Both statement I and statement II are incorrect

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

Q10. The total number of hydrogen bonds of a DNA-double Helix strand whose one strand has the following sequence of bases is_____.

5′ - G - G-C-A-A-A-T-C-G-G-C-T-A-3'

Q11.



Choose the correct option for structures of A and *B*, respectively.

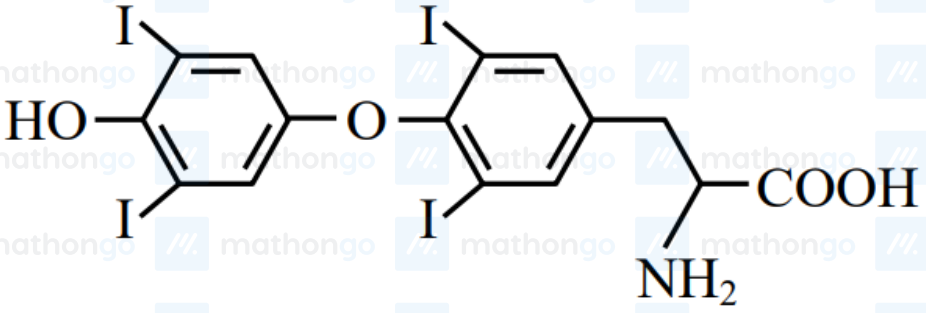
(1) $H_3\overset{+}{N}-CH(CH(CH_3)_2)-COOH$ and $H_2N-CH(CH(CH_3)_2)-COO^-$

(2) $H_2N-CH(CH(CH_3)_2)-COO^-$ and $H_3\overset{+}{N}-CH(CH(CH_3)_2)-COOH$

(3) $H_2N-CH(CH(CH_3)_2)-COO^-$ and $H_3\overset{+}{N}-CH(CH(CH_3)_2)-COO^-$

(4) $H_3\overset{+}{N}-CH(CH(CH_3)_2)-COO^-$ and $H_3\overset{+}{N}-CH(CH(CH_3)_2)-COOH$

Q1. Thyroxine, the hormone has given below structure



The percentage of iodine in thyroxine is ____ %. (nearest integer)

(Given molar mass in $gmol^{-1}$ C : 12.H : 1, O : 16, N : 14, I : 127)

Some Basic Concepts of Chemistry

1. (63) **2.** (1) **3.** (372) **4.** (2) **5.** (9) **6.** (3) **7.** (184) **8.** (3)
9. (12) **10.** (138) **11.** (2) **12.** (1)

Structure of Atom

1. (3) **2.** (4) **3.** (54) **4.** (4) **5.** (4) **6.** (4) **7.** (3) **8.** (2)
9. (4) **10.** (2)

States of Matter

1. (4)

Thermodynamics (C)

1. (4) **2.** (3) **3.** (2) **4.** (304) **5.** (4) **6.** (3) **7.** (25) **8.** (3)
9. (2500) **10.** (2) **11.** (2) **12.** (4) **13.** (98) **14.** (4) **15.** (1)

Chemical Equilibrium

1. (2) **2.** (2) **3.** (74) **4.** (2)

Ionic Equilibrium

1. (3) **2.** (2) **3.** (5) **4.** (2) **5.** (25) **6.** (48) **7.** (3)

Redox Reactions

1. (4)

Solutions

1. (33) **2.** (2) **3.** (4) **4.** (3) **5.** (2) **6.** (25) **7.** (2) **8.** (3)
9. (4) **10.** (1) **11.** (2) **12.** (1) **13.** (4)

Electrochemistry

1. (6) **2.** (1) **3.** (400) **4.** (2) **5.** (10) **6.** (2) **7.** (23) **8.** (2)
9. (3) **10.** (3) **11.** (2)

Chemical Kinetics

1. (1) **2.** (3) **3.** (43) **4.** (3) **5.** (2435) **6.** (4) **7.** (3) **8.** (4)
9. (3) **10.** (1) **11.** (1) **12.** (2) **13.** (1)

Classification of Elements and Periodicity in Properties

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

Chemical Bonding and Molecular Structure

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

p Block Elements (Group 13 & 14)

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

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

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

d and f Block Elements

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

Coordination Compounds

1. (1) **2.** (4) **3.** (2) **4.** (4) **5.** (2) **6.** (3) **7.** (3) **8.** (2)
9. (0) **10.** (1) **11.** (4) **12.** (2) **13.** (1) **14.** (2) **15.** (3) **16.** (3)
17. (4) **18.** (1) **19.** (1) **20.** (4) **21.** (4)

Practical Chemistry

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

General Organic Chemistry

1. (4) **2.** (1) **3.** (3) **4.** (4) **5.** (4) **6.** (3) **7.** (4) **8.** (3)
9. (4) **10.** (3) **11.** (1) **12.** (4) **13.** (1) **14.** (4) **15.** (111) **16.** (1)
17. (20) **18.** (18) **19.** (2) **20.** (8)

Hydrocarbons

1. (80) **2.** (2) **3.** (2) **4.** (2) **5.** (7) **6.** (2) **7.** (3) **8.** (2)
9. (1) **10.** (3) **11.** (2)

Haloalkanes and Haloarenes

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

Alcohols Phenols and Ethers

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

Aldehydes and Ketones

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

Carboxylic Acid Derivatives

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

Amines

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

Biomolecules

1. (3) **2.** (2) **3.** (4) **4.** (2) **5.** (4) **6.** (4) **7.** (1) **8.** (2)
9. (3) **10.** (33) **11.** (1)

Chemistry in Everyday Life

1. (65)

Q1. $CaCO_3 \rightarrow CaO + CO_2$

() mass of $CaCO_3 = \frac{150 \times 75}{100} = 112.5$ kg

$= 112500$ g

$n_{CaCO_3} = 1125$

So moles of $CaO = 1125$

mass of $CaO = \frac{1125 \times 56}{1000} = 63$ kg

Correct answer $\Rightarrow 63$

Q2. $NaI_{(aq)} + AgNO_{3(aq)} \rightarrow AgI_{(s)} + NaNO_3(aq)$

() M, 20ml excess

4.74 g

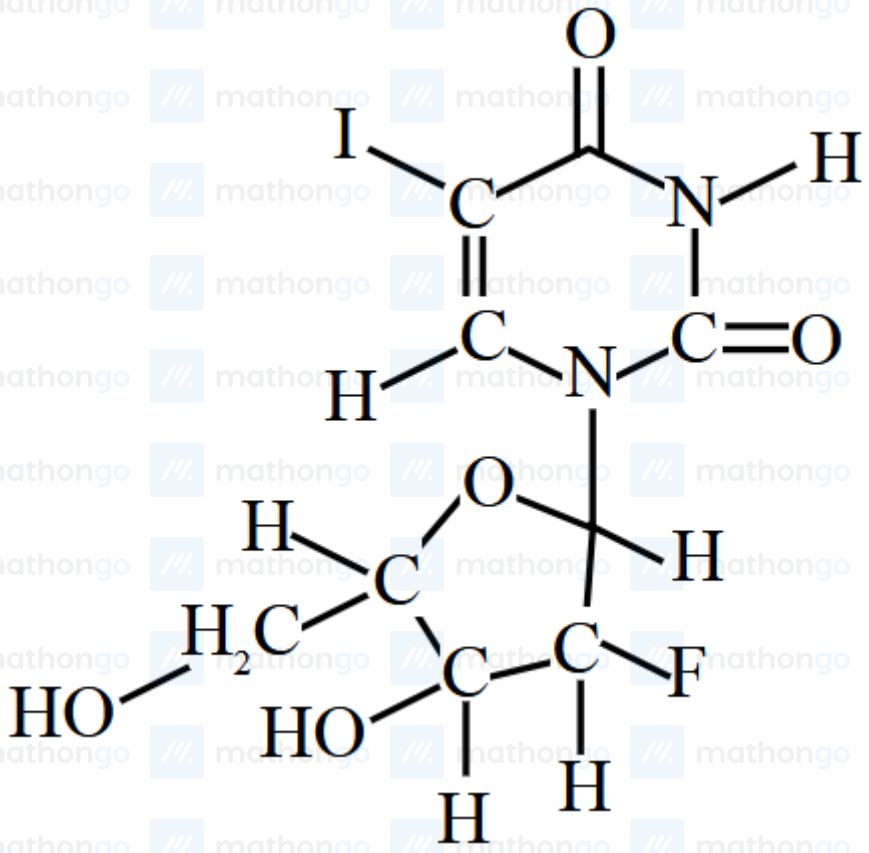
Moles of I^- in NaI = Moles of (I^-) in AgI $= \frac{4.74}{235}$

Moles of NaI $= \frac{4.74}{235}$

Molarity $[NaI] = \frac{4.74}{235 \times 0.02} = 1.008$

Q3.

(372)



Molar mass $= 372$gm

$\therefore 0.1$ mole has $= 372 \times 10^{-1}$gm

Q4. No. of atoms $= \frac{\text{Massin } g}{\text{Molar Mas}(\text{ g/mol})} \times N_A$

(2) Therefore for the same Mass element having the least Molar mass will have the higher no. of atoms.

- $M_{Po} = 209$
- $M_{Pr} = 141$

- $M_{Pb} = 207$
- $M_{Pt} = 195$

Q5. Let mass of iron $= wg$

() $\Rightarrow \frac{w}{150 \times 10^3} \times 10^6 = 12$

$\Rightarrow w = 150 \times 12 \times 10^{-3} = 1.8gm$

Let mass of $FeSO_4 \cdot 7H_2O = w_1 gm$

$\Rightarrow$ Moles of $Fe = \frac{1.8}{56} = \left(\frac{w_1}{56 + 96 + 7 \times 18}\right)$

$\Rightarrow w_1 = 8.935gm$

Q6. $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

(3) Moles of $CaCO_3 = \frac{1000}{100} = 10$

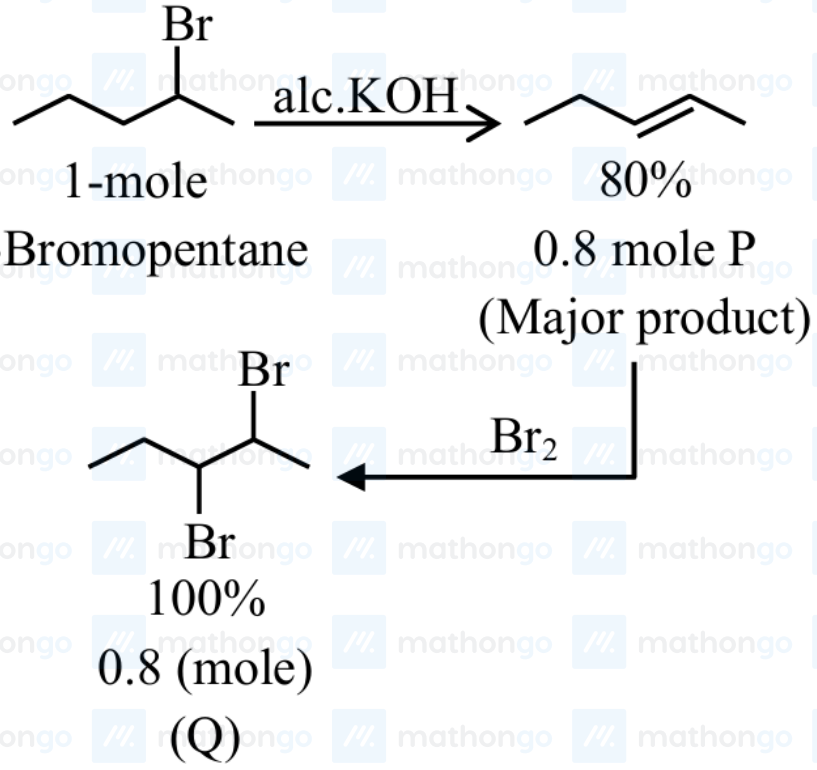
Moles of $HCl = 0.76 \times \frac{250}{1000} = 0.19$ (L.R.)

Moles of $CaCl_2$ formed $= \frac{0.19}{2}$

Mass of $CaCl_2 = \frac{0.19}{2} \times 111 = 10.545gm$

Q7.

()



Molecular mass of $Q = 230\ g\ mol^{-1}$

Mass of $Q = 0.8 \times 230$

$= 184\ g$

Q8. $Mg + 2HCl \rightarrow MgCl_2 + H_2$

(3) Volume H_2 evolved $= 220ml$

Mole of $H_2 = \frac{220\times10^{-3}}{22.4}$ = mole of Mg used

$\therefore$ Mass of Mg used $= \dfrac{220\times10^{-3}}{22.4}\times 24$

$= 235.7\times10^{-3}\text{gm}$

$= 235.7\text{mg}$

Q9. 0

Organic compound $\xrightarrow{\text{CuO}} CO_2 + H_2O$

$\xrightarrow{\Delta}$

$n_{CO_2} = \dfrac{220\times10^{-3}}{44} = 5\times10^{-3}\text{moles}$

$m_C = 5\times10^{-3}\times 12$

$\%$ m carbon $= \frac{5\times10^{-3}\times12}{500\times10^{-3}}\times100 = 12\%$

Correct answer is 12

Q10. 0

$C_4H_{10} + \dfrac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

$3\times10^3 \quad 10\times10^3$

Moles of H_2O formed $= n_{H_2O} = 5\times\frac{2}{13}\times10\times10^3$

Then $w_{H_2O} = \frac{10^5}{13}\times18$

$= 1.3846\times10^5$ g

Volume of H_2O will be $= 138.46$ litre.

Ans. 138

Q11. **(2)**

In the combustion of organic compound, all "C" in CO_2 and all "H" in H_2O comes from organic compound

$$\underset{0.210\,gm}{C_xH_yO_z} + O_2 \longrightarrow \underset{0.307\,gm}{CO_2} + \underset{0.127\,gm}{H_2O}$$

$$\text{Weight of "C" in } CO_2 = \frac{12}{44} \times 0.307$$

$$= 0.0837 \text{ gm}$$

$$\text{Weight of "H" in } H_2O = \frac{2}{18} \times 0.127 = 0.0141 \text{g}$$

$$\%\text{ 'H' in compound} = \frac{0.0141}{0.21} \times 100 = 6.719\ \%$$

$$= 6.72\ \%$$

Weight of "O" in compound

$$= 0.210 - (0.0837 + 0.0141)$$

$$= 0.1122$$

$$\%\text{ of "O" in compound} = \frac{0.1122}{0.21} \times 100$$

$$= 53.41\ \%$$

Q12. **(1)**

$\text{Moles of 'C'} = n_{CO_2} = \frac{1.46}{44} = 0.033$

$\text{Moles of 'C'} = W_C = 0.033 \times 12$

$\text{Moles of 'H'} = 2 \times n_{H_2O} = 2 \times \frac{0.567}{18} = 0.063$

$\text{Mass of 'H'} = 0.0063$

$\text{Mass of Oxygen (O)} = 1 - (W_c + W_H) = 1 - (0.033 \times 12 + 0.063 \times 1) = 0.541\text{gm}$

$\text{Moles of 'O'} = \frac{0.541}{16} = 0.033$

Empirical formula $= CH_2O$

Empirical formula mass $= 30$.

Q1. $r \propto n^2$

(3) (1) $\frac{r_3}{r_1} = \frac{9}{1}$

(2) $\frac{r_8}{r_4} = \frac{64}{16} = 4$

(3) $\frac{r_6}{r_4} = \left(\frac{6}{4}\right)^2 = \frac{9}{4}$

(4) $\frac{r_4}{r_2} = \left(\frac{4}{2}\right)^2 = 4$

Q2. Orbital angular momentum $= \sqrt{\ell(\ell+1)}\frac{h}{2\pi}$

(4) $\therefore$ For 2 s orbital : $\ell = 0$

Orbital angular momentum $= 0$

$\therefore$ For 2p orbital : $\ell = 1$

Orbital angular momentum $= \sqrt{1(1+2)}\frac{h}{2\pi}$

$= \sqrt{2}\frac{h}{2\pi}$

Q3.

0

$$E_T = -13.6\frac{z^2}{n^2}ev$$

For energy of H-atom, energy of 1^{st} Bohr orbit

$E_1 = -13.6$ eV $[z = 1, n = 1]$

For Be^{+3} ion, energy of I^{st} E.S. $[z = 4, n = 2]$

$$\frac{E_H}{E_{Be^{+3}}} = \frac{z_1^2}{n_1^2} \times \frac{n_2^2}{z_2^2}$$

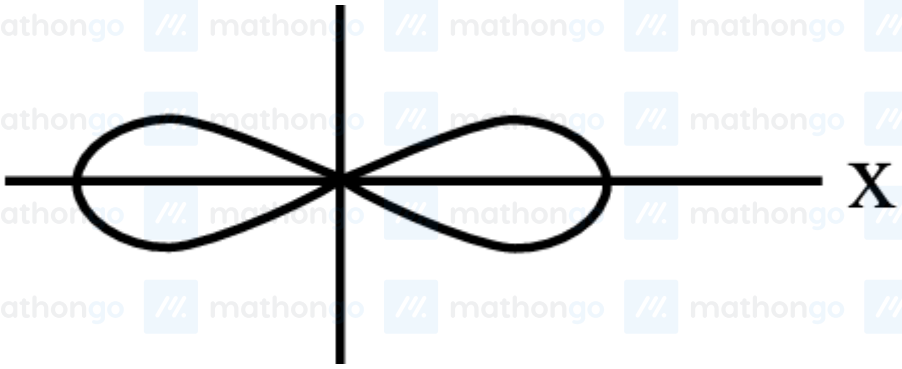
$$\frac{E_H}{E_{Be^{+3}}} = \frac{1}{1} \times \frac{4}{16}$$

$$E_{Be^{+3}} = -13.6 \times 4 = -54.4\,eV$$

$$|E_{Be^{+3}}| = 54.4\,eV$$

Q4. (A) Azimuthal quantum number (ℓ) indicates the shape of orbital occupied by the electron

(4) (B)



p_x orbital

(C) The + and - sign in the wave function of $2p_x$ orbital refer to the sign (Phase) of the wave function, not the charge

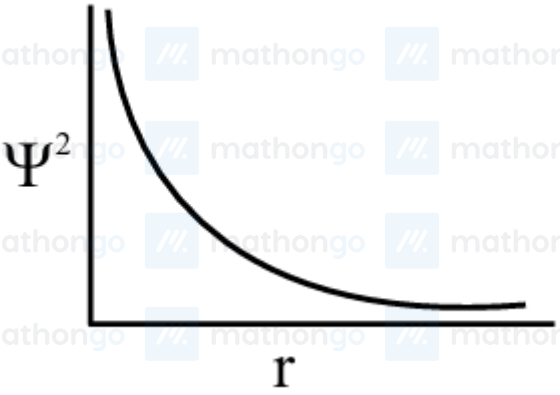
(D) The wave function of $2p_x$ orbital will be zero in yz plane (Nodal plane).

Q5. The electron in a H-atom's stationary state moves in a spherical path.

(4)

Q6.

(4)



1. Ψ^2 = Probability density is maximum at nucleus.
2. Electron can exist upto infinity from nucleus.
3. True
4. Energy of electron is maximum at infinite distance from nucleus.

Q7. $Cr : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

(3) $\ell = 1 \quad \ell = 1 \quad \ell = 2$

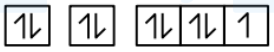
electrons having $\ell = 1 \Rightarrow 12$

electrons having $\ell = 2 \Rightarrow 5$

Q8. Element with atomic number 9 is Fluorine

(2)

$F(9) = 1s^2\ 2s^2\ 2p^5$



(A) 5 electrons can be up-spin $\left[m_s = +\frac{1}{2}\right]$ and 4 electrons can be down spin $\left[m_s = -\frac{1}{2}\right]$

(B) Unpaired electron can be in anyone of p_x, p_y or p_z orbital

(C) Last electron is in 2p subshell with $n = 2, \ell = 1$

(D) Angular node for s-orbital = 0 while of each p-orbital = 1

Sum of all angular node = 3

Q9. $\lambda = \frac{C}{v} = \frac{3 \times 10}{5.16 \times 10^{14}}$

(4)

$\lambda = 581.39$ nm

* λ_{Photon} is near & below yellow light it can show photoelectric effect.
* If intensity of light decreases photocurrent decreases.
* Red light will not produce photoelectric effect.
* $v_{Blue} > v_{yellow}$ so photoelectric current will be produced.
* White light contain all frequencies so it will show photo electric current.

Correct statements are A B D & E.

Q10. Extra stability of half filled is due to :

(2) (i) Symmetrical distribution of electrons

(ii) Large exchange energy

(iii) Smaller coulombic repulsion

(iv) Smaller shielding of electrons by one another

Q1. $\frac{P_{N_2}}{P_{O_2}} = \frac{x_{N_2} \cdot P_T}{x_{O_2} \cdot P_T} = \frac{n_{N_2}}{n_{O_2}}$ {using Dalton's law of partial pressure}

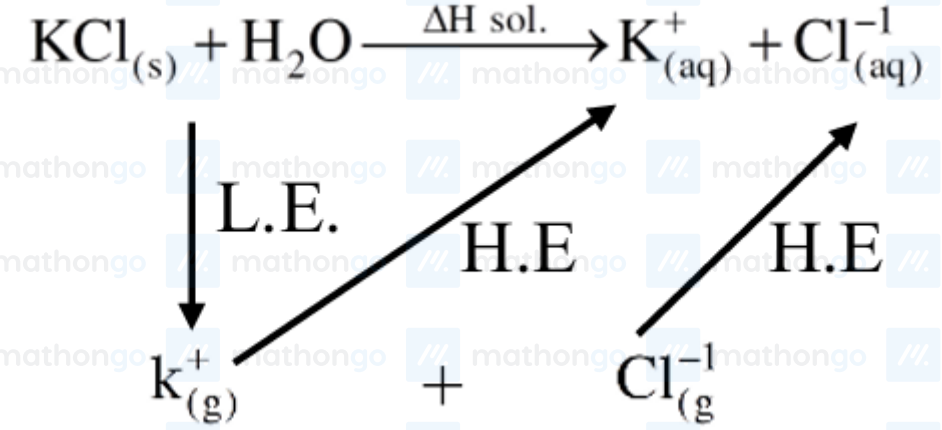
(4)

$$= \frac{70/28}{27/32} = 2.96$$

$$\frac{P_{O_2}}{P_{Ar}} = \frac{n_{O_2}}{n_{Ar}} = \frac{27/32}{3/40} = 11.25$$

Q1. **(4)** Both solutions are having same composition, which is 1 mole of ' x ' in 1 ' ℓ ' water, so all the intensive properties will remain same, but as total amount is greater in solution ' 1 ' compared to solution ' 2 '. So extensive properties will be different hence Gibbs free energy will be different.

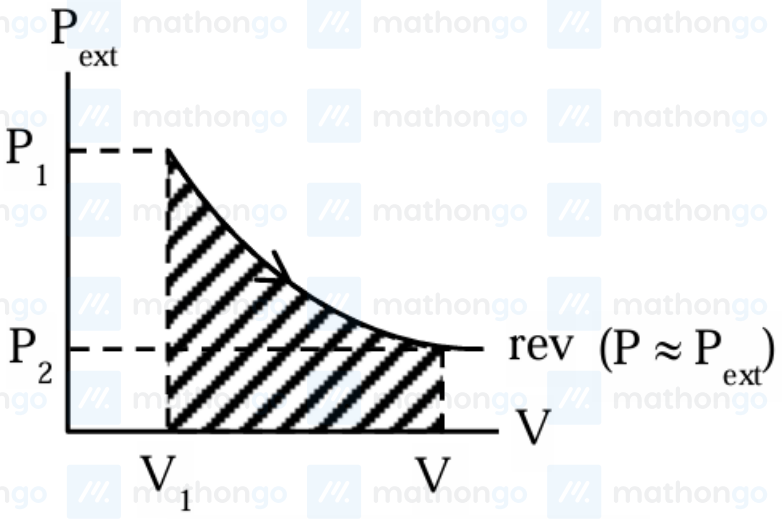
Q2. **(3)**



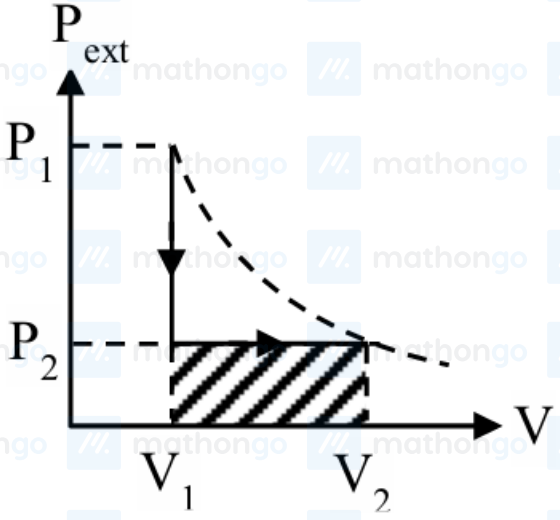
$$\Delta H_{Sol^n.} = L \cdot E \cdot + (H \cdot E)_{K^+_{(g)}} + (HE)_{Cl^{-1}_{(g)}}$$
$$= Z - x - y$$
$$= z - (x + y)$$

Q3. **(2)** For isothermal process

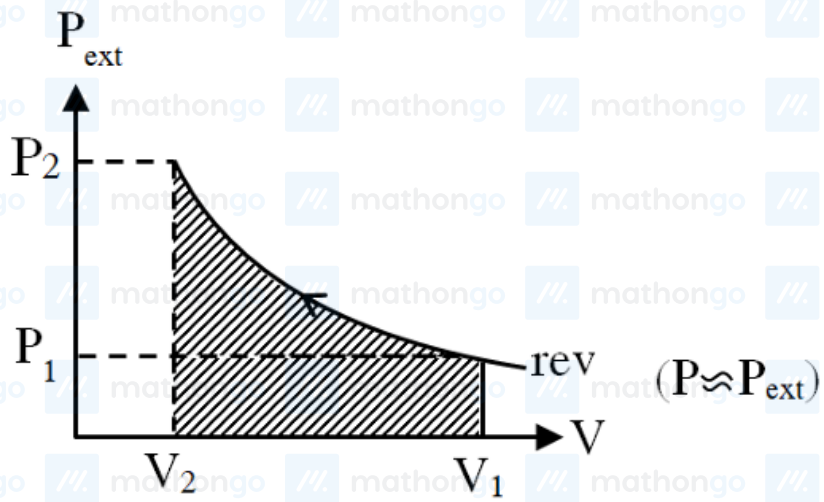
$$|W_{\text{reversible}}|_{\text{expansion}} = |W_{\text{reversible}}|_{\text{compression}}$$
$$= -nRT \ln \frac{V_f}{V_i}$$
$$|W_{\text{irreversible}}|_{\text{expansion}} < |W_{\text{irreversible}}|_{\text{compression}}$$
$$d > c = a > b$$
$$|W_{\text{irreversible}}|_{\text{expansion}} = -P_{ext}\ (V_f - V_i)$$



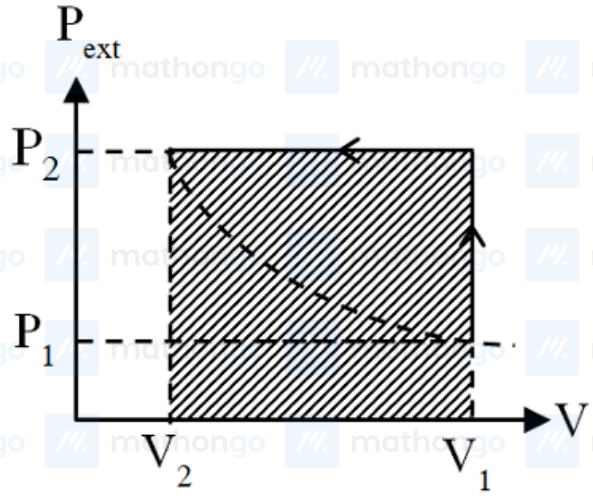
(Reversible expansion)



(Single step irreversible)



(Reversible)



(Single step irreversible)

Graphical representation

We can compare work by area of PV graph

Q4. $W_{1\to 2} = 0$

0 $W_{2\to 3} = -P\Delta V$

$= -3[2-1]$

$= -3 \text{ atm} - \ell$

$W_{3\to 4} = 0$

Total work done

$= -3 \text{ atm} - \ell$

$= -3 \times 101.3 \text{ Joule}$

$= -304 \text{ Joule}$

Q5. $(10\ \mathrm{L}, 300\ \mathrm{K}) \xrightarrow{n=1} (20\ \mathrm{L}, 300\ \mathrm{K})$

(4)

$-\mathrm{q} = \mathrm{w} = -\mathrm{nRT}\ln\dfrac{\mathrm{V_2}}{\mathrm{V_1}}$

$= -8.3 \times 300 \times \ln\left(\dfrac{20}{10}\right)$

$= -1.718\ \mathrm{kJ}$

$\Rightarrow \mathrm{q} = 1.718\ \mathrm{kJ}$

$\mathrm{w} = -1.718\ \mathrm{kJ}$

$\Delta\mathrm{U} = 0 (\because \Delta\ \mathrm{T} = 0)$

Q6. For reaction to be spontaneous according to 2^{nd} law:

(3)

$\Delta\mathrm{G} < 0$

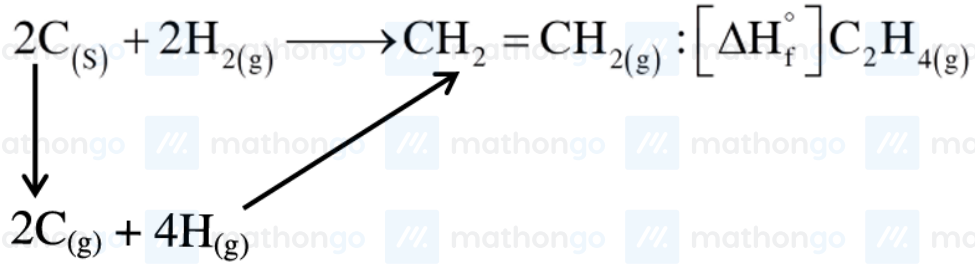
$\Rightarrow \Delta\mathrm{H} - \mathrm{T}\Delta\ \mathrm{S} < 0$

$\Rightarrow\ \mathrm{T} > \left(\dfrac{\Delta\mathrm{H}}{\Delta\ \mathrm{S}}\right) = \mathrm{T_e}$

$\Rightarrow\ \mathrm{T} > \mathrm{T_e}$

Q7.

()



$[\Delta\mathrm{H_f^o}]_{\mathrm{C_2H_{(4)}}} = 2 \times [\Delta\mathrm{H_{sub}^o}]_{\mathrm{C_{(s)}}} + 2 \times \Delta\mathrm{H_{H-H}^o} - 1 \times \Delta\mathrm{H_{C=C}^o} - 4 \times \Delta\mathrm{H_{CH}^o}$

$\Rightarrow\ [\Delta\mathrm{H_f^o}]_{\mathrm{C_2H_{4(g)}}} = (2 \times 710) + (2 \times 436) - 611 - 4 \times 414$

$\Rightarrow\ [\Delta\mathrm{H_f^o}]_{\mathrm{C_2H_{4(g)}}} = 25\ \mathrm{kJ/mol}$

Q8. At melting point when ice melts, supplied heat is utilised to overcome intermolecular attraction within the

(3) molecules so temperature remain constant.

Q9. Mole of octane $= \frac{1.14}{114} = 0.01$ mole

() Heat evolved $= \mathrm{C} \times \Delta\mathrm{T}$

$= 5 \times 5\ \mathrm{kJ}$

$= 25\ \mathrm{kJ}$

$\therefore$ Magnitude of Heat of combustion $= \frac{25}{0.01} = 2500\ \mathrm{kJ/}$ mole

Q10. From the given information

(2) $\Delta\mathrm{H}$ is negative so it means dissolution of gas $\mathrm{HCl(g)}$ is exothermic.

$\mathrm{HCl(g)} + 10\mathrm{H_2O(l)} \rightarrow \mathrm{HCl.10H_2O}$ ...(1)

$\Delta\mathrm{H_1} = -69.01\frac{\mathrm{kJ}}{\mathrm{mol}}$

$\mathrm{HCl(g)} + 40\mathrm{H_2O(l)} \rightarrow \mathrm{HCl.40H_2O}$ ...(2)

$\Delta\mathrm{H_2} = -72.79\frac{\mathrm{kJ}}{\mathrm{mol}}$

Hence heat of solution depends upon amount of solvent

By equation..(2) - equation

$\mathrm{HCl.10H_2O} + 30\mathrm{H_2O}(\ell) \rightarrow \mathrm{HCl \cdot 40H_2O}$

So Heat of dilution $= -72.79 - (-69.01)$

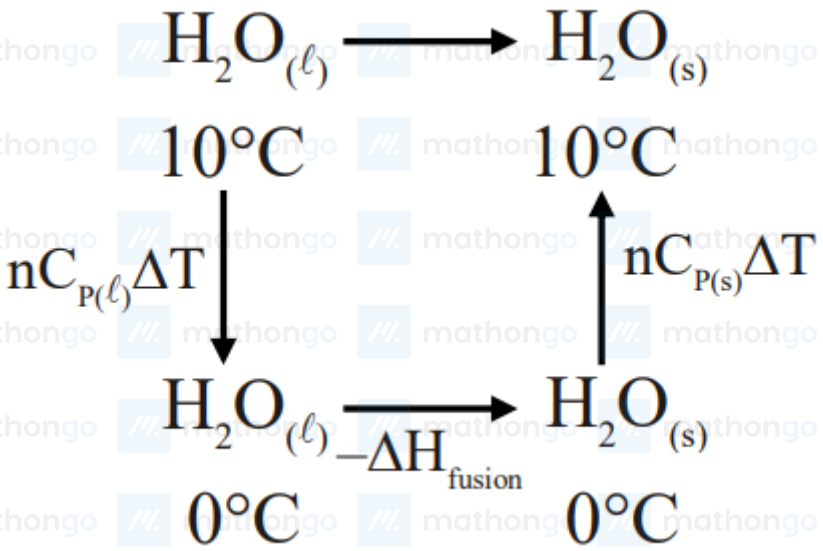
$= -3.78 \frac{\text{kJ}}{\text{mol}}$

Hence option (3) is incorrect.

For heat of formation reactant should be in elemental form hence option (4) is incorrect

Q11.

(2)



$\Delta H = 1 \times y(0 - 10) - x \times 1000 + 1 \times z(-10^{\circ} - 0^{\circ})$

$\Delta H = -10(100x + y + z)$ Joule.

Q12. For standard state $\Rightarrow$ pressure $= 1$ bar and temperature is specified only

(4) $\Rightarrow (\Delta H_f^{\circ})_{O_{2,(g)}} = 0$

Q13. 0

$$\Delta H_{R.E} = \Delta H_{f\,(exp)} - \Delta H_{f\,(Theo)}$$

$$\Delta H_{f\,(exp)} \text{ for } X_2Y_{(g)} = 80 \text{ kJ/mole}$$

for $\Delta H_{f\,(Theo)}$

$$X_{2(g)} + \frac{1}{2} Y_{2(g)} \rightarrow X_2Y_{(g)}\ \Delta H_f = ?$$

$$\Delta H_{f\,(Theo)} = \left(BE_{X \equiv X} + \frac{1}{2} BE_{Y=Y} \right) - \left(BE_{X=X} + BE_{X=Y} \right)$$

$$= \left(940 + \frac{1}{2} \times 500 \right) - (410 + 602)$$

$$= 178 \text{ kJ/mole}$$

$$\Delta H_{R.E} = 80 - 178$$

$$= -98 \text{ kJ/mol}$$

$$|\Delta H_{R.E}| = 98$$

Q14. It is free expansion of gas $\Rightarrow P_{ext} = 0$

(4) Where $w = 0, q = 0$ and $\Delta U = 0$

Q15. $N_2(g) + 3H_2(g) \rightarrow 2NH_3$

(1) $\Delta H^\circ = -ve$

$\Delta S^\circ = -ve$

(As gaseous moles decreases).

(1) As temperature increases $\frac{-\Delta H_R^0}{T}$, decreases

(2) $\Delta G^\circ = -RT \ln K_{eq}$

$R \ln K_{eq} = -\frac{\Delta G^0}{T}$

(on increasing temperature in exothermic reaction K_{eq} decreases)

ΔH° and ΔS° are almost constant with temperature.

Q1. A catalyst can change equilibrium composition if it is added at constant pressure, but it can not change
(2) equilibrium constant.

Q2. On addition of inert gas at constant P \& T, reaction moves in the direction of greater no. of moles so it will shift
(2) in forward direction, so $[PCl_5]$ decrease and $[PCl_3]$ & $[Cl_2]$ will increase.

Q3.

	$CO(g)$	$+$	$2H_2(g)$	$\rightleftharpoons$	$CH_3OH(g)$
(74) $t=0$	0.1 mol		a mol		–
t_{eq}	$0.1-x$		$a-2x$		$x=0.04$
	$=0.06$		$=a-0.08$		
			$=0.23-0.08$		
			$=0.15$ mole		

$V = 2\ L$

$T = 500\ K$

$P_{total} = 5bar$

$n_{Total} = 0.25 = \frac{1}{4}\ mol$

$P_{total} = n_{total} \times \frac{RT}{V}$

$\Rightarrow 5 = (0.06 + a - 0.08 + 0.04) \times \frac{0.08 \times 500}{2}$

$\Rightarrow 10 = (0.02 + a) \times 0.08 \times 500$

$\Rightarrow a = 0.25 - 0.02 = 0.23\ mol.$

$$K_P = \frac{X_{CH_3OH}}{X_{CO} \times X_{H_2}^2} \times \frac{1}{(P_T)^2} = \frac{0.04}{0.06 \times (0.15)^2} \times \left[\frac{1/4}{5}\right]^2$$

$$= \frac{4}{6 \times (0.15)^2 \times 16} \times \frac{1}{25}$$

$$= \frac{100 \times 100}{24 \times 225 \times 25} = \frac{100 \times 100}{135000}$$

$$= 0.074 = 74 \times 10^{-3}$$

Q4.
(2)

$$A(g) \rightleftharpoons B(g) + C(g)$$

$t=0$	a	0	0
$t=t$	$a(1-\alpha)$	$a\alpha$	$a\alpha$

a moles of $A(g)$ taken initially and at time Now moles fraction of $A(g), B(g)$ and $C(g)$ are

$$X_A = \frac{a - a\alpha}{a + a\alpha} = \frac{1-\alpha}{1+\alpha}$$

$$X_B = \frac{a\alpha}{a + a\alpha} = \frac{\alpha}{1+\alpha}$$

$$X_C = \frac{a\alpha}{a + a\alpha} = \frac{\alpha}{1+\alpha}$$

Now if P is total pressure then partial pressure o $\mathrm{A(g)}, \mathrm{B(g)}$ and $\mathrm{C(g)}$ are

$$\mathrm{P_A} = \left(\frac{1-\alpha}{1+\alpha}\right)\mathrm{P}$$

$$\mathrm{P_B} = \left(\frac{\alpha}{1+\alpha}\right)\mathrm{P}$$

$$\mathrm{P_C} = \left(\frac{\alpha}{1+\alpha}\right)\mathrm{P}$$

$$\mathrm{K_P} = \frac{\left(\frac{\alpha}{1+\alpha}\right)\mathrm{P}\left(\frac{\alpha}{1+\alpha}\right)\mathrm{P}}{\left(\frac{1-\alpha}{1+\alpha}\right)\mathrm{P}}$$

$$\mathrm{K_P} = \frac{\alpha^2\mathrm{P}}{1-\alpha^2}$$

As K_P is only function of temperature.

So as $\mathrm{P}\uparrow \quad \alpha\downarrow$

Q1. $\mathrm{pH}=10$

() $\mathrm{pOH}=4$

$\left[\mathrm{OH}^{-}\right]=10^{-4}$

no. of moles of $\mathrm{OH}^{-}=10^{-4}$

no. of moles of $\mathrm{Mg(OH)_2}=\frac{10^{-4}}{2}=5\times10^{-5}$

mass of $\mathrm{Mg(OH)_2}=5\times10^{-5}\times58\times10^{3}\mathrm{mg}$

$=2.9$

Q2. $\mathrm{HCl_{(aq)}}\mathrm{pH}=1;\left[\mathrm{H}^{+}\right]=10^{-1}$

(2) If equal volume of water is added concentration will become half

$\left[\mathrm{H}^{+}\right]_{\mathrm{sol}}=\frac{10^{-1}}{2}$

$\mathrm{pH}=1.3$

Q3. $\mathrm{H_2O(g)}\rightleftharpoons\mathrm{H_{2(g)}}+\frac{1}{2}\mathrm{O_{2(g)}}$

()

$\mathrm{t}=0\quad 1\text{ mole}$

$\mathrm{t}=\mathrm{t_{eq}}\quad 1-\alpha\quad\alpha\quad\frac{\alpha}{2}$

$\mathrm{n_T}=1+\frac{\alpha}{2}\simeq1(\alpha\ll1)$

$\mathrm{k_P}=\frac{\mathrm{P_{H_2}}\cdot\mathrm{P_{O_2}^{1/2}}}{\mathrm{P_{H_2O}}}=\frac{(\alpha\cdot\mathrm{P})\left(\frac{\alpha}{2}\mathrm{P}\right)^{\frac{1}{2}}}{(1-\alpha)\mathrm{P}}$

$8\times10^{-3}=\frac{\alpha^{3/2}}{\sqrt{2}}$

$\alpha^{3/2}=8\sqrt{2}\times10^{-3}$

$\alpha^{3}=128\times10^{-6}$

$\alpha=\sqrt[3]{128}\times10^{-2}$

$=5.03\times10^{-2}$

Q4. When $10\mathrm{ml},2\mathrm{M}\mathrm{NaOH}$ solution is added to 20 ml of 1 M HCl solution :

(2) $\mathrm{NaOH}+\mathrm{HCl}\rightarrow\mathrm{NaCl}+\mathrm{H_2O}$

Initial : $\mathrm{MV}=2\times0.1\quad\mathrm{MV}=1\times0.2$

$=0.2\text{ mole}\qquad=0.2\text{ mole}$

Final $0\quad0$

$\therefore$ Resulting solution becomes neutral.

Now when 10 mol of above solution is poured into a flask containing 2 mole HCl and made solution 100 ml will distilled water.

Molarity of $\mathrm{HCl}=\frac{2}{100}\times1000=20$

Q5. $HX_{(aq)} \rightleftharpoons H^+_{(aq)} + X^-_{(aq)} \quad K_a = 4 \times 10^{-10}$

() $0.01(1-\alpha) \quad 0.01\alpha \quad 0.01\alpha \quad$ Not justified

$\Rightarrow 0.01\alpha = 10^{-5} \Rightarrow \alpha = 10^{-3}$

$K_a = 0.01\alpha^2 = 10^{-8}$

On dilution let final concentration of $HX = cM$

$Hx_{(an)} \rightleftharpoons H^+_{(aq)} + X^-_{(an)}$

$C(1-\alpha) \quad C\alpha \quad C\alpha$

$\Rightarrow C\alpha = 10^{-6} \ldots (1)$

$\frac{C\alpha^2}{1-\alpha} = K_a = 10^{-8} \ldots (2)$

$\Rightarrow \frac{10^{-6}\alpha}{1-\alpha} = 10^{-8}$

Data given is inconsistent \& contradictory. This should be bonus.

Q6.

() $pOH = pK_b + \log \frac{[NH_4^+]}{[NH_3]}$

$\mathbf{pOH} = 4.745$

on adding 0.05 mole HCl

$NH_3 +$	$H^{\oplus}$	$\rightarrow$	$NH_4^{\oplus}$
0.1	0.05		0.1
0.05	0		0.15

$pOH' = 4.745 + \log 3$

$pOH' - pOH = 0.477$

$14 - pH' - 14 + pH = 0.477$

$\Delta pH = 0.477$

$= 47.7 \times 10^{-2} \approx 48 \times 10^{-2}$

Q7. When equal volumes are mixed molarity reduce to half.

(3) For precipitation $Q_{SP} = \left[A^{+2}\right]\left[Y^-\right]^2 > K_{SP}$

(1) $Q_{SP} = \left(1.8 \times 10^{-3}\right)\left(\frac{5}{2} \times 10^{-4}\right)^2 < K_{sP}$

(2) $Q_{SP} = \left(10^{-4}\right)\left(0.4 \times 10^{-3}\right)^2 < K_{sp}$

(3) $Q_{SP} = \left(10^{-2}\right)\left(10^{-2}\right)^2 > K_{sP}$

(4) $Q_{SP} = \left(\frac{1.5}{2} \times 10^{-4}\right)\left(\frac{1.5}{2} \times 10^{-3}\right)^2 < K_{sP}$

Q1. The primary standard is a highly pure stable compound with a known exact composition that can be accurately weighed and dissolved to creat a solution of known concentration.

(4)

NaOH is hygroscopic and can't be used.

$FeSO_4 \cdot 6H_2O$ is unstable and can be easily oxidised.

$Na_2Cr_2O_7$ is hygroscopic and can't be used.

Q1. $MX_3 \rightarrow M^{+3} + 3X^{\ominus}$

() $i = 1 + (n-1)\alpha$

$i = 1 + (4-1)\alpha = 2$

$\alpha = \frac{1}{3} = 33.33\% \approx 33\%$

Q2. Sea water is 6 Molar in NaCl , So 1000 ml of sea water contains 6 mol of NaCl.

() mass of solution = Volume $\times$ density

$= 1000 \times 2$

mass of solution = 2000 g

$$\text{ppm} = \frac{\text{mass of } O_2}{2000} \times 10^6$$

mass of $O_2 = 5.8 \times 2 \times 10^{-3}$

$= 1.16 \times 10^{-2}$ g

molality for $O_2 = \frac{1.16 \times 10^{-2}/32}{(2000 - 6 \times 58.5)} \times 1000$

$$= \frac{1.16 \times 10}{32 \times 1649}$$

$=0.000219$

$=2.19 \times 10^{-4}$

Correct answer $\Rightarrow 2$

Q3. $P_S = P_A^o \cdot X_A + P_B^o \cdot X_B$

(4) $500 = 200 \times \frac{1}{4} + P_B^o \cdot \frac{3}{4}$

$P_B^o = 600$ mmHg

As $P_A^o < P_B^o \Rightarrow$ A is least volatile.

Q4. $P_A^o < P_B^o$

(3) $\frac{P_A^o}{P_B^o} < 1$

$\frac{y_A}{y_B} = \frac{P_A^o}{P_B^o}\frac{x_A}{x_B}$

$\frac{y_A}{y_B}$

$\frac{x_A}{x_B}$

Q5. Binary mixture of C_6H_5OH and $C_6H_5NH_2$ shows negative deviation from Raoult's law

(2) So vapour pressure of solution is less than V.P of pure $C_6H_5OH \& C_6H_5NH_2$

So B.P. of solution is greater than boiling point of pure $C_6H_5OH \& C_6H_5NH_2$

So shows maximum Boiling azeotrope

Q6. For AB

() $\Delta T_b = 2.7$ K

$2.7 = 1 \times 0.5 \times m$

$m = \frac{27}{5}$

Let molar mass of AB = x.

So $\frac{1/x}{15} \times 1000 = \frac{27}{5}$

$x = 12.34$

For AB_2

$\Delta T_b = 1.5\ K$

$1.5 = 1 \times 0.5 \times m$

$m = 3$

Let molar mass of $AB_2 = y$

So $\frac{1/y}{15} \times 1000 = 3$

$y = \frac{1000}{45}$

$y = 22.22$

Now let a and b be atomic masses of A and B respectively, then

$A + b = 12.34 \quad \ldots(i)$

$A + 2\,b = 22.22 \quad \ldots(ii)$

$B = 22.22 - 12.34 = 9.88$

Now $a = 12.34 - 9.88 = 2.46$

$= 24.6 \times 10^{-1} = 25 \times 10^{-1}$

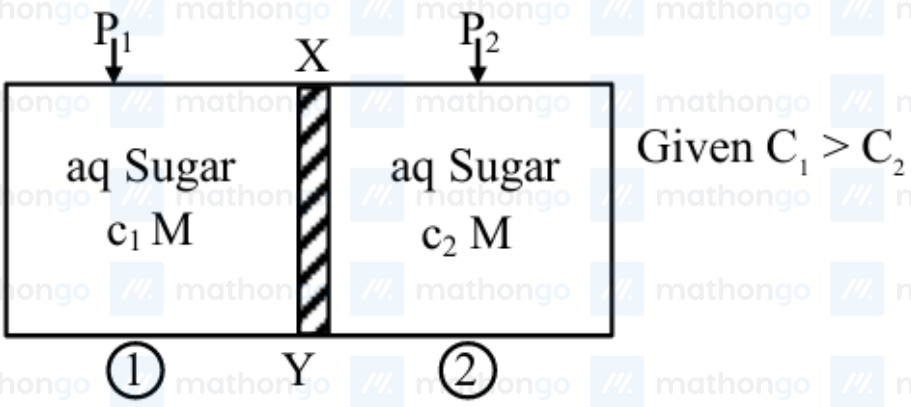
Q7. **(2)**

$\Delta T_b = i_1\, m_1 k_b + i_2\, m_2 k_b$

$= 1 \times \frac{2}{0.5} \times 0.52 + \frac{1 \times 2}{0.5} \times 0.52 = 4.16$

$(T_b)_{solution} = 373.16 + 4.16 = 377.3\ K.$

Q8. **(3)**



Normal osmosis occurs from (2) to (1)

For reverse osmosis from (1) to (2)

Pressure : $P_1 > \pi$

$\therefore$ Answer [A \& C] only

Q9. **(4)**

Statement-I

Molar depression constant $k_f = \frac{M_1 R T_f^2}{\Delta H_{fus}}$

$$k_f = \frac{M_1 R T_f}{\left[\frac{\Delta H_{fus}}{T_f}\right]}$$

$$k_f = \frac{M_1 R T_f}{\Delta S_{fus}}$$

Hence statement-I is correct

but k_f for benzene $= 5.12 \frac{^\circ C}{molal}$

k_f for water $= 1.86 \frac{^\circ C}{molal}$ Hence statement- II is incorrect

Q10. $\Delta T_f = i k_f m$

(1) $0.2 = i \times 1.8 \times 0.1$

$$i = \frac{20}{18} = \frac{10}{9}$$

For $HA_{(aq)} \rightleftharpoons H^+_{(aq)} + A^-_{(aq)}$

$t = 0 \quad 1$

$t = t_{eq} \quad 1-\alpha \quad \alpha$

$i = 1 + \alpha$

$$\frac{10}{9} = 1 + \alpha$$

$$\alpha = \frac{1}{9}$$

$$K_{eq} = \frac{[H^+][A^-]}{[HA]} = \frac{C\alpha^2}{1-\alpha}$$

$$0.1\left(\frac{1}{9}\right)^2$$

$$= \frac{1}{1-\frac{1}{9}} = \frac{1}{720}$$

$K_{eq} = 1.38 \times 10^{-3}$

Q11. $\underset{1^\circ C}{\text{Water}} \xrightarrow[\text{decreases}]{\text{Volume}} \underset{4^\circ C}{\text{Water}} \xrightarrow[\text{thermal expansion}]{\text{Volume increases}} \underset{25^\circ C}{\text{Water}}$ Water

(2) $\text{Molarity} = \frac{n_{solute}}{(\text{ Volume of solution })_\ell}$

Hence

$1^\circ C \xrightarrow[\text{increases}]{\text{molarity}} 4^\circ C \xrightarrow[\text{decreases}]{\text{molarity}} 25^\circ C$

Q12. (A) Solution of chloroform and acetone shows -ve deviation, so maximum boiling azeotrope.

(1) (B) Solution of ethanol \& water shows +ve deviation. So minimum boiling azeotrope.

(C) Solution of benzene and toluene form ideal solution. $\Delta V_{mix} = 0$.

(D) Acetic acid in benzene form dimer.

Q13. As temperature increases solubility first decrease then increase hence K_H first increase than decrease also at

(4) moderate temperature K_H value $He > N_2 > CH_4$.

Q1. $QH_2 + 2Ag^+ \rightarrow 2Ag + Q + 2H^+$

(6) $E = E^\circ - \frac{0.06}{2}\log\left[H^+\right]^2$

$E = E^\circ - 0.06 \times \log\left[H^+\right]$

$pH = -\log\left(H^+\right) = \frac{E - E^o}{0.06} = \frac{0.4 - 0.1}{0.06}$

$= \frac{0.3}{0.06} = 5$

$pH + NH_4X = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$

$5 = 7 - \frac{1}{2} \times pK_b - \frac{1}{2}\log\left(10^{-2}\right)$

$pK_b = 6$

Q2. $\because E^o_{cell} = E^o_{cathode} - E^o_{Anode}$

(1) $1.21 = 1.229 - E^o_{Anode}$

$\because$ Fuel cell involves oxidation of methanol which will occur at anode and reduction of O_2 will occur at cathode.

Q3. * $Cu^{+2} + 2e^- \longrightarrow Cu$

() $(1 \text{ faraday } = \text{ charge on 1 mole electron })$

$t = 0 \quad 1.5 \quad 1 \text{ mole}$

$t = t \quad 1 \quad - \quad 0.5 \text{ mole}$

$\left[Cu^{+2}\right] = 1M$ after electrolysis

* $Ag \oplus + e^- \quad \longrightarrow Ag$

$t = 0 \quad 0.2 \quad 0.1 \text{ mole}$

$t = t \quad 0.1 \quad - \quad -$

$\left[Ag^+\right] = 0.1M$ after electrolysis

Cell $\quad Cu_{(s)} + 2Ag^+_{(aq)} \rightarrow Cu^{+2}_{(aq)} + 2Ag_{(s)}$

reaction

$E = E^\circ - \frac{0.06}{n}\log\frac{\left[Cu^{+2}\right]}{\left[Ag^+\right]^2}$

$E = (0.8 - 0.34) - \frac{0.06}{2}\log\frac{1}{(0.1)^2} = 0.4 \text{ V}$

Correct answer $= 400mV$

Q4. Statement-II $\Rightarrow$ At cathode, instead of Mg, $H_2O_{(\ell)}$ will reduce \& evolve H_2 gas.

(2)

Q5. $Cr_2O_{7\,(aq)}^{-2} + 14H_{(aq)}^{+} + 6e^{-} \rightarrow 2Cr_{(aq)}^{+3} + 7H_2O_{(\ell)}$

()

$$E_R = E_R^0 - \frac{0.059}{6}\log\frac{\left[Cr^{+3}\right]^2}{\left[Cr_2O_7^{-2}\right]\left[H^+\right]^{14}}$$

$$0 = 1.33 - \frac{0.059}{6}\log\frac{10^{-6}}{\left[H^+\right]^{14}}$$

$$\frac{1.33 \times 6}{0.059} = \log\frac{10^{-6}}{[H]^{14}}$$

$$135.254 = -6 - 14\log\left[H^+\right]$$

$$141.254 = 14pH$$

$$pH = \frac{141.254}{14} = 10.08$$

Q6. For charging of lead storage battery cell reaction is

(2) $2PbSO_4(s) + 2H_2O(l) \rightarrow Pb(s) + PbO_2(s) + 2H_2SO_4(aq)$ At anode $PbSO_4$ reduced back to Pb and at cathode $PbSO_4$ oxidised back to PbO_2.

$\because \quad x_1 = +2, y_1 = 0$

$x_2 = +2, y_2 = 4$

Q7. Given : Concentration of $NaOH = 0.2\%(w/v)$

() $\therefore$ 0.2 g of NaOH in 100 ml of solution.

Molarity of NaOH solution

$$= \frac{\text{moles of solute}}{V_{ml}} \times 1000$$

$$= \frac{0.2/40}{100} \times 1000 == \frac{0.2}{40 \times 100} \times 1000 = \frac{2}{40}M$$

Given resistivity of solution $= 870$ m ohm m $= 870 \times 10^{-3}$ohmm

$$= 870 \times 10^{-3} \times 10 \text{ohmdm}$$

$$= 870 \times 10^{-2} \text{ ohm dm}$$

$$= 8.7 \text{ ohm dm}$$

Now conductivity

$K = \frac{1}{\rho} = \frac{1}{8.7}\text{ohm}^{-1}\text{dm}^{-1}$

Now molar conductivity of solution is

$$\lambda_m = \frac{K}{M} = \frac{\frac{1}{8.7}}{\frac{2}{40}} = \frac{40}{2 \times 8.7} = 2.29 \text{ Sdm}^2 \text{ mol}^{-1}$$

$$2.29 \times 10^3 \text{ m Sdm}^2 \text{ mol}^{-1}$$

$$= 22.9 \times 10^2 \text{ m Sdm}^2 \text{ mol}^{-1}$$

$$= 23 \times 10^2 \text{ m Sdm}^2 \text{ mol}^{-1}$$

Q8. Limiting Molar Conductivities of Ions:

(2) - $\overset{\oplus}{H}$: $349.8 Scm^2\ mol^{-1}$

- Na^+ : $50.11 Scm^2\ mol^{-1}$
- K^+ : $73.52 Scm^2\ mol^{-1}$
- Ca^{+2} : $119 Scm^2\ mol^{-1}$

- Mg^{+2} : $106.12 Scm^2\ mol^{-1}$

Therefore correct order of limiting molar conductivity of cations will be -

$\overset{\oplus}{H} > Ca^{+2} > Mg^{+2} > K^+ > Na^+$

Q9. λ_m° of $NH_4Cl = 185$

()

$(\lambda_m^\circ)_{NH_4^+} + (\lambda_m^\circ)_{Cl^-} = 185$

$(\lambda_m^\circ)_{NH_4^+} = 185 - 70 = 115 Scm^2\ mol^{-1}$

$(\lambda_m^\circ)_{NH_4OH} = (\lambda_m^\circ)_{NH_4^+} + (\lambda_m^\circ)_{OH^-}$

$= 115 + 170$

$(\lambda_m^\circ)_{NH_4OH} = 285 Scm^2\ mol^{-1}$

$$\text{degree of dissociation} = \frac{(\lambda_m)_{NH_4OH}}{(\lambda_m^\circ)_{NH_4OH}}$$

$$= \frac{85.5}{285}$$

$$= 0.3$$

$$= 3 \times 10^{-1}$$

Q10. Mohr's salt : $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

(3) Using Kohlrousch law

$\lambda_m^\infty(\text{ Mohr's salt }) = x_1 + 2x_2 + 2x_3$

Q11. From the given graph 2 ml NaOH solution is used for neutralisation of HCl and 3 ml NaOH solution is used for

(2) neutralisation of CH_3COOH.

$\therefore$ Mole of HCl = Mole of NaOH used

$M \times 40 = 0.1 \times 2$

$M = 0.005$

$\therefore$ Mole of CH_3COOH = Mole of NaOaH used

$M \times 40 = 0.1 \times 3$

$M = 0.0075$

HCl is strong acid and will be neutralised first.

Q1. $r_1 = k[A]^n[B]^m$

(1) Now A is doubled \& B is halved in concentration

$\Rightarrow r_2 = k2^n[A]^n \cdot \frac{[B]^m}{2^m}$

Now $\frac{r_2}{r_1} = 2^{(n-m)}$

Q2. $A(g) \longrightarrow 2B(g) + C(g)$

(3) $t = 0 \quad P_0$

$t \to \infty \quad 0 \quad 2P_0 \quad P_0$

$P_\infty = 3P_0 = 240$

$P_0 = 80$ mm of Hg

$Kt = \ln\left(\frac{P_\infty - P_0}{P_\infty - Pt}\right)$

$K \times 10 = \ln\left(\frac{240-80}{240-160}\right)$

$K = \frac{\ell n 2}{10} = 0.0693\ \text{min}^{-1}$

Option (3) is incorrect

Q3. () As it is difficult to predict order using data provided in graph.

For specific time interval $0-5$sec, $5-10$sec and $10-15$sec. order comes to be zero, but graph is not a straight line.

Assuming 1^{st} order kinetics

$K = \frac{1}{t}\ln\frac{A_0}{A_t}$

$K = \frac{1}{10}\ln\frac{40}{20}$

Time required to reduce to $2.5\ g/L$

$K = \frac{1}{t}\ln\frac{50}{2.5}$

$\frac{1}{10}\ln 2 = \frac{1}{t}\ln 20$

$t = \frac{1.3010 \times 10}{0.3010} = 43.3\text{sec}$

Q4.

	$A_{(g)}$	$\rightarrow$	$B_{(g)}$	$+C_{(g)}$
(3) $t=0$	P^o		0	0
$t=t$	$P^o - x$		x	x
$t=\infty$	0		P^o	P^o

$P_t = P^o + x \Rightarrow x = P_t - P^o = P_t - \frac{P_\infty}{2}$

$P_\infty = 2P^o \Rightarrow P^0 = \frac{P\infty}{2}$

$k = \frac{1}{t}\ell\ln\frac{P^o}{P^o - x}$

$k = \frac{1}{t}\ell n\frac{P_\infty}{2(P_\infty - P_t)}$

Q5. $t_{1/2} \propto [A]_0 \Rightarrow$ Order $=$ zero

(2435) $t_{1/2} = \dfrac{A_0}{2\,K} \Rightarrow$ Slope $= \dfrac{1}{2\,K} = 76.92$

$K = \dfrac{1}{2 \times 76.92}$

$[A]_{10} = -Kt + A_0 = -\dfrac{1}{2 \times 76.92} \times 10 + 2.5 = 2.435$

$= 2435 \times 10^{-3}$ mol/L

Q6. Given : $[A]_0 = 8[\,B]_0$

(4) $\left[t_{1/2}\right]_A = 10$ min.

$\left[t_{1/2}\right]_B = 40$ min.

I^{st} order kinetics

$t = ?$

$[A]_t = [B]_t$

$-k_A \times t \quad -k_B \times t$

$\Rightarrow \quad [A]_0 e = [B]_0 e$

$\Rightarrow \quad \frac{[A]_0}{[\,B]_0} = e^{(k_A - k_B)t}$

$\Rightarrow \quad 8 = e^{(k_A - k_B) \times t}$

$\Rightarrow \quad \ell n 8 = (k_A - k_B) \times t$

$\Rightarrow \quad \ln 8 = \ln 2 \left(\frac{1}{(ta_2)_A} - \frac{1}{(ta_2)_B}\right) \times t$

Q7. For zero order reaction

(3) Half life $= \dfrac{A_o}{2k}$

$60\,\text{min} = \dfrac{2}{2k}$

$k = \dfrac{1}{60} \text{M/ min}$

Now

$A_t = A_o - kt$

$t = \dfrac{A_o - A_t}{k}$

$= \dfrac{0.5 - 0.25}{1/60}$

0.25×60

$t = 15$ min

Q8. For I^{st} order reaction

(4) When $C_t = Co/4$

$t_1 = 2t_{50\%}$.

when $C_t = Co/8$

$t_2 = 3t_{50\%}$

so $\dfrac{t_1}{t_2} = \dfrac{2}{3}$

Q9. Arrhenious equation hold true for elementary as well as complex reactions.

(3) Unit of A is same as unit of k. Rate of reaction is high if activation energy is low,

A and Ea are temperature independent.

Q10. $A_2 + B_2 \rightleftharpoons 2AB$

(1) $E_f = 180 \text{ kJ mol}^{-1}$

$E_b = 200 \text{ kJ mol}^{-1}$

$\Delta H = E_f - E_b = -20 \text{ kJ mol}^{-1}$

In presence of catalyst :

$E_f = 180 - 100 = 80 \text{ kJ mol}^{-1}$

$E_b = 200 - 100 = 100 \text{ kJ mol}^{-1}$

Catalyst does not change ΔH or ΔG of a reaction.

Q11. $K = Ae^{-Ea RT}$

(1) $\log k = \log A - \dfrac{Ea}{2.303RT}$

For graph between logk with $\frac{1}{T}$

$|\text{ Slope of curve }| = \frac{Ea}{2.303R}$

From given graph

Magnitude of slope $\Rightarrow (2) > (1) > (3)$

Hence $Ea_2 > Ea_1 > Ea_3$

Q12. *Before applying medicine

(2) $\frac{dA}{dt} = K[A]$ (First order growth) (Rate law)

$\frac{A}{A_0} = \frac{N}{N_0} = e^{Kt}$

*After applying medicine

$$\text{Active Bacteria} \rightarrow \text{Inactive Bacteria}$$

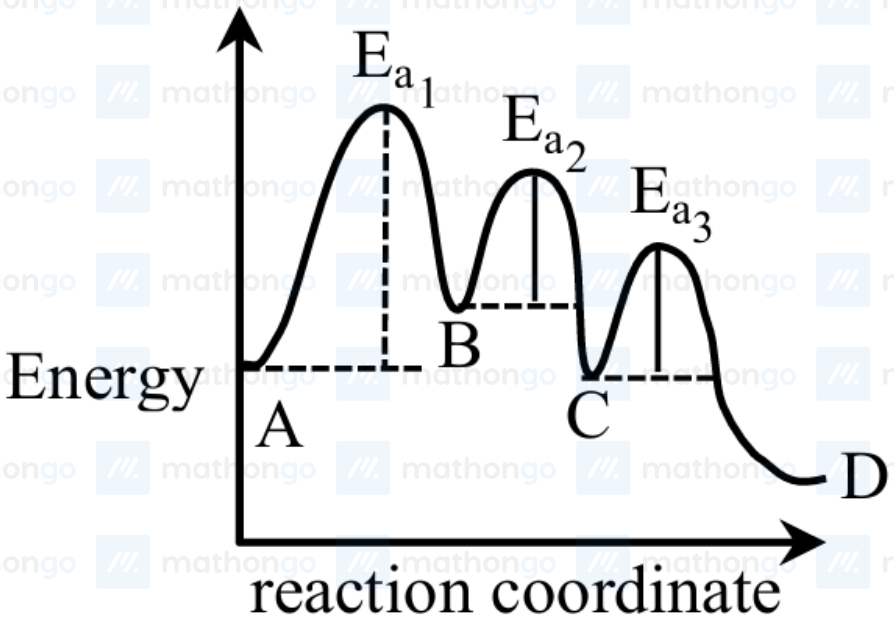
$$(A) \qquad (I)$$

$r = -\frac{dA}{dt} = K[A]^2$ (Rate law)

$y = Kx^2$ Parabola

Q13.

(1)



$A \rightarrow B Slow$

$\Delta H = +ve \quad E_{a_1} \rightarrow High$

$B \rightarrow C fast$

$\Delta H = -ve \quad E_{a_2} \rightarrow Low$

$C \rightarrow D$

$\Delta D = -ve \quad E_{a_3} \rightarrow Low$

Q1. (A) Pnictogen $\Rightarrow$ Mc (Moscovium),

(2) Atomic No. $= 115$

(B) Chalcogen $\Rightarrow$ Lv (Livermorium),

Atomic No. $= 116$

(C) Halogen $\Rightarrow$ Ts (Tennessine),

Atomic No. $= 117$

(D) Noble gas $\Rightarrow$ Og (Oganesson),

Atomic No. $= 118$

Q2. $\Rightarrow$ The metallic radius order of Al & Ga is

(2) $B < \underbrace{Ga < Al} < In < T\ell$

$\downarrow$

(due to poor shielding of d-subshell electrons)

$\Rightarrow$ The ionic radius order of Al^{+3} & Ga^{+3} is $B^{+3} < Al^{+3} < Ga^{+3} < In^{+3} < T\ell^{+3}$

Q3. Size order

(1) $Al > Ga$

$Al^{3+} < Ga^{3+}$

Atomic number of Ga is 31

Q4.

(3)

Atomic no. $32 \Rightarrow$ Ge

Atomic no. $35 \Rightarrow$ Br

Atomic no. $87 \Rightarrow$ Fr

Atomic no. $19 \Rightarrow$ K

Lowest first I.E. among the given element will be of Fr [87].

$Fr - [Rn]\ 7s^1$

Q5. The order of first four elements of group-17 are as follows.

(3) $F < Cl < Br < I$ (Covalent radius)

$Cl > F > Br > I$ (Electron affinity)

$F^- < Cl^- < Br^- < I^-$ (Ionic radius)

$F > Cl > Br > I$ (I^{st} ionization energy\)

Electron affinity order is irregular.

Q6. (i) True, $T\ell^+$ is more stable than $T\ell^{3+}$, due to inert pair effect. So $T\ell^{3+}$ is a powerful oxidising agent.

(2) (ii) True, $E^0_{Al^{3+}/Al} = -1.66$ V. So it is difficult to reduce $A\ell^{3+}$. So $A\ell^{3+}$ is highly stable.

(iii) False, as $T\ell^{3+}$ is unstable

(iv) True, $T\ell^{+}$is more stable than $T\ell^{3+}$

(v) True, $A\ell^{3+}$ and $T\ell^{+}$are highly stable

Q7. **(4)** N : $-1\ s^2 2\ s^2 2p^3$ (Electronegativity $= 3$)

O : $-1\ s^2 2\ s^2 2p^4$ (Electronegativity $= 3.5$)

F : $-1\ s^2 2\ s^2 2p^5$ (Electronegativity $= 4$)

C : $-1\ s^2 2\ s^2 2p^2$ (Electronegativity $= 2.55$)

Correct order $=$ C $>$ B $>$ A $>$ D

Q8. **(1)** (A) The process of adding an $e^-$to a neutral gaseous atom is not always exothermic it may be exothermic or endothermic.

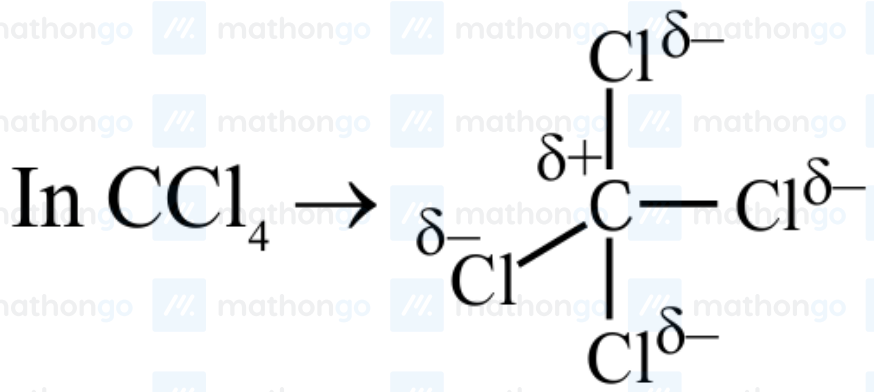
(C) Be B

$1s^2 2s^2$ $1s^2 2s^2 2p^1$

In Be 2 s subshell in fully filled

So, need high energy to remove e^-as compared to B.

(D)



due to partially positive charge $z_{\text{eff}}\uparrow$, EN $\uparrow$

So, EN of C $\Rightarrow$ $CCl_4 > CH_4$

(E) Cs is most electropositive.

Q9. **(1)**

	B	Al	Ga	In	Tl
Atomic radius (pm)	88	143	135	167	170
Electronegativity	2	1.5	1.6	1.7	1.8
Density (g/cm^3)	2.35	2.7	5.9	7.31	11.85
Ionisation Energy(kJ/mol)					

& 801 & 577 & 579 & 558 & 589 \\\hline\end{array}

Radius Order $\mathrm{T}\ell > \mathrm{In} > \mathrm{A}\ell > \mathrm{Ga} > \mathrm{B}$

EN Order $\mathrm{B} > \mathrm{T}\ell > \mathrm{In} > \mathrm{Ga} > \mathrm{Al}$

Density Order $\mathrm{T}\ell > \mathrm{In} > \mathrm{Ga} > \mathrm{A}\ell > \mathrm{B}$

IE_1 Order $\mathrm{B} > \mathrm{T}\ell > \mathrm{Ga} > \mathrm{A}\ell > \mathrm{In}$

Q10. IE order

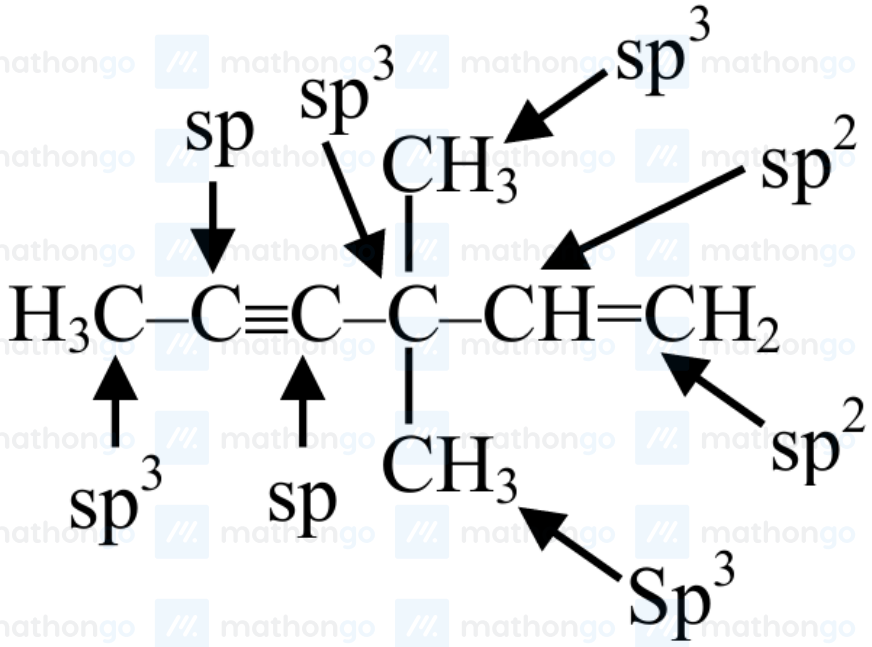
(4) $\mathrm{B} > \mathrm{T}\ell > \mathrm{Ga} > \mathrm{Al} > \mathrm{In}$

Q11. In a period from left to right atomic size decreases.

(2)

Q1.

(1)



$4\text{-}sp^3, 2\text{-}sp^2, 2\text{-}sp$

Q2.

(4)

Molecule	Hybridisation	Dipole Moment	Lone pair on the central atom
SO_2	sp^2	Non-zero	1
NF_3	sp^3	Non-zero	1
NH_3	sp^3	Non-zero	1
XeF_2	sp^3 d	zero	3
$C\ell F_3^{SF_4}$	sp^3 d	Non-zero	2
sp^3 d	Non-zero	1	

Q3. Given A is rarest, monoatomic, non-radioactive p-block element and form AX_4Y type of molecule.

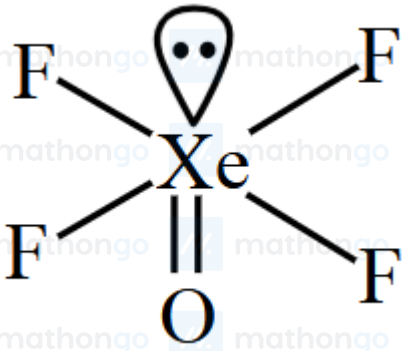
(1) ∴ It is concluded that it is Xe

It is given the electronegativity of A is less than X & Y

It is given the electronegativity of X & Y is highest and second highest respectively among all element.

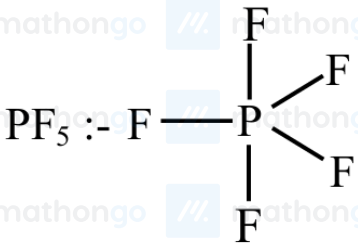
∴ X & Y are F & O

$\therefore$ Compound is consider as $XeOF_4$ with square pyramidal shape.

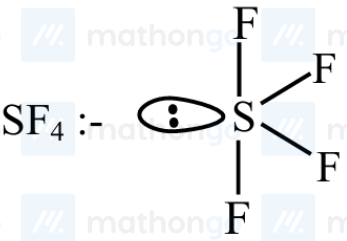


Q4.

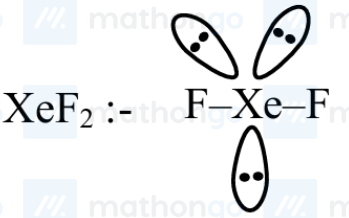
(3)



(a) Hybridisation = sp^3d
(b) All bonds are not identical
(c) No lone pair on central atom



(a) Hybridisation = sp^3d
(b) All bonds are not identical
(c) 1 lone pair on central atom



(a) Hybridisation = sp^3d
(b) All bonds are identical
(c) 3 lone pair on central atom

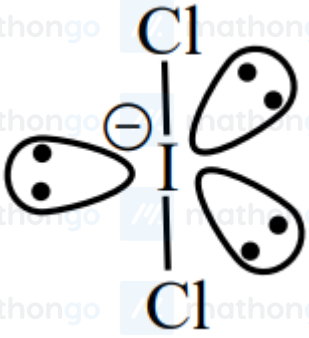
XeF_4 : $-sp^3\ d^2$ Hybridisation

Q5. Statement 1 is correct.

(2) Statement 2 is incorrect since in sp^3 d hybridization; lone pair cannot occupy axial position.

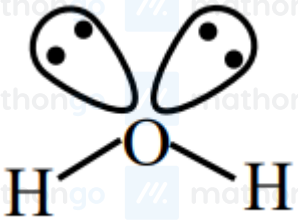
Q6.

(2)



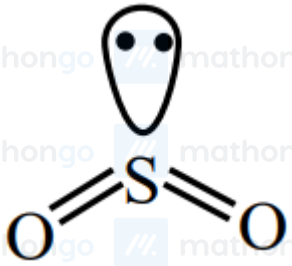
(A)

B.P : L.P = 2 : 3



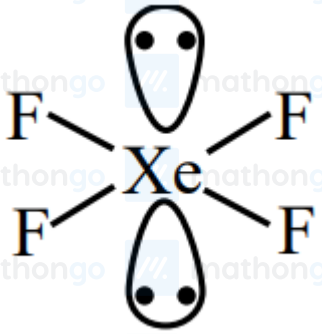
(B)

_____ B.P : L.P = 2 : 2



(C)

_____ B.P : L.P = 4 : 1

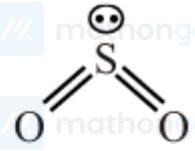


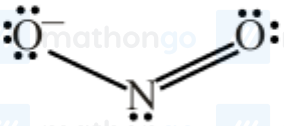
(D)

_____ B.P : L.P = 4 : 2

Q7.

(1)

SO_2  sp^2

NO_2^-  sp^2

N_3^-  sp

Q8.

		No. of unpaired e^-
(A)	O_2	2
(B)	N_2	0
(C)	F_2	0
(D)	S_2	2
(E)	Cl_2	0

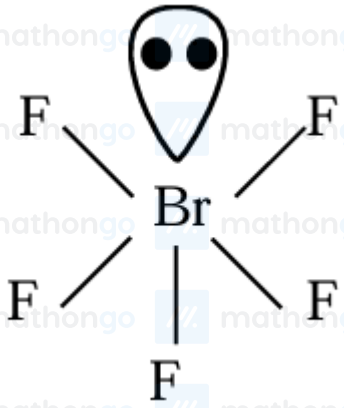
(4)

If species contain unpaired electron than it is paramagnetic.

So A \& D are paramagnetic.

Q9.

()



1 lone pair hence 1 mole AgCl.

Complex is $\left[M(NH_3)_3Cl_3\right]$ Cl.

It shows 2 geometrical isomers (Ma_3 b_3 type) facial (fac) & meridional (Mer)

Q1. Statement 1 is correct since left to right $1E$ increases in general in periodic table.

(1) Statement 2 is incorrect since M.P. of group 14 elements is more than group 13 elements.

Q2. As per given information of ionisation energy

(3) $\mathrm{A} = \mathrm{Sn} \& \mathrm{B} = \mathrm{Pb}$

$\mathrm{A}^{+2} = \mathrm{Sn}^{2+} =$ Reducing agent

$\mathrm{B}^{+4} = \mathrm{Pb}^{+4} =$ Oxidising agent

Q1. $\ddot{N}-\ddot{N}$ single bond weaker than $\ddot{P}-\ddot{P}$ due to more $\ell p-\ell p$ repulsion.

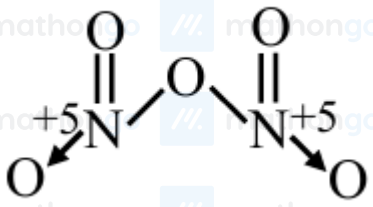
(2) Bond length $\Rightarrow d_{p-p}>d_{N-N}$(size $\uparrow$, B.L. $\uparrow$)

In group 15 elements only N \& P show disproportionation in +3 oxidation state, As, Sb \& Bi have almost inert for disproportionation in +3 oxidation state.

So both statements are false.

Q2. In oxide of nitrogen it can achieve +5 oxidation state because it can form $p\pi-p\pi$ bond with oxygen e.g. N_2O_5

(4)



Nitrogen cannot form halide in +5 oxidation state because it does not contain d-orbital.

e.g. NX_5 does not exist

$X=$ halide

Q3. TeO_2 is oxidizing in nature because it can be reduced from +4 oxidation state to lower oxidation state.

(1) TeH_2 due to less bond dissociation energy easily breaks and hence acidic in nature.

Q4.

(4)

$$\text{Acidic strength}: H_2Se < H_2Te$$

$$\Delta_{dis}H \quad : \quad H_2Se \quad > \quad H_2Te$$

$$[276\ \text{KJ/mol}] \quad [238\ \text{KJ/mol}]$$

Q1.
(1)

			Configuration	No. of unpaired e^-
(1)	V^{3+}	$\Rightarrow$	$[Ar]3d^3 4s^0$	3
	Co^{2+}	$\Rightarrow$	$[Ar]3d^7 4s^0$	3
(2)	Ti^{2+}	$\Rightarrow$	$[Ar]3d^2 4s^0$	2
	Co^{2+}	$\Rightarrow$	$[Ar]3d^7 4s^0$	3
(3)	Fe^{3+}	$\Rightarrow$	$[Ar]3d^5 4s^0$	5
	Cr^{2+}	$\Rightarrow$	$[Ar]3d^4 4s^0$	4
(4)	Ti^{3+}	$\Rightarrow$	$[Ar]3d^1 4s^0$	1
	Mn^{2+}	$\Rightarrow$	$[Ar]3d^5 4s^0$	5

So V^{2+}&Co^{2+} same number of unpaired electron.

Q2. Given magnetic moment = 4.9 B.M.
(4) We know M.M = $\sqrt{n(n+2)}$ B.M.
Where, n $\rightarrow$ No. of unpaired e^-
$4.9 = \sqrt{n(n+2)}$
We get $n = 4$
(A) $_{24}Cr^{2+} \Rightarrow [Ar]3\ d^4$ (4 unpaired e)
(B) $_{26}Fe^{2+} \Rightarrow [Ar]3\ d^6$ (4 unpaired e)
(C) $_{26}Fe^{3+} \Rightarrow [Ar]3\ d^5$ (5 unpaired e)
(D) $_{27}Co^{2+} \Rightarrow [Ar]3\ d^7$ (3 unpaired e^-)
(E) $_{25}Mn^{3+} \Rightarrow [Ar]3\ d^4$ (4 unpaired e^-)

Q3. Statement-I is true but statement II is false.
(2) Cr(VI) is less stable than Mo(VI)
Hence, CrO_3 easily reduce into Cr^{+3} as compared to MoO_3 and show stronger oxidizing nature.

Q4.
()

\begin{array}{|l|l|l|l|l|}\hline & Sc & Mn & Co & Cu \\\hline \begin{array}{l} Enthalpy of \\Atomisation \\(kJ/mole)\end{array}
& 326 & 281 & 425 & 339 \\\hline\end{array}

Highest Co
$Co^{+2} = (Ar)3\ d^7$

$n = 3$

$\mu = \sqrt{15} = 3.87$

Nearest integer $= 4$

Q5. Out of Cr, Co, Fe and Ni

(3) Chromium has lowest heat of atomisation.

$Cr = [Ar]3\,d^5 4\,s^1$

$\because$ Total six valence e^- in Cr.

Q6. * In 3d series Vanadium has highest enthalpy of atomization and colour of V^{+3} is green.

(3) * Oxide form by V^{+3} is V_2O_3 (Basic oxide)

Q7. $CrO_3 =$ Acidic

(1) $Mn_2O_7 =$ Acidic

$\therefore x = 2$

$$[\overset{III}{Co}(H_2NCH_2CH_2NH_2)_3]_2\ (SO_4)_3 \rightleftharpoons 2[\overset{III}{Co}(H_2NCH_2CH_2NH_2)_3]^{3+} + 3SO_4^{2-}$$

$\therefore$ Primary valency $= 3$

$\therefore x + y = 5$

Q8. $Cu^+ : [Ar]3\,d^{10}$, Spin only magnetic moment $= 0$

(3) B.M.

$Cu^{+2} : [Ar]3\,d^9$, Spin only magnetic moment $= \sqrt{3}$

B.M.

$Cr^{+2} : [Ar]3\,d^4$, Spin only magnetic moment $= \sqrt{24}$

B.M.

$Cr^{+3} : [Ar]3\,d^3$, Spin only magnetic moment $= \sqrt{15}$

B.M.

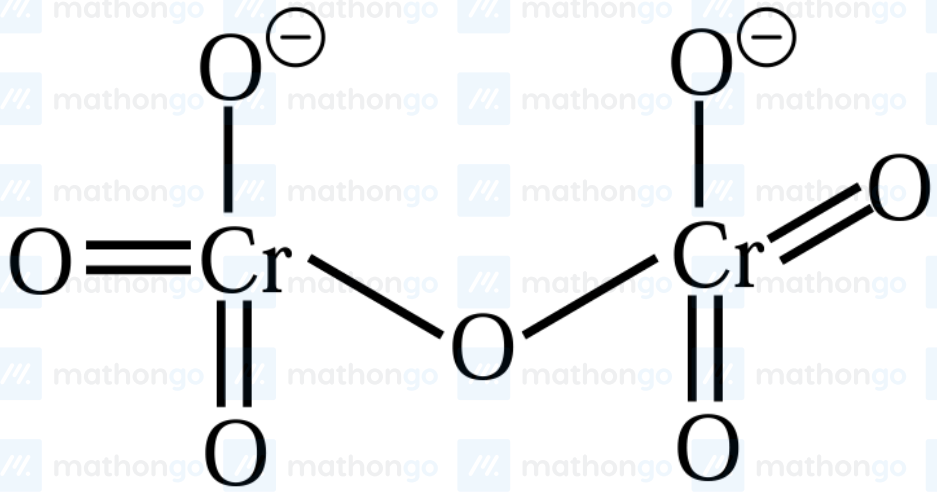
Order of μ : $Cr^{+2} > Cr^{+3} > Cu^{+2} > Cu^+$

Q9. $Cr_2O_7^{2-} + NaCl + H_2SO_4 \rightarrow CrO_2Cl_2$

() $CrO_2Cl_2(\text{ Vapour }) + NaOH \rightarrow Na_2CrO_4 + NaCl + H_2O$

$$Na_2CrO_4 + H^{\oplus} \rightarrow Na_2Cr_2O_7 + H_2O$$

(C)



$Na_2Cr_2O_7 \rightarrow 2Na^{\oplus} + Cr_2O_7^{2-}$

No of terminal "O" = 6

Q10. $Mn^{2+} : [Ar]3\ d^5$

(4) Half filled stability

More 1 E than Fe^{2+}

$Fe^{2+} : [Ar]3\ d^6$

Q11. $\underset{(O.A)}{\overset{+7}{K}MnO} \xrightarrow{\text{Acidic medium}} Mn^{2+}$

()

X is difference in oxidation state.

$6CH_3COO^{\ominus} + Fe^{3+} + H_2O \rightarrow \left[Fe_3\left(OH_2\right)\left(CH_3COO\right)_6\right]^{\oplus} + 2H^{\oplus}$

$\left[Fe_3(OH)_2(CH_3COO)_6\right]^{\oplus}(\text{Brown red ppt}) + 4H_2O \rightarrow \left[Fe(OH)_2\left(CH_3COO\right] + CH_3COOH + H^{\oplus}\right.$

$Fe^{3+} \Rightarrow 3\ d^5 4\ s^0$ contains 5 d electrons

So $Y = 5$

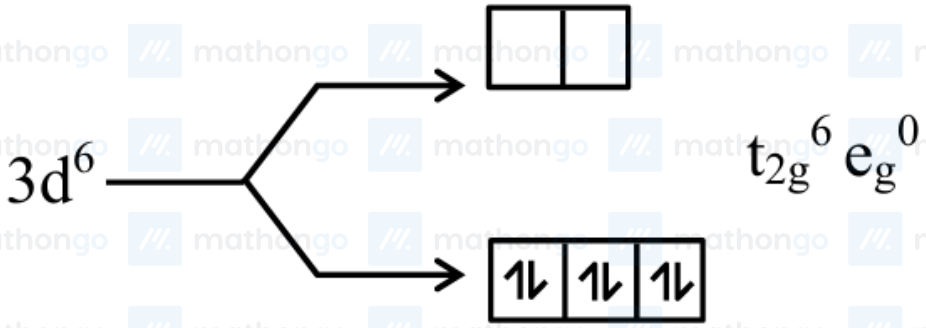
$X + Y = 5 + 5 = 10$

Q1. In $[Co(en)_3]^{+3}$ S.F.L. is present and hence highest value of CFSE

(1) In rest all complexes WFL is present hence CFSE will be low.

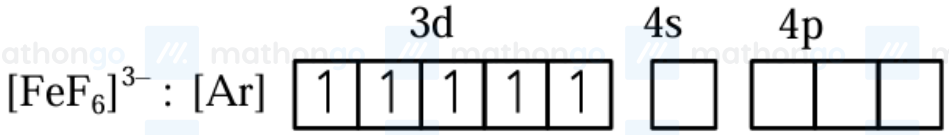
$[Co(en)_3]^{+3} \Rightarrow Co^{+3}$ and en (SFL)

$Co^{+3} \Rightarrow [Ar]3\,d^6$

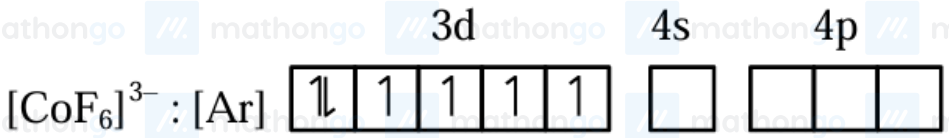


Q2.

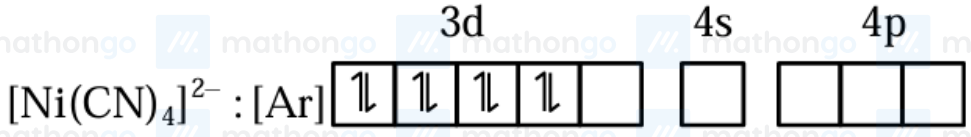
(4)



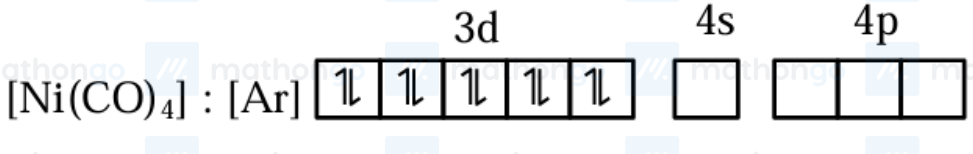
5 unpaired electrons



4 unpaired electrons



Zero unpaired electrons



Zero unpaired electrons

(electrons from 4s de-excited to 3d)

Q3. Primary valency = Oxidation state

(2) Secondary valency = Co-ordination number

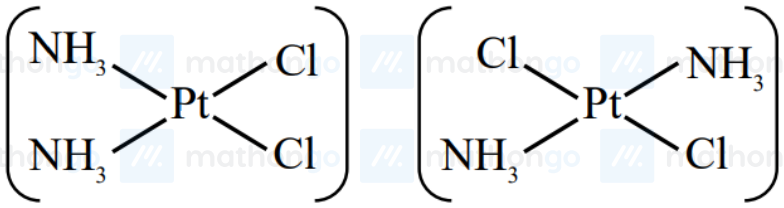
\begin{array}{|l|l|c|c|}\hline & Complex & \begin{array}{l} Primary \\valency\end{array}

& Secondary \\\hline (A) & {\left[\mathrm{Co}(\mathrm{en})_2 \mathrm{Cl}_2\right] \mathrm{Cl}} & 3 & 6 \\\hline (B) & {\left[\mathrm{Pt}\left(\mathrm{NH}_3\right)_2 \mathrm{Cl}\left(\mathrm{NO}_2\right)\right]} & 2 & 4 \\\hline (C) & \mathrm{Hg}\left[\mathrm{Co}(\mathrm{SCN})_4\right] & 3 & 4 \\\hline (D) & {[\mathrm{Mg}(\mathrm{EDTA})]^{2-}} & 2 & 6 \\\hline\end{array}

Q4. Homoleptic complex of type $[Ma_6]$ (Where a $\Rightarrow$ monodentate ligand) cannot show geometrical as well as optical isomerism.

(4)

Cis-platin and trans-platin has formula $[Pt(NH_3)_2Cl_2]$ which is a heteroleptic complex of platinum.



Cis-platin Trans-platin

Q5. $FeCl_3 + KOH + H_2SO_4 \rightarrow K_3\left[Fe(C_2O_4)_3\right]$

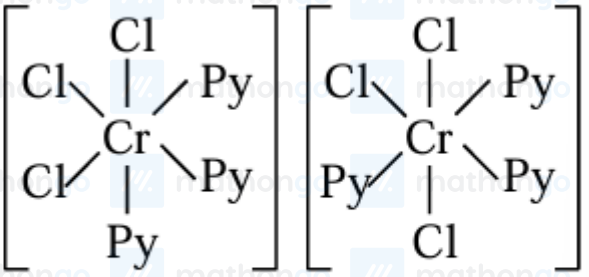
() $\Rightarrow \left[Fe(C_2O_4)_3\right]^{3-}$ is $[M(AA)_3]$ type complex.

So total optical isomers $= 2$

Q6.

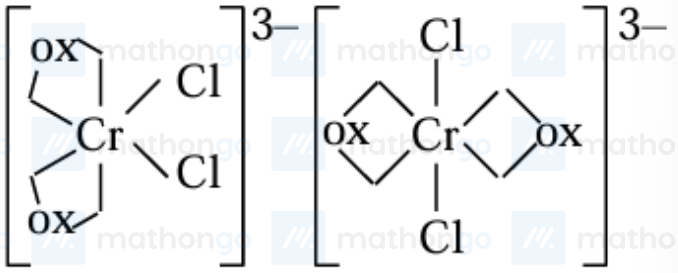
(3)

$[CrCl_3(Py)_3]$



Facial Meridional

$[CrCl_3(ox)_2]^{3-}$



cis isomer trans isomer

(Optically active)

So total stereo isomer $= 2$

Geometrical isomer $= 2(1$ cis $+1$ trans $)$

Optical isomer $= 3$ (2 optically active $+1$ optically inactive)

Stereoisomer $= 3$

Q7. (A) complex is $\left[Co(NH_3)_5(SO_4)\right]$ Cl

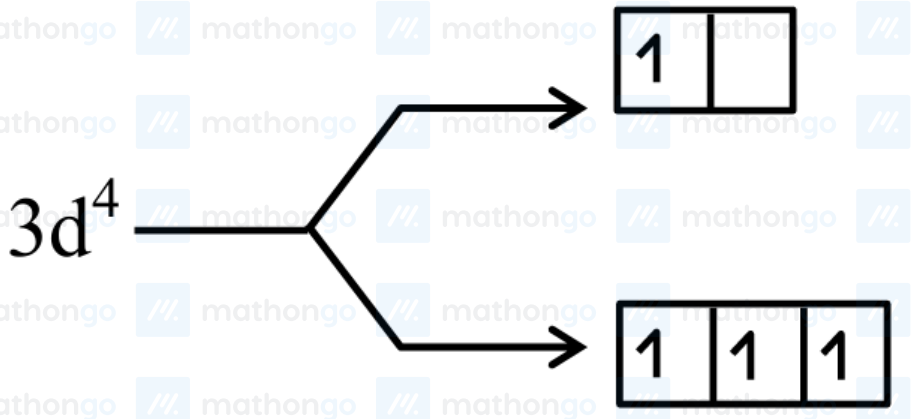
(3) (B) complex is $\left[Co(NH_3)_5Cl\right] SO_4$

Both (A) and (B) are Ionisation isomers.

Q8. $[MnCl_6]^{3-}$ contains Mn^{+3}

(2) $Mn^{+3}: -[Ar]3\,d^4$

Ligand $\Rightarrow Cl^-$ (WFL)



Hybridisation $= sp^3\, d^2$

4 unpaired electrons

Q9. $K_2[NiCl_4] \Rightarrow sp^3$, Paramagnetic

() $[Zn(H_2O)_6]Cl_2 \Rightarrow sp^3\, d^2$, Diamagnetic

$K_3[Mn(CN)_6] \Rightarrow d^2sp^3$, Paramagnetic

$[Cu(PPh_3)_3I] \Rightarrow sp^3$, Diamagnetic

Hence the value of n is 2

Least value of enthalpy of atomisation among Ni , Zn, Mn and Cu is of Zn

$Zn^{+2} : -[Ar]3\, d^{10}$

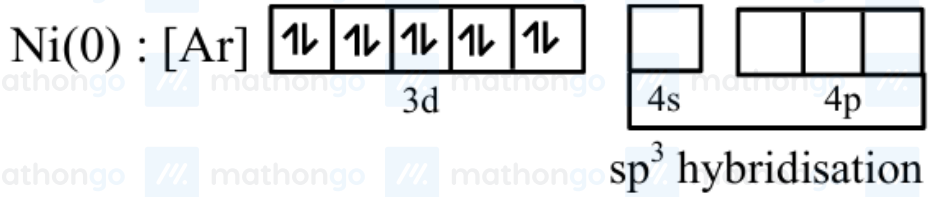
$\mu = 0$

Q10. $PF_5 : 5\sigma + 0\ell p \rightarrow sp^3\, d$

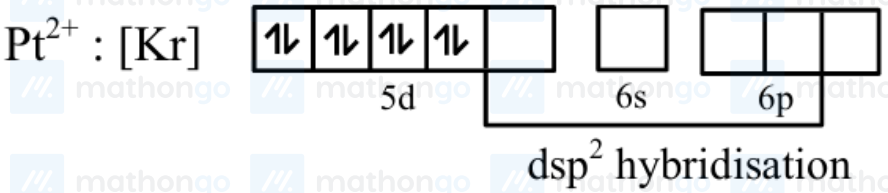
(1) $SF_6 : 6\sigma + 0\ell p \rightarrow sp^3\, d^2$

$Ni(CO)_4 : Ni \rightarrow 0$

In presence of ligand field :-



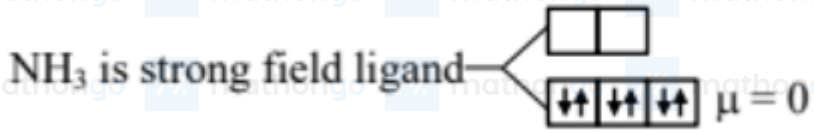
$[PtCl_4]^{2-} : Pt \rightarrow +2$



In presence of ligand field :-

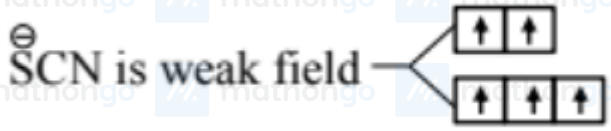
Q11. (1) $[Co(NH_3)_6]^{3+}$ $Co^{3+} \Rightarrow 3\, d^6 4\, s^0$

(4)



$= [-0.4 \times 6 + 0.6 \times (0)]\Delta_0 = -2.4\Delta_0$

(2)



$[Mn(SCN)_6]^4$

$Mn^{2+} \Rightarrow 3\, d^5 4\, s^0$

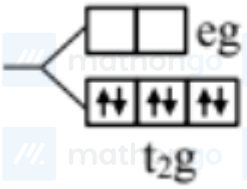
$\mu = \sqrt{35}$ B.M. $= 5.96$ B.M.

$CFSE = (-0.4 \times 3 + 0.6 \times 2)\Delta_0$

So $\Delta_0 = 0$

(3)

$\ominus$CN is SFL

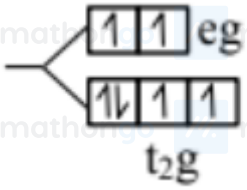


$\mu = 0$

$[Fe(CN)_6]^{-4}$ $Fe^{2+} \Rightarrow 3\,d^6 4\,s^0$

$CFSE = -2.4\Delta_0$

(4) $[FeF_6]^{4-}$



$Fe^{2+} \Rightarrow 3\,d^6 4\,s^0$

$\mu = \sqrt{24}$ B.M. $= 4.89$ B.M.

$CFSE = (-0.4 \times 4 + 0.6 \times 2)\Delta_0 = -1.2\Delta_0$

Q12. $[FeF_6]^{3-}$ Paramagnetic $sp^3\,d^2$

() $[Fe(CN)_6]^{3-}$ Paramagnetic d^2sp^3

$[Mn(CN)_6]^{3-}$ Paramagnetic d^2sp^3

$[Co(C_2O_4)_3]^{3-}$ Diamagnetic d^2sp^3

$[MnCl_6]^{3-}$ Paramagnetic $sp^3\,d^2$

$[CoF_6]^{3-}$ Paramagnetic $sp^3\,d^2$

Only $[Fe(CN)_6]^{3-}$ and $[Mn(CN)_6]^{3-}$ are paramagnetic and d^2sp^3 hybridisation of metal.

Q13.

(1)

$[Fe(CN)_6]^{3-}$ Fe^{3+} $3d^5$ $t_{2g}^{2,2,1}$ $e_g^{0,0}$ unpaired $e^- = 1$

$[FeF_6]^{3-}$ Fe^{3+} $3d^5$ $t_{2g}^{1,1,1}$ $e_g^{1,1}$ unpaired $e^- = 5$

$[CoF_6]^{3-}$ Co^{3+} $3d^6$ $t_{2g}^{2,1,1}$ e_g^{1}, unpaired $e^- = 4$

$[Mn(CN)_6]^{3-}$ Mn^{3+} $3d^4$ $t_{2g}^{2,1,1}$ $e_g^{0,0}$ unpaired $e^- = 2$

Q14. ()

$[Co(NH_3)_6]^{3+}$ Co^{3+} $3d^6$ $t_{2g}^{2,2,2}$ $e_g^{0,0}$

Diamagnetic (unpaired electron = 0)

$[Co(C_2O_4)_3]^{3-}$ Co^{3+} $3d^6$ $t_{2g}^{2,2,2}$ $e_g^{0,0}$

Diamagnetic (unpaired electron = 0)

$[MnCl_6]^{3-}$ Mn^{3+} $3d^4$ $t_{2g}^{1,1,1}$ $e_g^{1,0}$

Paramagnetic (unpaired electron = 4)

$[Mn(CN)_6]^{3-}$ Mn^{3+} $3d^4$ $t_{2g}^{2,1,1}$ $e_g^{0,0}$

Paramagnetic (unpaired electron = 2)

$[CoF_6]^{3-}$ Co^{3+} $3d^6$ $t_{2g}^{2,1,1}$ $e_g^{1,1}$

Paramagnetic (unpaired electron = 4)

$[Fe(CN)_6]^{3-}$ Fe^{3+} $3d^5$ $t_{2g}^{2,2,1}$ $e_g^{0,0}$

Paramagnetic (unpaired electron = 1)

$[FeF_6]^{3-}$ Fe^{3+} $3d^5$ $t_{2g}^{1,1,1}$ $e_g^{1,1}$

Paramagnetic (unpaired electron = 5)

Q15. In $[Co(NH_3)_6]^{3+}$, Co^{+3} : $[Ar]3\,d^6$, NH_3 is S.F.L

(3) Hybridisation state of Co^{3+} is d^2sp^3

In SF_6, Hybridisation state of sulphur is $sp^3\,d^2$

In $[CrF_6]^{3-}$, Cr^{+3} : $[Ar]3\,d^3$

Hybridisation state of Cr^{3+} is d^2sp^3

$[CoF_6]^{3-}$, Co^{+3} : $[Ar]3\,d^6$ F^- is W.F.L

Hybridisation state of Co^{3+} is $sp^3\,d^2$

$[Mn(CN)_6]^{3-}$, Mn^{+3} : $[Ar]3\,d^4$ CN^- is S.F.L Hybridisation state of Mn^{3+} is d^2sp^3

$[MnCl_6]^{3-}$, Mn^{+3} : $[Ar]3\,d^4$ Cl^- is W.F.L

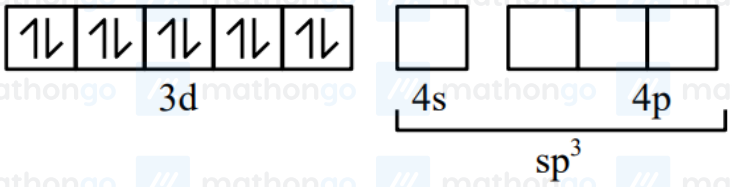
Hybridisation state of Cl^- is $sp^3\,d^2$

Total number of $sp^3\,d^2$ hybridized molecules is 3

Q16.
(3)

(A) $[Ni(CO)_4]$, Ni^0 : $[Ar]3d^8\ 4s^2$

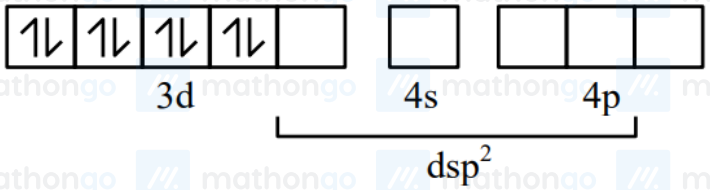
Valence orbitals of Ni^0 in pre-hybridisation state :



Tetrahedral, Diamagnetic, $\mu = 0$ B.M.

(B) $[Ni(CN)_4]^{2-}$, Ni^{+2} : $[Ar]3d^8 4s^0$

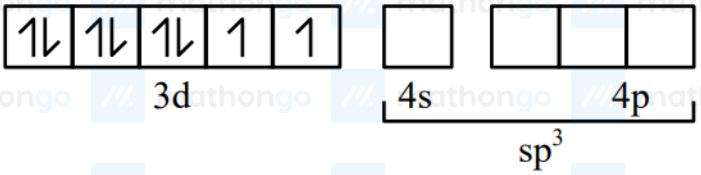
Valence orbitals of Ni^{+2} in pre-hybridisation state :



Square planar, Diamagnetic, $\mu = 0$ B.M.

(C) $[NiCl_4]^{2-}$, Ni^{+2} : $[Ar]3d^8 4s^0$

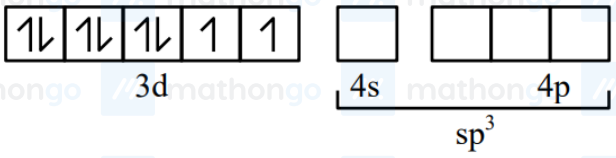
Valence orbitals of Ni^{+2} in ground state :



Tetrahedral, paramagnetic, $\mu = \sqrt{8} = 2.8$ B.M.

(D) $[MnBr_4]^{2-}$, Mn^{+2} : $[Ar]3d^5$

Valence orbitals of Mn^{+2} in ground state :



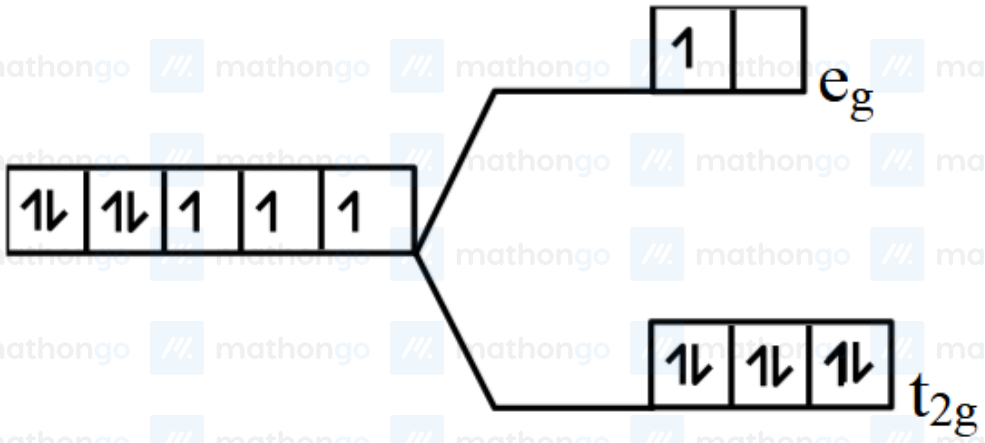
Tetrahedral, paramagnetic, $\mu = \sqrt{35} = 5.9$ B.M.

Q17. In octahedral complex $(CN = 6)$

(4) If $\Delta_0 <$ P.E., then high spin complexes are formed
If $\Delta_0 >$ P.E., then low spin complexes are formed But in tetrahedral complex $(CN = 4)$
$\Delta_t <$ P.E., then mainly high spin complexes are formed and rarely low spin complexes are formed.

Q18. Co has highest standard electrode potential $\left(M^{+3}/M^{+2}\right)$ among Mn, Cr, Co, Fe

(1) $\therefore$ Complex is $[Co(CN)_6]^{4-}$ and its splitting is as follows.



$\therefore$ electron in e_g orbital is one.

Q19. We know $E = h\upsilon = \frac{hC}{\lambda}$

(1) $E \propto \frac{1}{\lambda}$

Here all Co in +3 oxidation state.

So, as the ligand field strength ↑, CFSE ↑

Order of field strength of ligand :

$CN > NH_3 > H_2O > Cl^-$

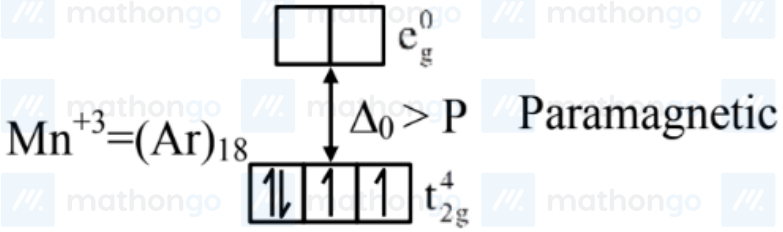
CFSE order : $C > B > A > D$

Wavelength order: $D > A > B > C$

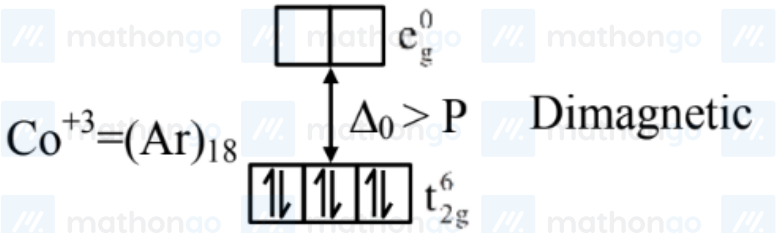
Q20.

(4)

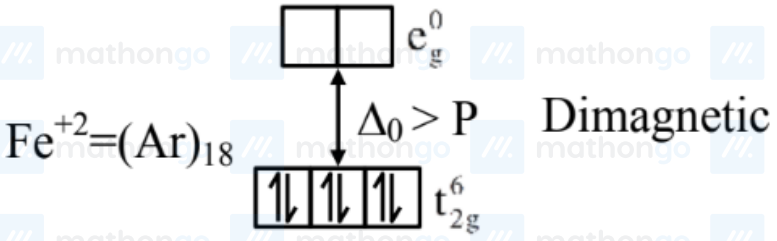
(A) $[Mn(CN)_6]^{3-}$



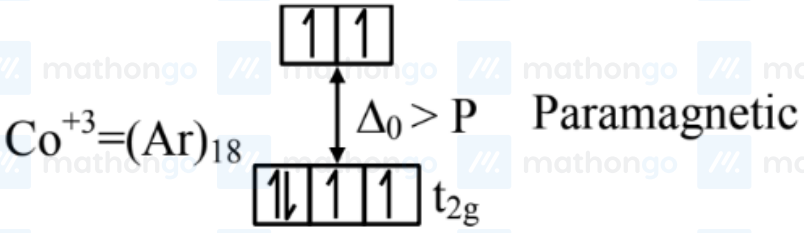
(B) $[Co(NH_3)_6]^{3+}$



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

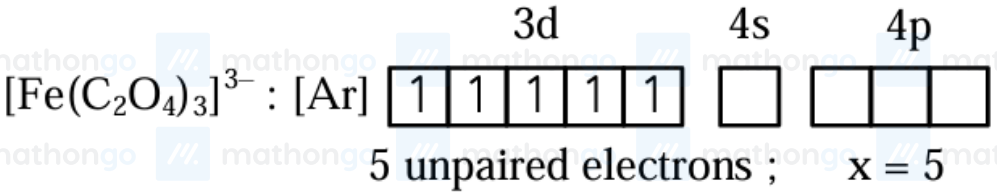


(D) $[Co(H_2O)_3F_3]$



Q21. Most stable is $\left[Fe(C_2O_4)_3\right]^{3-}$ due to Chelation effect.

(4)



5 unpaired electrons ; x = 5

V_2O_5 is amphoteric.

Q1.

(3)

$$\underset{\text{Sodium sulphide}}{Na_2S} + \underset{\text{Sodium nitro Prusside}}{Na_2[Fe(CN)_5NO]} \rightarrow \underset{\text{Violet Colour}}{Na_4[Fe(CN)_5NOS]}$$

Q2. $NH_4^+ + NaOH \longrightarrow H_2O + NH_3 \uparrow$

(2)

$$2[HgI_4]^{2-} + NH_3 + 3OH^- \longrightarrow \underbrace{HgO.Hg\begin{matrix}NH_2\\I\end{matrix}}_{\text{Brown ppt}} + 7I^- + 2H_2O$$

NH_3 is identify by $K_2[HgI_4] + KOH$

Q3. $2CuSO_4 + K_4[Fe(CN)_6] \xrightarrow{CH_3COOH} \underset{\text{(Chocolate brown ppt.)}}{Cu_2[Fe(CN)_6]} + 2K_2SO_4$

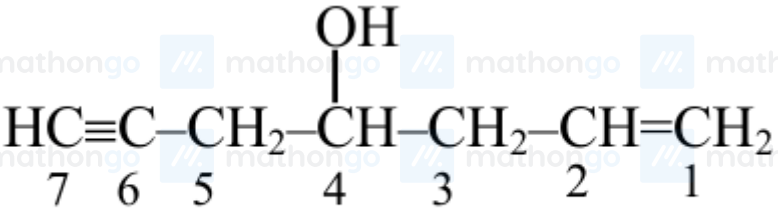
(3)

$$4FeCl_3 + 3K_4[Fe(CN)_6] \longrightarrow \underset{\text{(Prussian Blue ppt.)}}{Fe_4[Fe(CN)_6]_3} + 12KCl$$

$$3ZnCl_4 + 2K_4[Fe(CN)_6] \xrightarrow{NH_4OH} \underset{\text{(White or bluish white ppt.)}}{K_2Zn_3[Fe(CN)_6]_2} + 6KCl$$

Q1.

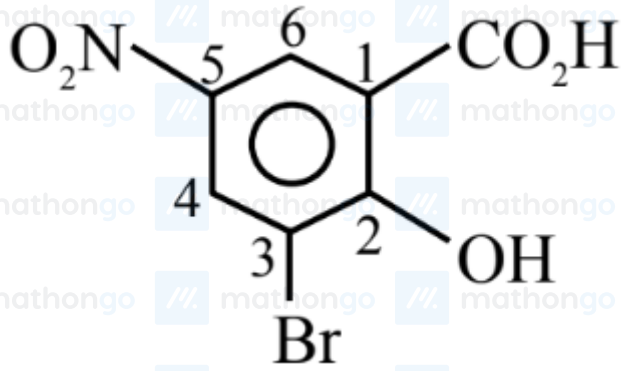
(4)



Hept-1-en-6-yn-4-ol

Q2.

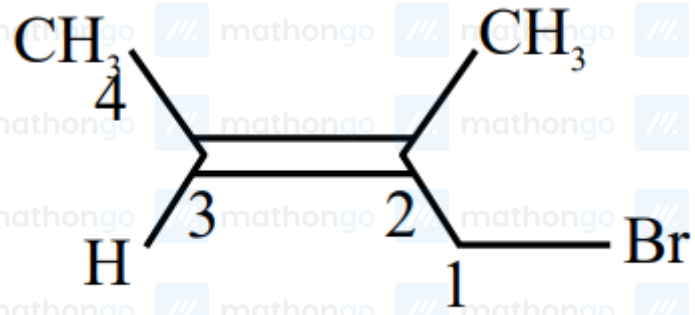
(1)



IUPAC 3-Bromo-2-hydroxy-5-nitro-Benzoic acid

Q3.

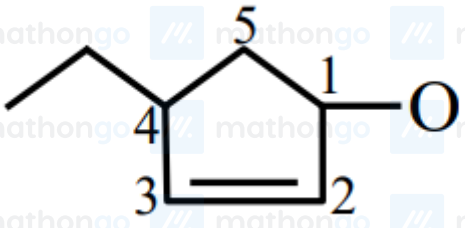
(3)



1-Bromo-2-methyl but-2-ene

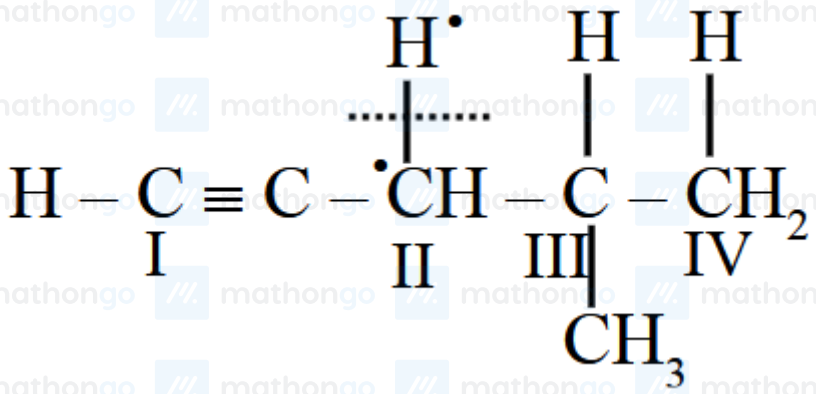
Q4.

(4)



4-Ethylclopent-2-en-1-ol

Q5.
(4)



II most stable carbon radical due to resonance stablise

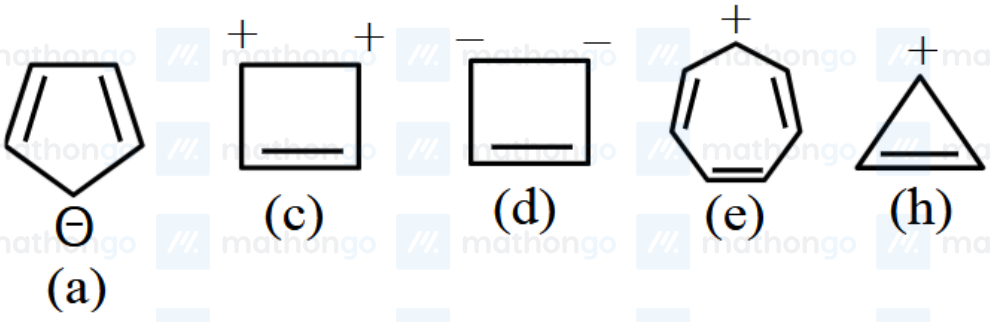
I least stable carbon radical due to no stabilising factor.

Q6.
(3)

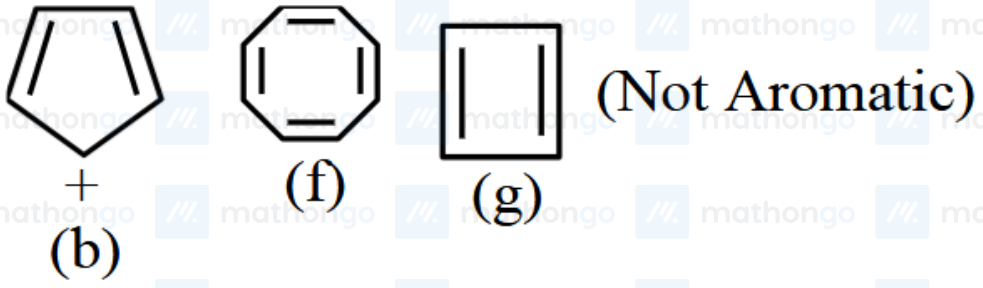
Hyper conjugation is permanent effect because external reagent is not required, so Statement-I is false and Statement-II is true. because moore alkyl group, more $\alpha - H$, so more hyperconjugation which results more stability of carbocation.

Q7.
(4)

Aromatic compounds



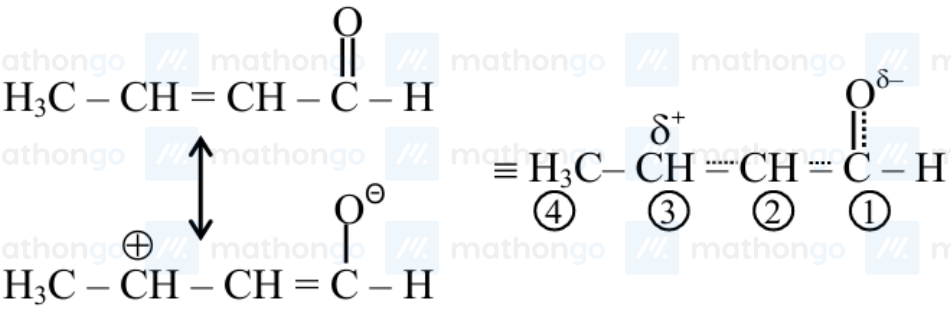
a, c, d, e, h follow Huckel's rule



b, *f*, *g*, are not aromatic, these compounds do not follow Huckel's rule

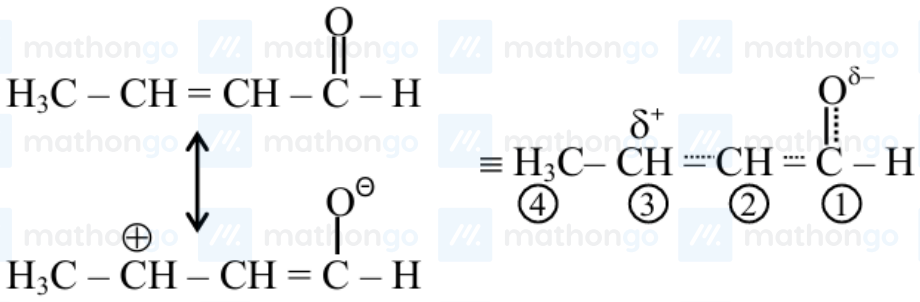
Q8. Statement-I :

(3)



$\mu = q \times d$

More charges and more distance between charges than other compound so more dipole moment. Statement-I is true.

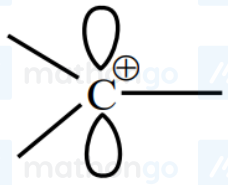


Statement-II :

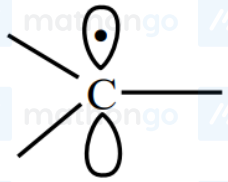
$C_1 - C_2$ bond has partial double bond character that means lesser bond length than $C_1 - C_2$ bond of other compound. Statement-II is false.

Q9. **(4)**

(A) Carbocation $\rightarrow sp^2$ hybridised carbon with empty P-orbital



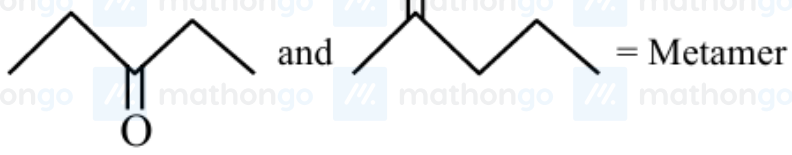
(B) Carbon free radical $\rightarrow sp^2/sp^3$ hybridised carbon with one unpaired electron.



(C) Nuecleophile $\rightarrow$ species of that can supply a pair of electron.

(D) Electrophile $\rightarrow$ species that can receive a pair of electron.

Q10. **(3)**

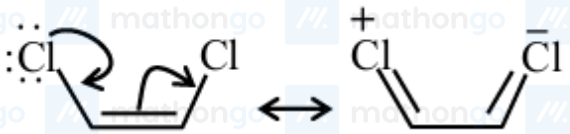
A.  = Metamer

B.  = F. G. isomer

In option C are momologoes to each - other and option D are only organic molecule not isomers.

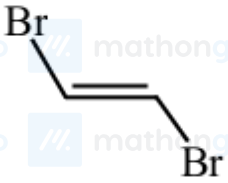
Q11.

(1)

S-I 

Due to vacant –d orbital

more polar

S-II 

$\mu = 0$

$\mu \neq 0$

⇩

Boiling point higher

Q12.

(4)

List-I (Purification technique)		List-II (Mixture of organic compounds)	
(A)	Distillation (simple)	(III)	Chloroform + Aniline
(B)	Fractional distillation	(I)	Diesel + Petrol
(C)	Distillation under reduced pressure	(IV)	Glycerol + Spent-lye
(D)	Steam distillation	(II)	Aniline + Water

Q13. (A) Aniline $-H_2O$: Steam Distillation

(1) (B) Glycerol from spent-lye in soap industry - Distillation under reduced pressure

(C) Different fraction of crude oil in petroleum industry - Fractional distillation

(D) $CHCl_3$ – Aniline - Simple distillation

Q14. Pressure of N_2 gas $= (715 - 15)$

(4) $= 700\text{mmHg}$

$n_{N_2} = \frac{PV}{RT}$

$n_{N_2} = \frac{700 \times 60 \times 10^{-3}}{760 \times 0.0821 \times 300}$

$= 2.24 \times 10^{-3}$ mol

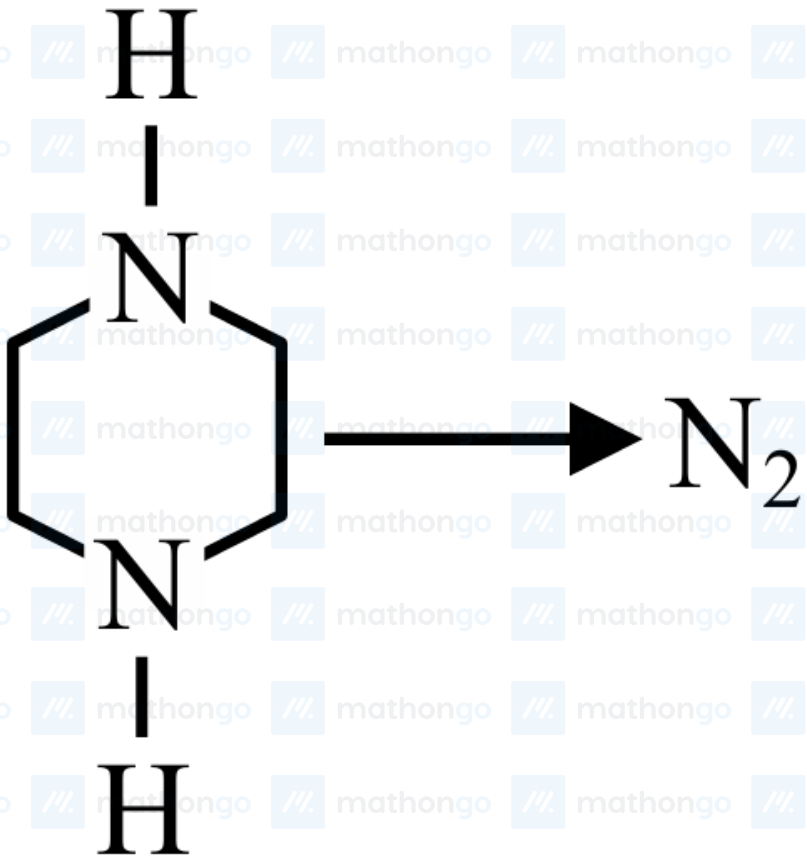
Mass of $N_2 = 2.24 \times 10^{-3} \times 28$ g

$= 0.06272$ g

$\%\ N_2 = \frac{0.06272}{0.5} \times 100 \simeq 12.57$

Q15. M.wt. of given compound $= 86$

()



Applying POAC on ' N '

$n_X \times 2 = n_{N_2} \times 2$

$\frac{0.42}{86} = n_{N_2}$

$\Rightarrow (\text{ Volume })_{N_2}$ at STP $= \frac{0.42}{86} \times 22.4$ L

$= 0.1108$ L $= 110.8$ mℓ

Q16. N_2 gas evolved $= 715 - 15$

$= 700$ mmHg

(1) Pressure of $= \frac{700}{760}$ atm.

$\therefore$ Mole of N_2 evolved $= \frac{PV}{RT}$

$= \frac{700 \times 60 \times 10^{-3}}{760 \times 0.0821 \times 300}$

$= 0.0022$ mole

$\therefore$ wt. % of nitrogen in compound

$= \frac{\text{wt. of nitrogen}}{\text{wt. of compound}} \times 100$

$= \frac{0.063}{0.4} \times 100$

$= 15.71\%$

Q17. Partial pressure of $N_2 = (900 - 15) = 885$ mmHg

0 Mole of $N_2 = \frac{\left(\frac{885}{760} \times 0.15\right)}{(0.0821 \times 300)} = 0.0071$

Moles % of nitrogen in organic compound

$= \frac{(0.0071 \times 28)}{1} \times 10$

$= 19.85\%$

Q18.

0 $\underset{292\text{ mg}}{\text{Organic compound}} \xrightarrow{\text{DUMA'S}} N_2$

$V = 50$ ml

$P = 715$ mm Hg

$T = 300$ k

Aq. tension $= 15$ mm Hg

$P_{N_2} = 715 - 15 = 700\,\text{mmHg}$

$P_{N_2} = \frac{700}{760}\,\text{atm}$

$n_{N_2} = \frac{P_{N_2} \cdot V}{RT}$

$n_{N_2} = \frac{700}{760} \times \frac{50}{1000} \times \frac{1}{0.0821 \times 300}$

$n_N = 2 \times n_{N_2}$

Mass of $N = 2 \times n_N \times 14$

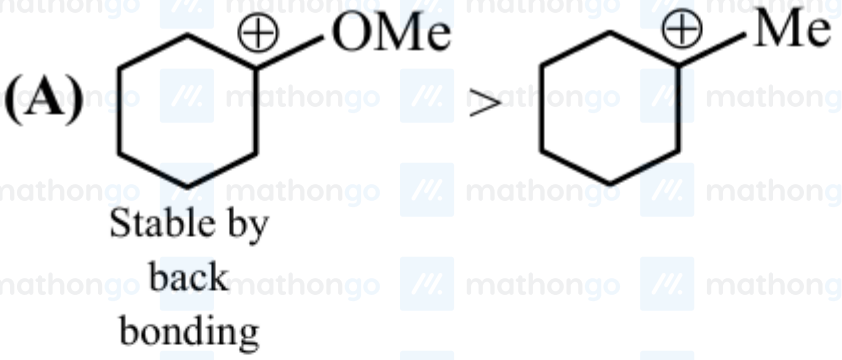
$\% N = \frac{\text{mass of N}}{\text{mass of organic compound}} \times 100$

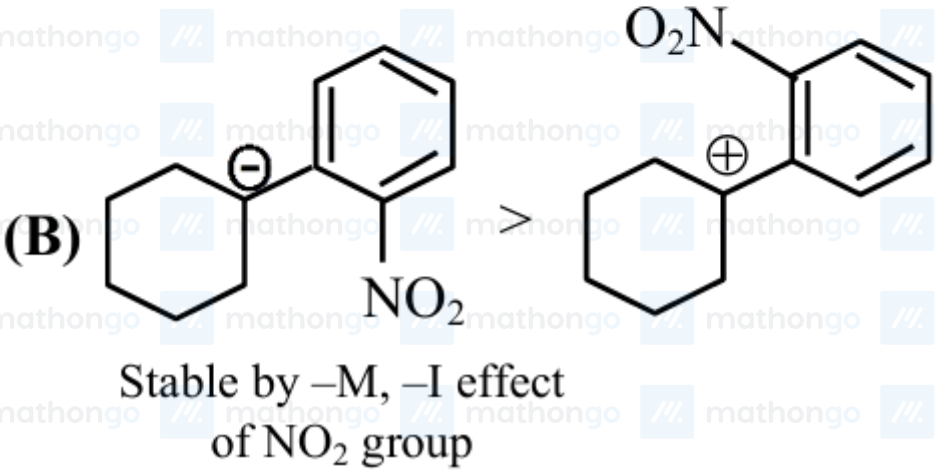
$\% N = \frac{700}{760} \times \frac{50}{1000} \times \frac{2 \times 14}{0.0821 \times 300} \times \frac{1000}{292} \times 100$

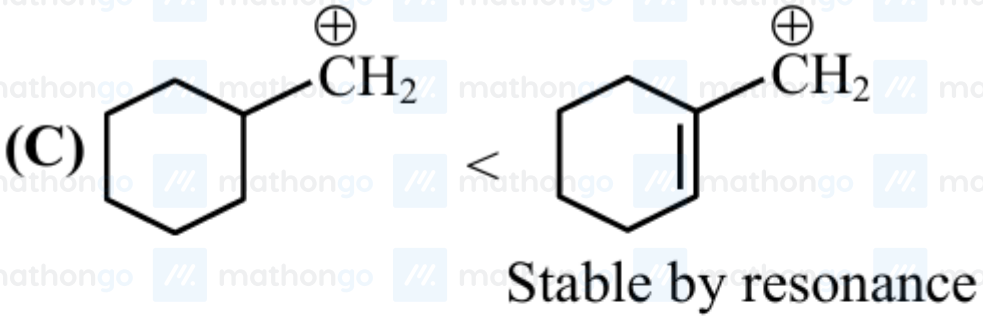
$\% N = 18\%$

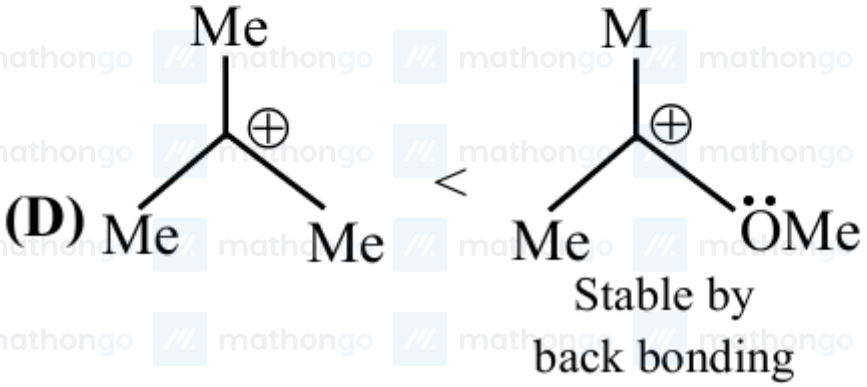
Q19.

(2)


(A)
OMe
Me
>
Stable by back bonding


(B)
O_2N
NO_2
>
Stable by –M, –I effect of NO_2 group

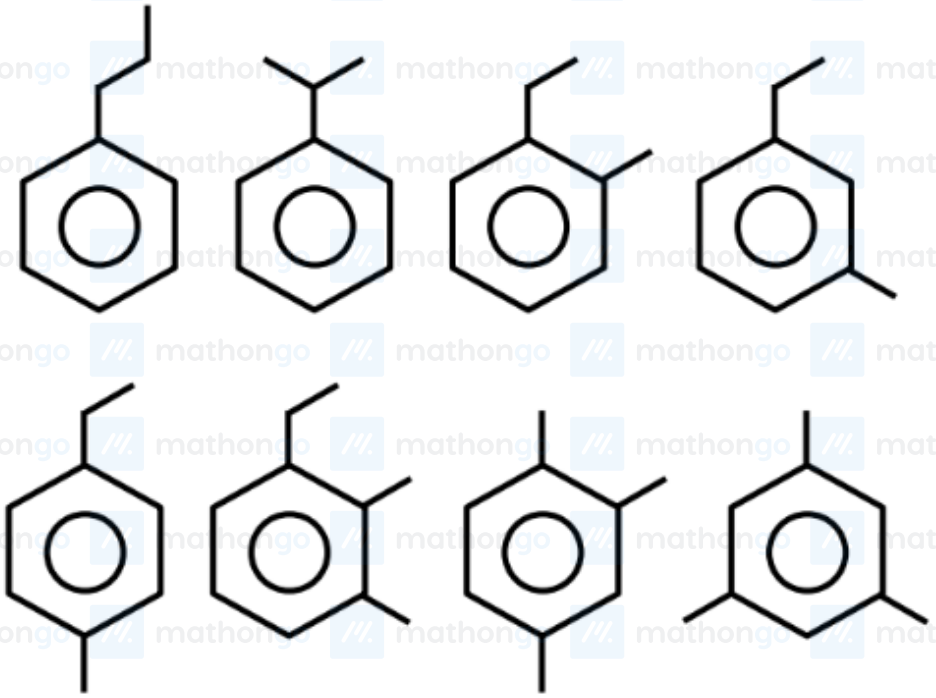

(C)
CH_2
CH_2
<
Stable by resonance


(D)
Me
Me
Me
<
M
Me
ÖMe
Stable by back bonding

Q20. $\mathrm{MF} = \mathrm{C_9H_{12}}$

()

$\Rightarrow$



Q1. Organic $\rightarrow CO_2$

() Compound

Applying POAC on ' C '

(mole) of ' C ' in compound $= n_{CO_2} \times 1$

So mass of ' C ' in compound

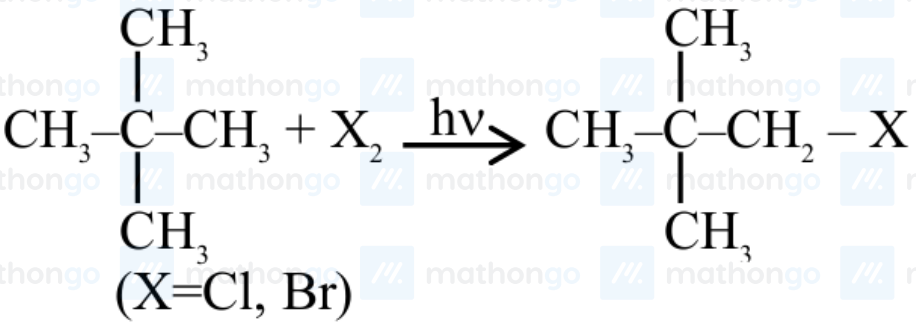
$= \frac{1.46}{44} \times 12$

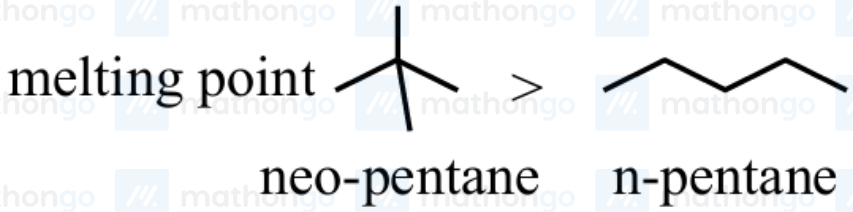
So, % of ' C ' in compound $= \frac{1.46}{44} \times \frac{12}{0.5} \times 100$

$= 79.63$

Q2. Both Statement-I and Statement-II are correct

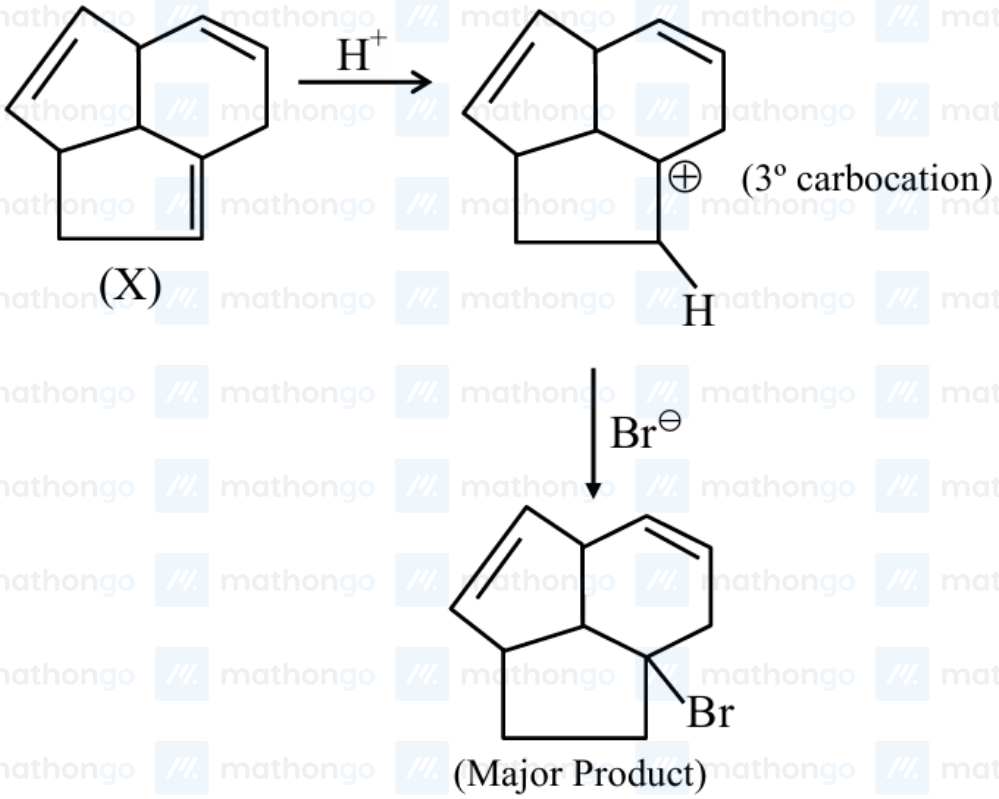
(2)





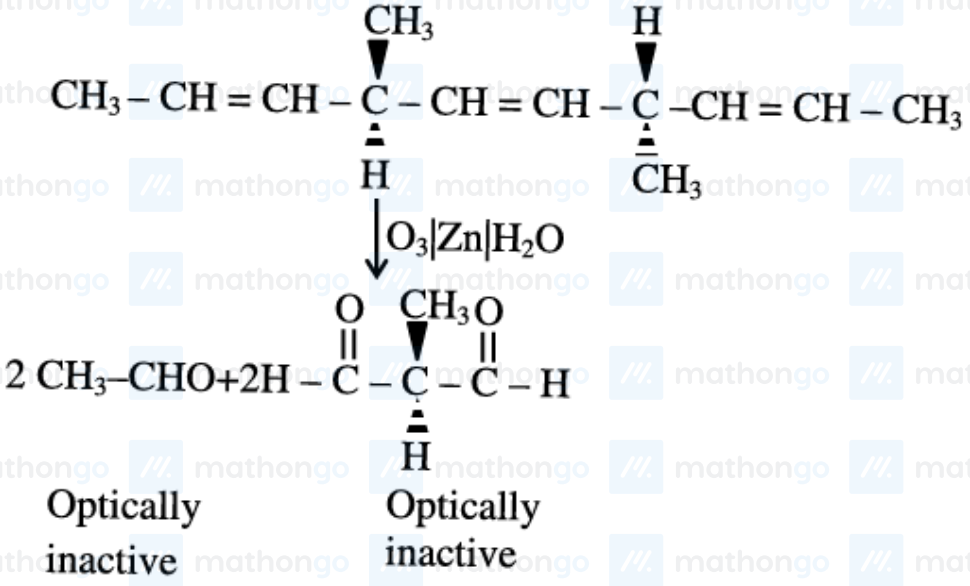
Q3.

(2)


H+
(X)
(3° carbocation)
H
Br⊖
Br
(Major Product)

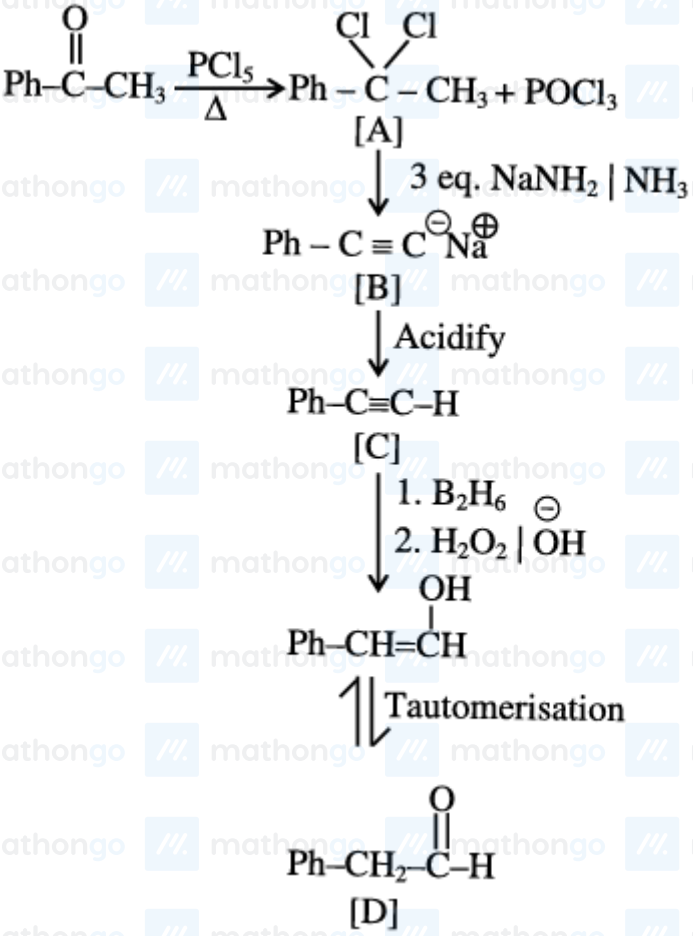
Q4.

(2)


CH3 – CH = CH – C – CH = CH – C –CH = CH – CH3
H
CH3
O3|Zn|H2O
2 CH3–CHO+2H – C – C – C – H
O
CH3 O
H
Optically inactive
Optically inactive

Q5.

()



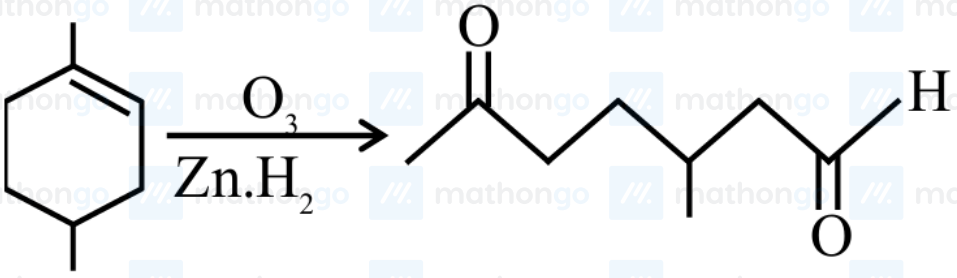
$\Rightarrow$ Number of sp^2C-atoms in product D $= 7$

NTA Ans. $= 7$

ALLEN Ans. $= 7$

Q6.

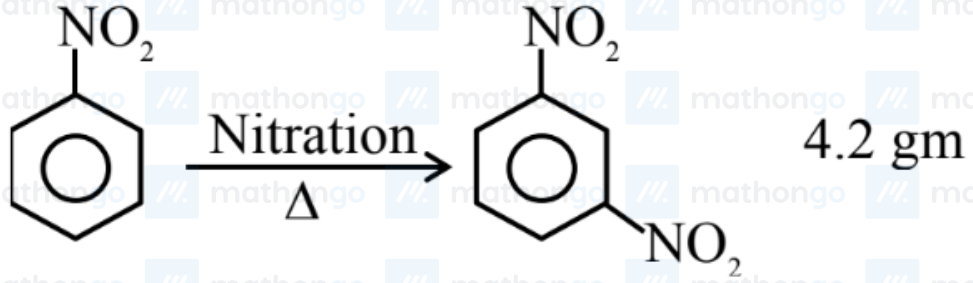
(2)



3-Methyl-6-ketoheptanal

Q7.

()



$C_6H_5NO_2$ $\quad$ MF $= C_6H_4\,N_2O_4$

MW $= 123$ $\quad$ MW $= 168$

$\therefore \frac{4.2}{168} = 0.025$ mol

$\because$ required gm of nitro benzene

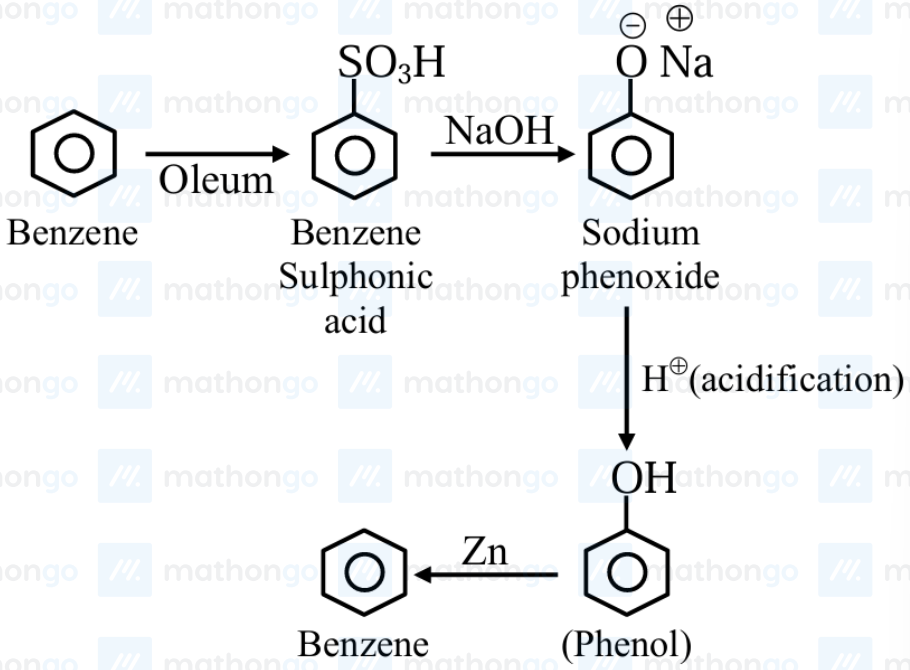
$= 123 \times 0.025$

$= 3.075$

$\therefore$ Nearest integer is 3

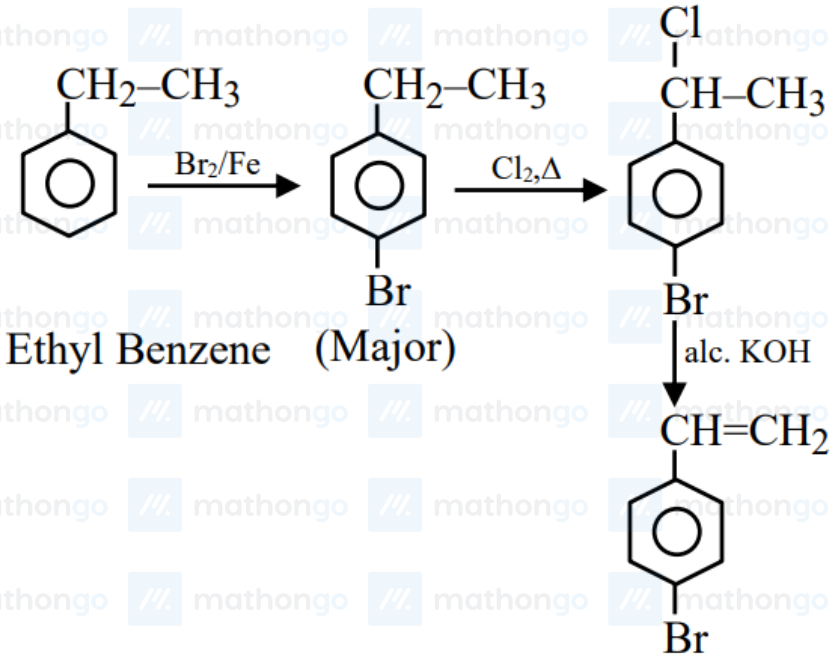
Q8.

(2)



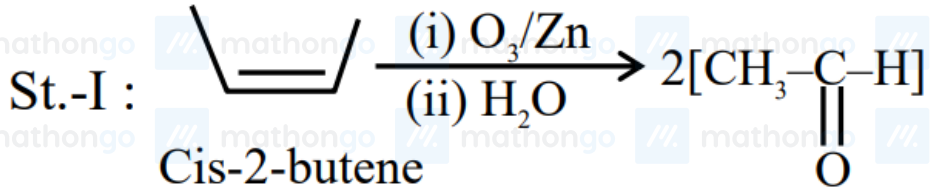
Q9.

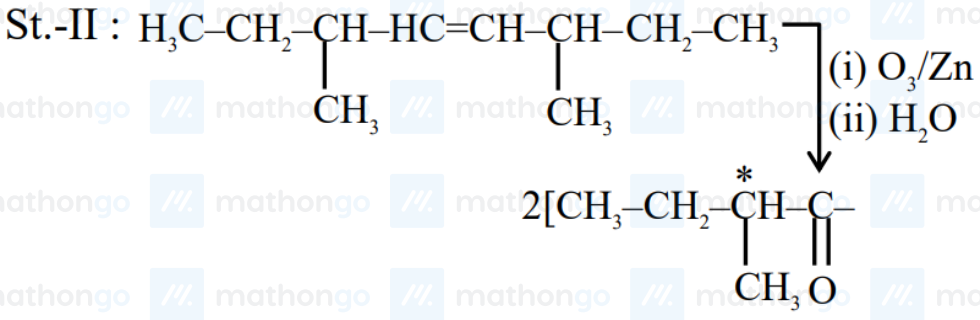
(1)



Q10.

(3)



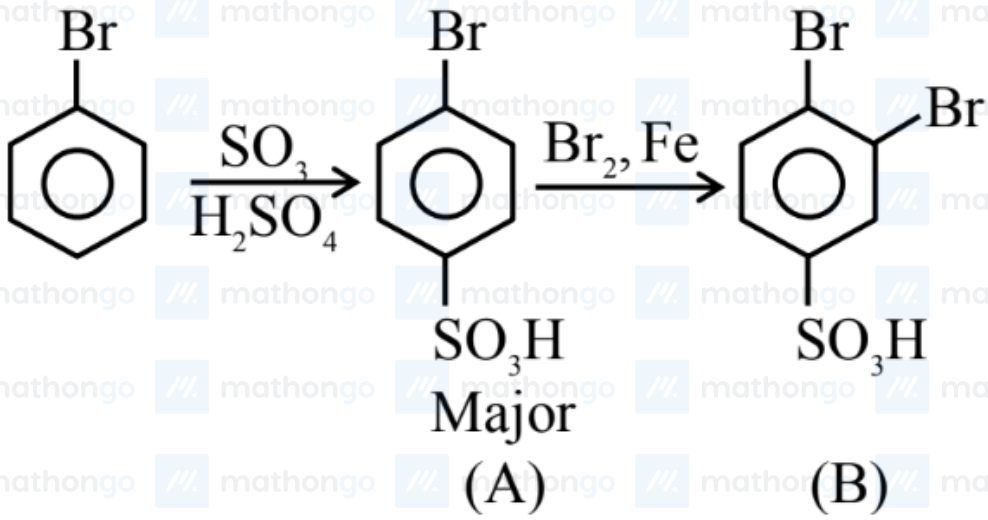


St-I : Correct statement

St-II : In correct statement because product has chiral centre.

Q11.

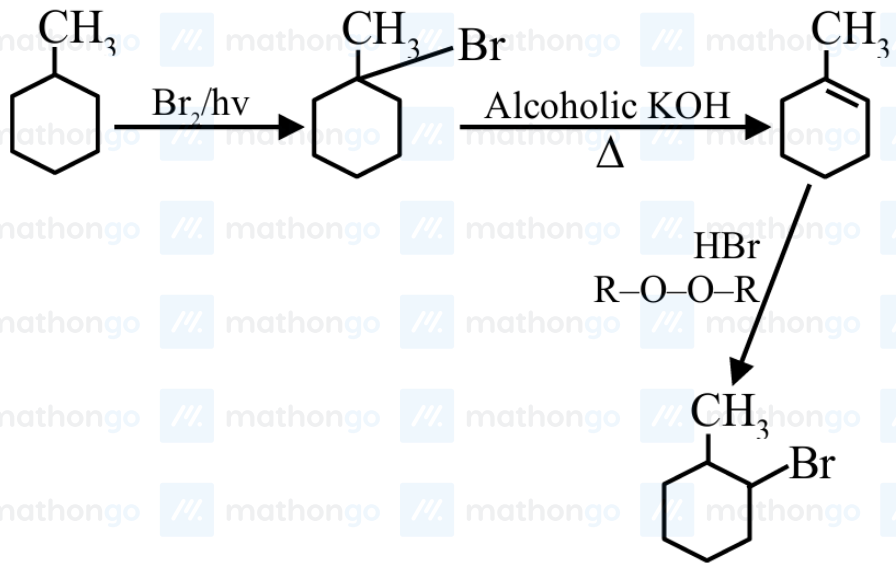
(2)



Both reactions are electrophilic substitution reaction, I^{st} is sulphonation and II^{nd} is halogenation :

Q1.

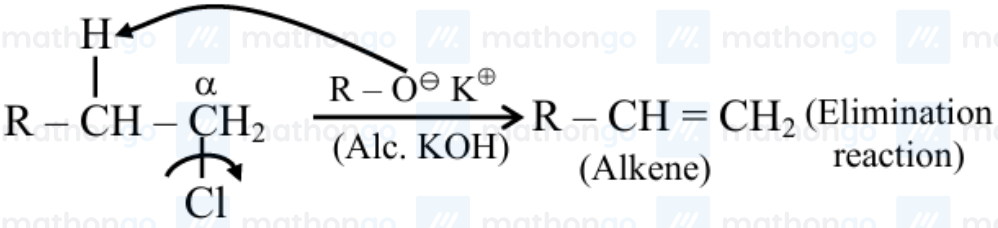
(2)



Q2. Statement (I) :

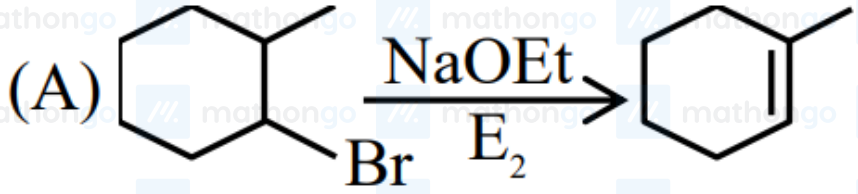
(2) $R - Cl \xrightarrow{(\text{aq. KOH})} R - OH\ (S_N \text{ reaction})$

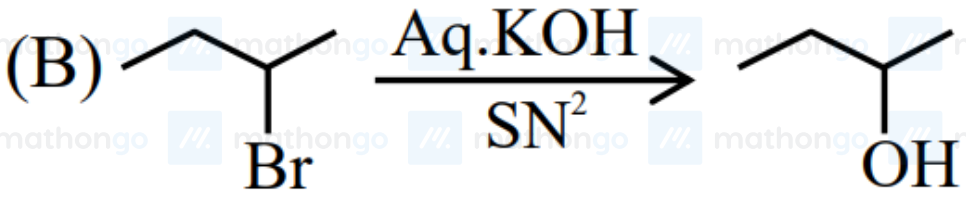
Statement (II) :

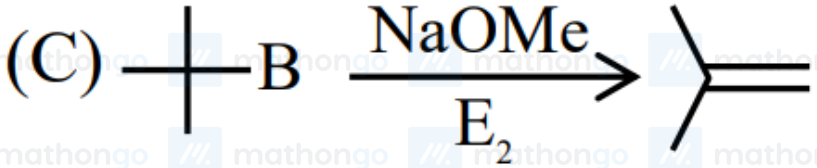


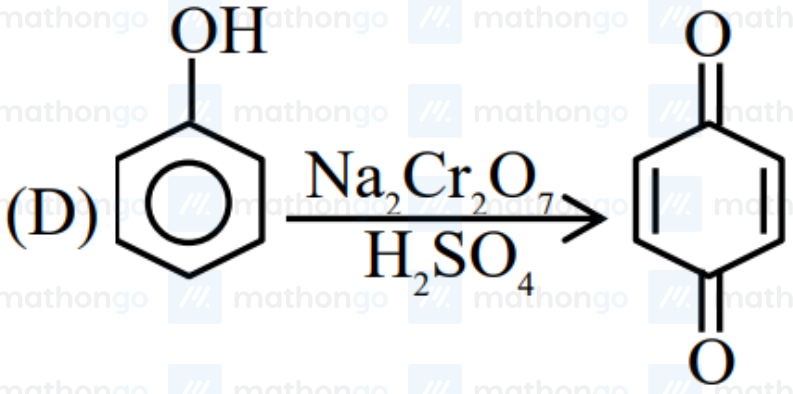
Q3.

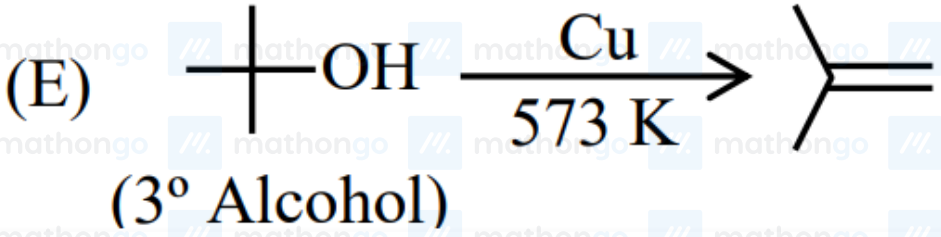
(4)





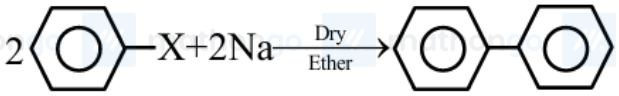






Option (B) and (D) reaction are not able to form alkene as a product.

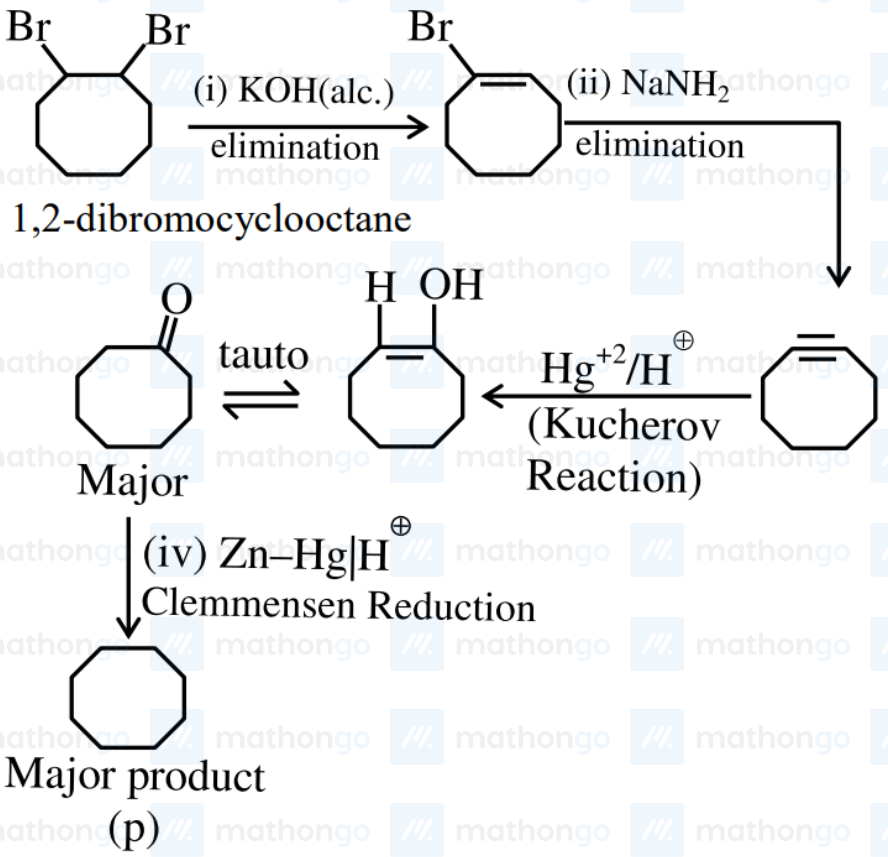
Q4.
(2)

List-I (Reaction)		List-II (Name of reaction)	
(A)		(III)	Fittig reaction
(B)	$ArN_2^+X^- \xrightarrow[HCl]{Cu} ArCl + N_2 \uparrow + CuX$	(IV)	Gatterman reaction
(C)	$C_2H_5Br + NaI \xrightarrow[Acetone]{Dry} C_2H_5I + NaBr$	(II)	Finkelstein reaction
(D)	$CH_3C(OH)(CH_3)CH_3 \xrightarrow[ZnCl_2]{HCl} CH_3C(Cl)(CH_3)CH_3$	(I)	Lucas reaction

Q5. Aromatic halide give nucleophilic substitution reaction at high temperature or in presence of $-I/-M$ group rate of reaction high even at low temperature.
(3)
A-IV
B-III
C-II
D-I

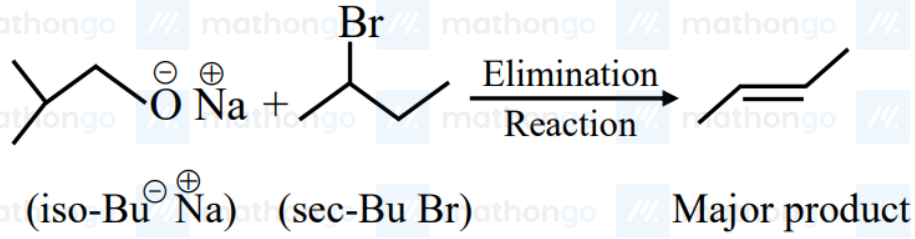
Q1. **(4)** **St-I :** - St-I is correct because both given ether are soluble in water → Di ethyl ether and butan-1-ol are miscible to almost same extent i.e., 7.5 and 9 gm per 100 ml water due to H -bonding**St-II :** - St. II is also correct because sodium metal is not used with ethyl alcohol as H_2 gas release with ethyl a below

Q2. **(2)**



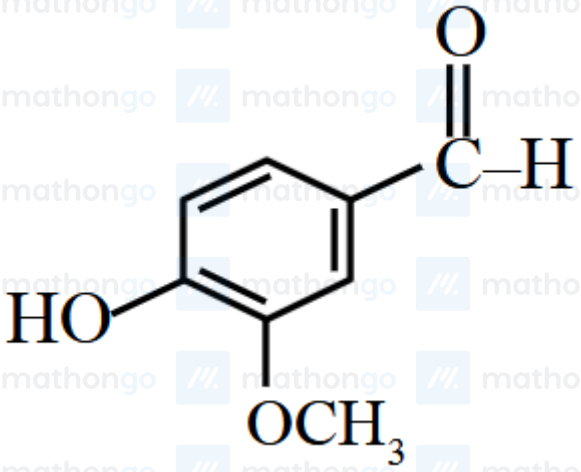
Q3. **(1)** (1) Carboxylic acid gives efferve scence with sodium bicarbonate solution
(2) Phenolic-OH gives voilet coloured complex with Neutral $FeCl_3$.
(3) Alcoholic-OH gives Red colour with cerric ammonium Nitrate.
(4) When alkaline $KMnO_4$ reacts with an unsaturated compound (Alkene or alkyne) the purple colour of $KMnO_4$ solution disappears, indicating positive test for unsaturation.

Q4. **(4)**



Q5.

(2)



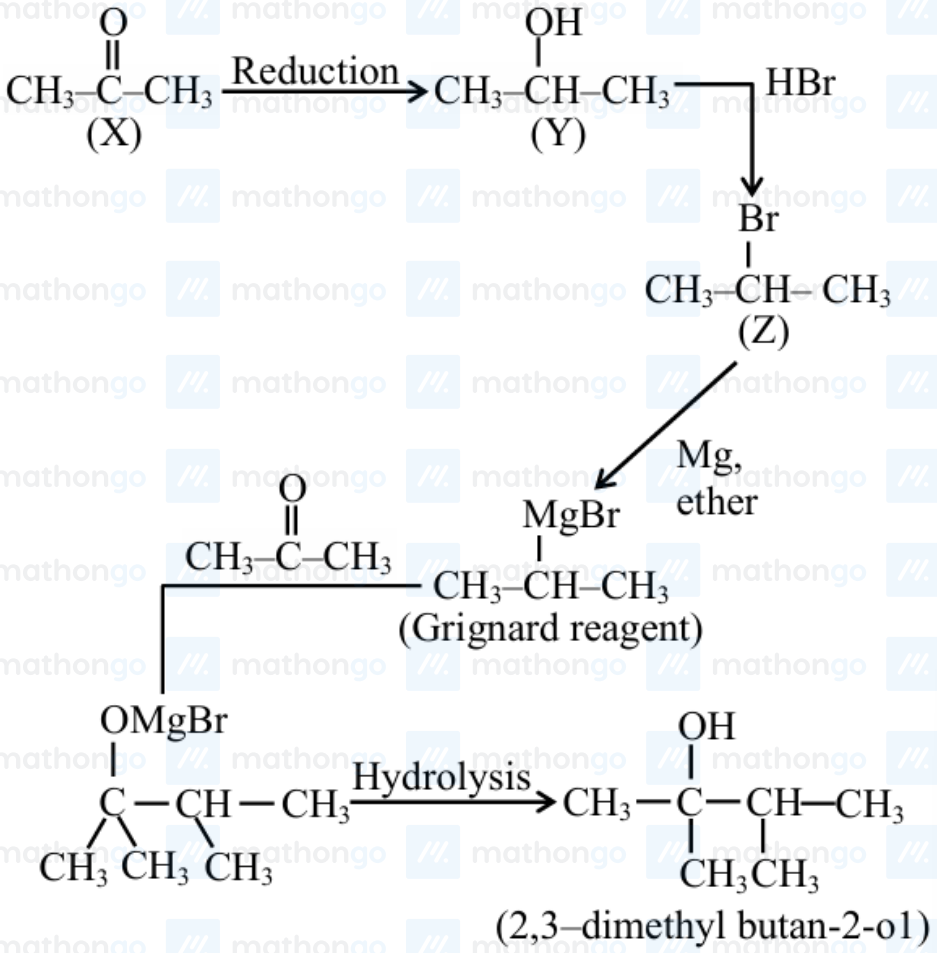
Phenolic group soluble in NaOH

Benzaldehyde derivative react with Tollen's reagent.

Vanillin does not give self-aldol reaction due to lack of acidic H for condensation.

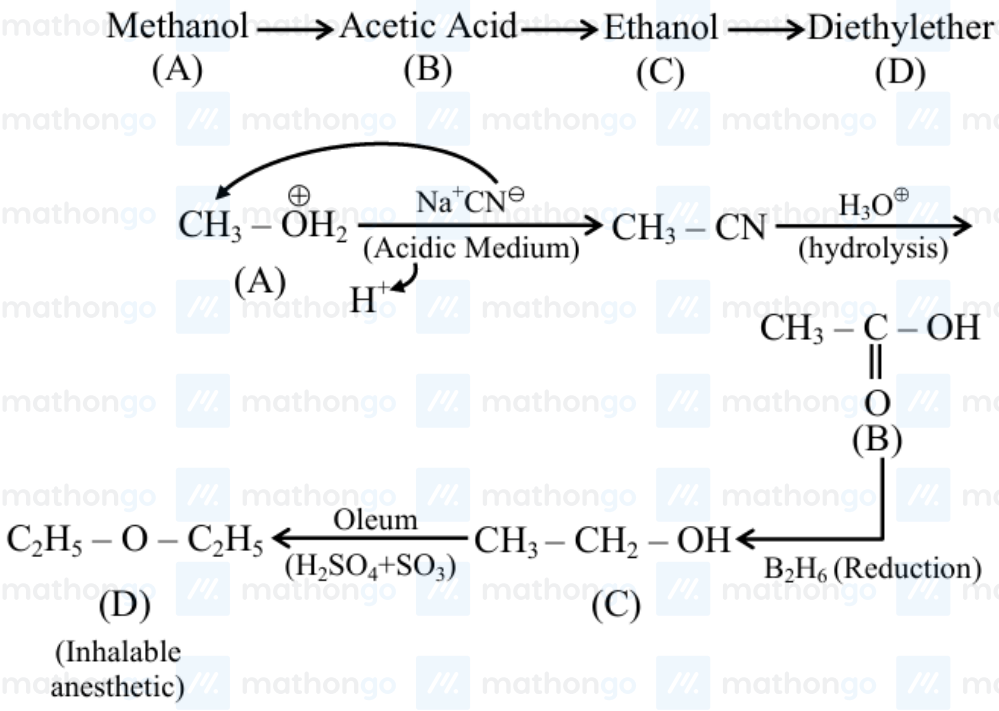
Q6.

(2)



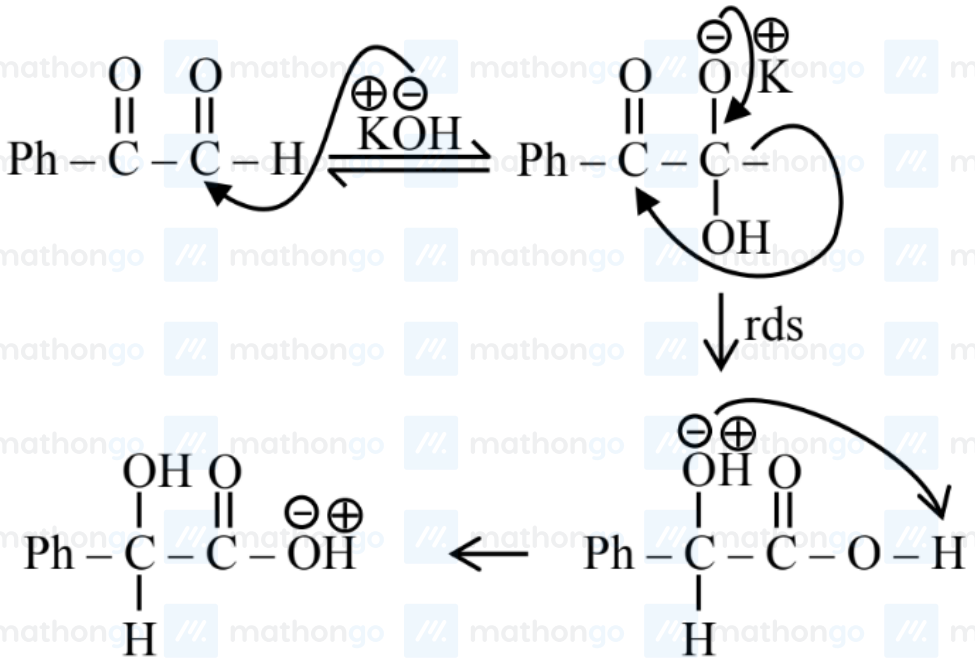
Q7.

(3)


Methanol
(A)
Acetic Acid
(B)
Ethanol
(C)
Diethylether
(D)
$CH_3 - \overset{\oplus}{O}H_2$
(A)
$Na^+CN^\ominus$
(Acidic Medium)
H^+
$CH_3 - CN$
$H_3O^\oplus$
(hydrolysis)
$CH_3 - C(=O) - OH$
(B)
B_2H_6 (Reduction)
$CH_3 - CH_2 - OH$
(C)
Oleum
$(H_2SO_4+SO_3)$
$C_2H_5 - O - C_2H_5$
(D)
(Inhalable anesthetic)

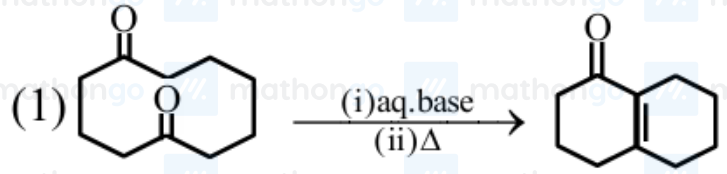
Q1.

(2)

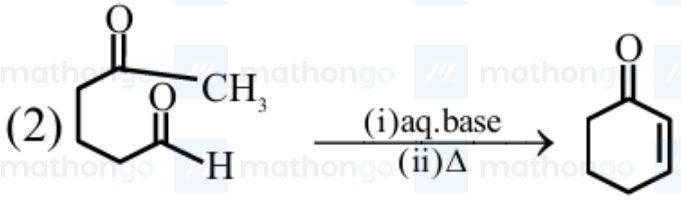


Q2.

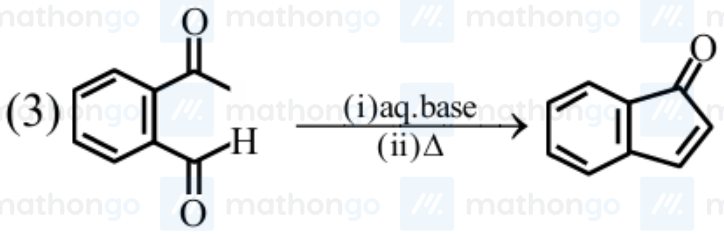
(4)



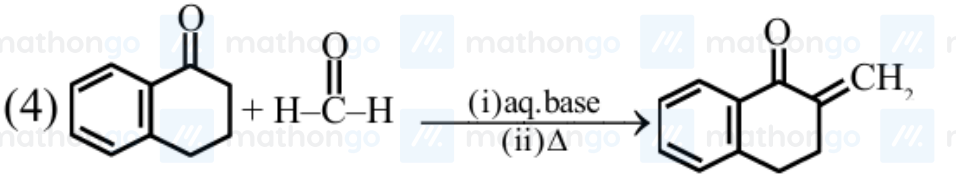
(Intramolecular aldol)



(Intramolecular aldol)

(3) 

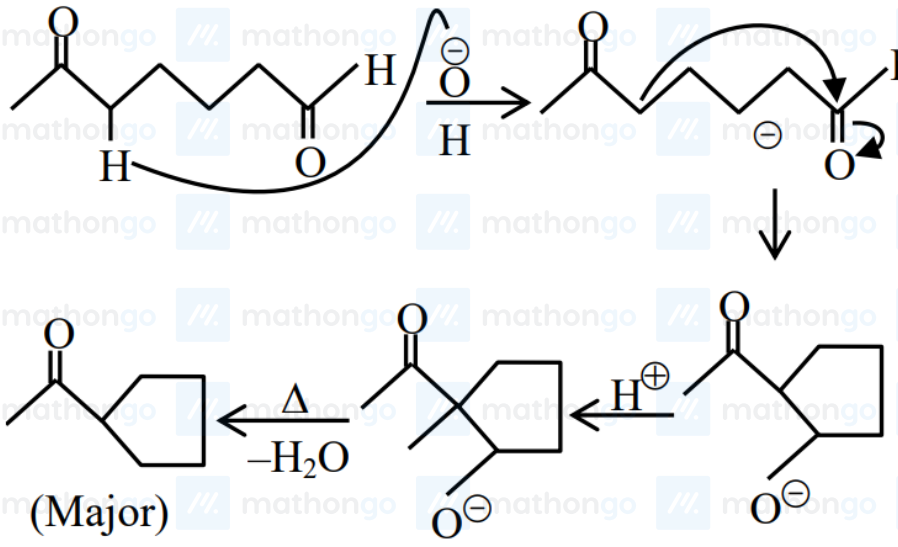
(Intramolecular aldol)

(4) 

(Intermolecular aldol)

Q3. Aldol condensation reaction

(1)



(Major)

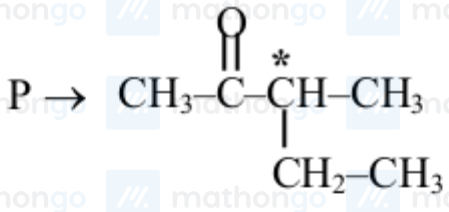
Q4.

(2) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3 \xrightarrow[NaOH]{NaOI} \underset{\text{Yellow solid}}{CHI_3} + CH_3-CH_2-\overset{\overset{O}{\|}}{C}-\bar{O}\overset{+}{Na}$

$CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3 \xrightarrow[NaOH]{NaOI} \underset{\text{Yellow solid}}{CHI_3} + CH_3-CH_2-\overset{\overset{O}{\|}}{C}-\bar{O}\overset{+}{Na}$

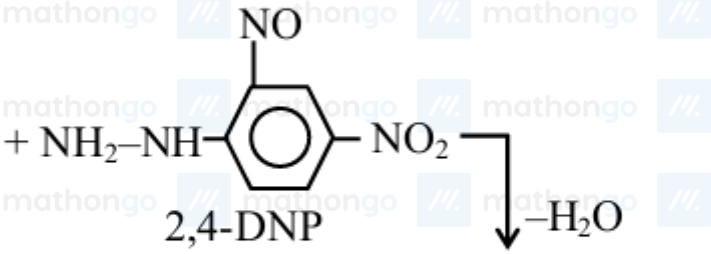
Q5.

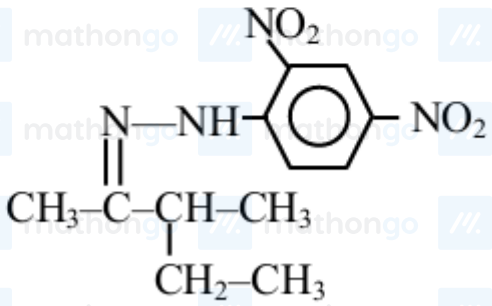
(2)



Chiral

Does not give Tollen's test

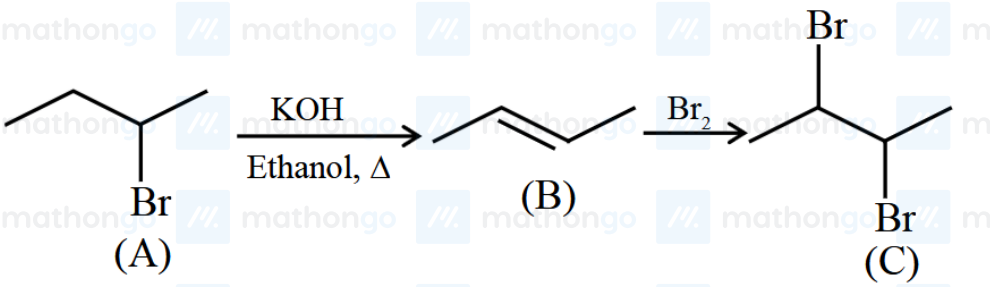


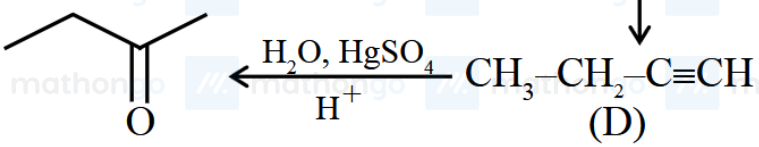


Gives test with 2,4-DNP

Q6.

(3)





(E)

Butan-2-one

Q7. Following will not give iodoform reaction/test.

(2) (1) Butanal

(2) 2-Pentanone

(3) Pentanal

(4) 3-Pentanol

Q1. Rate of hydrolysis $\propto$ Leaving group ability

(4)

$$\underset{(p)}{CH_3-CH_2-\overset{O}{\overset{\|}{C}}-Cl} > \underset{(q)}{Et-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3} > \underset{(r)}{Et-\overset{O}{\overset{\|}{C}}-OEt} > \underset{(s)}{Et-\overset{O}{\overset{\|}{C}}-NH_2}$$

Q2.

(A) $R-C\equiv N \xrightarrow[\text{mild condition}]{\text{(i) } H^+/H_2O} R-CONH_2$

(4)

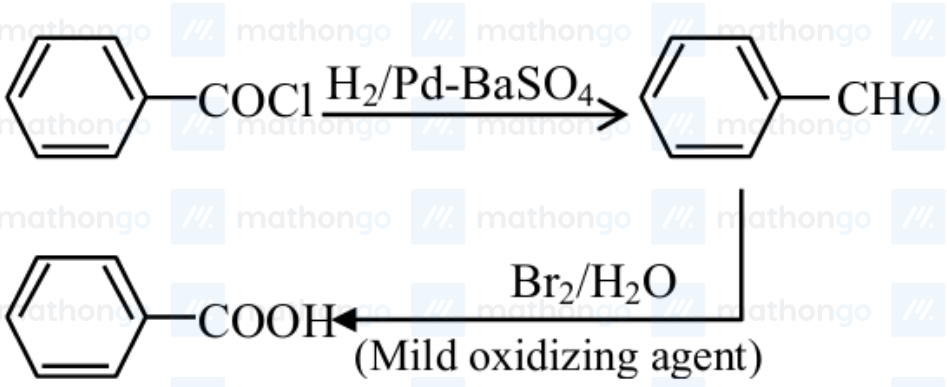
Under mild condition amide is formed because this reaction is typically slow if further more heat will supplied then it gets convert in to -COOH.

(B) $R-MgX \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } CO_2} R-COOH$

(C) $R-C\equiv N \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } SnCl_2/HCl} R-CHO$

(D) $R\cdot CH_2\cdot OH \xrightarrow[]{PCC} R-CHO$

(E)



Q3.

(1) $EtO_2C-C\equiv C-H$

C.B. of terminal alkyne will be sp hybridisation and loculised. In other C.B. will be resonance stablised.

Q4. Concept - Those compounds which are more acidic than H_2CO_3 can gives effervescence of CO_2 with aq.

(4) $NaHCO_3$.

Release $CO_2\uparrow$ gas with aq. NaHCO 3

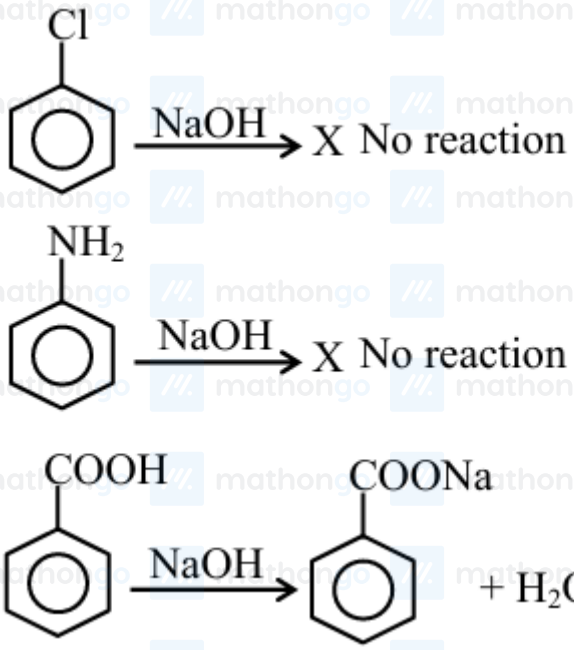
$\Rightarrow [\text{ A.S. }]_{\text{Comp.}} > [\text{ A.S. }]_{H_2CO_3}$

$\rightarrow$ Option 1,2 and 3 gives effervescence of CO_2 gas with $NaHCO_3$

$\rightarrow$ Option (4) Not gives CO_2 gas with $NaHCO_3$.

Q5.

(4)



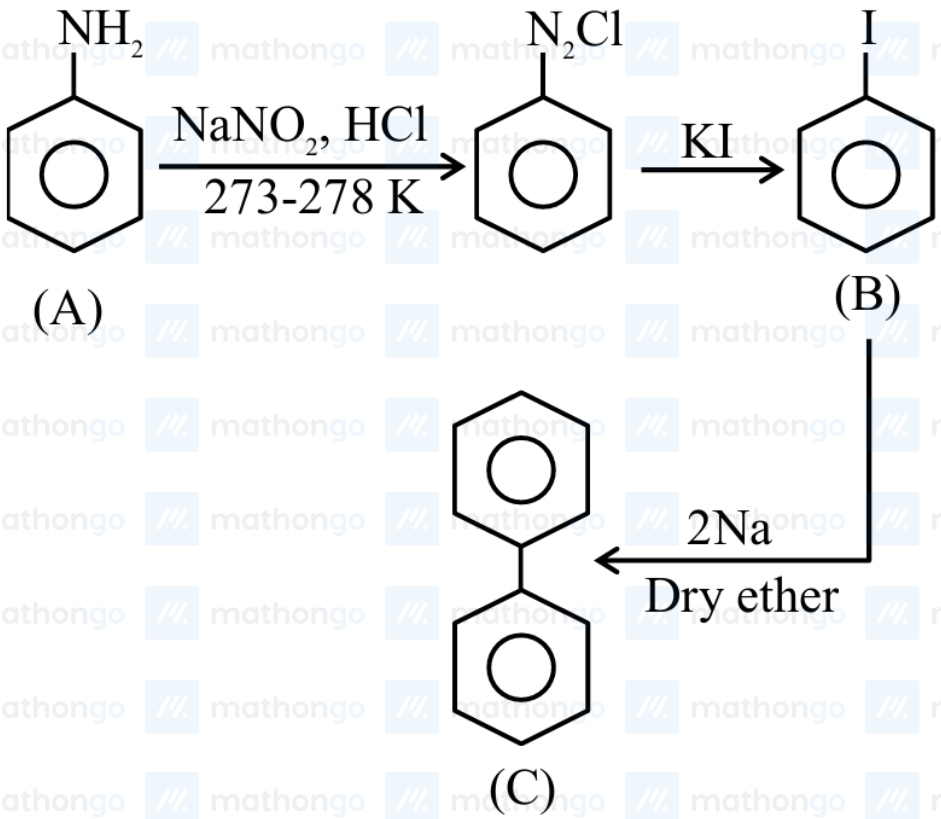
Organic layer in funnel are mixture of chloro benzene and aniline

Q1. Basic strength of amine depends on hydrogen bonding and electronic inductive effect.

(4) $NH(Et)_2 > N(Et)_3 > NH_2Et > \ddot{N}H_3 > NH_2 - NH_2$

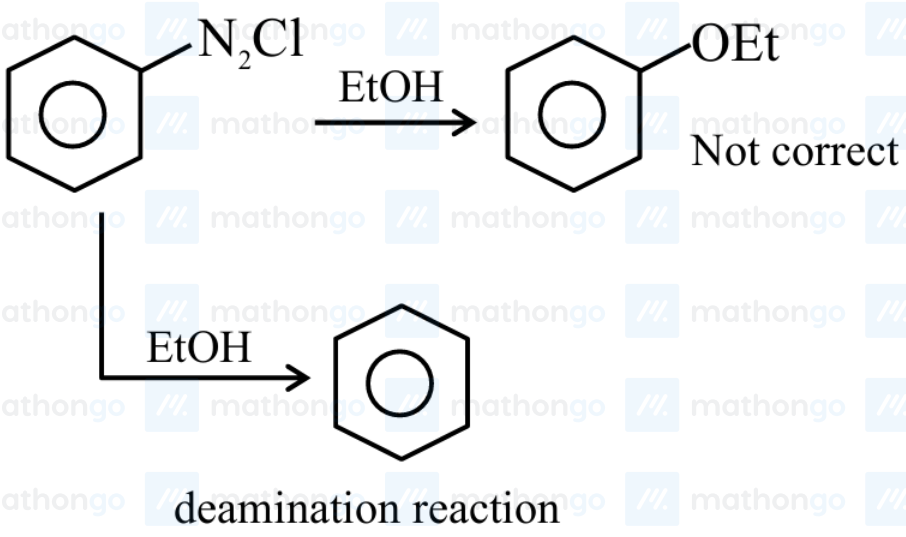
Q2.

(3)



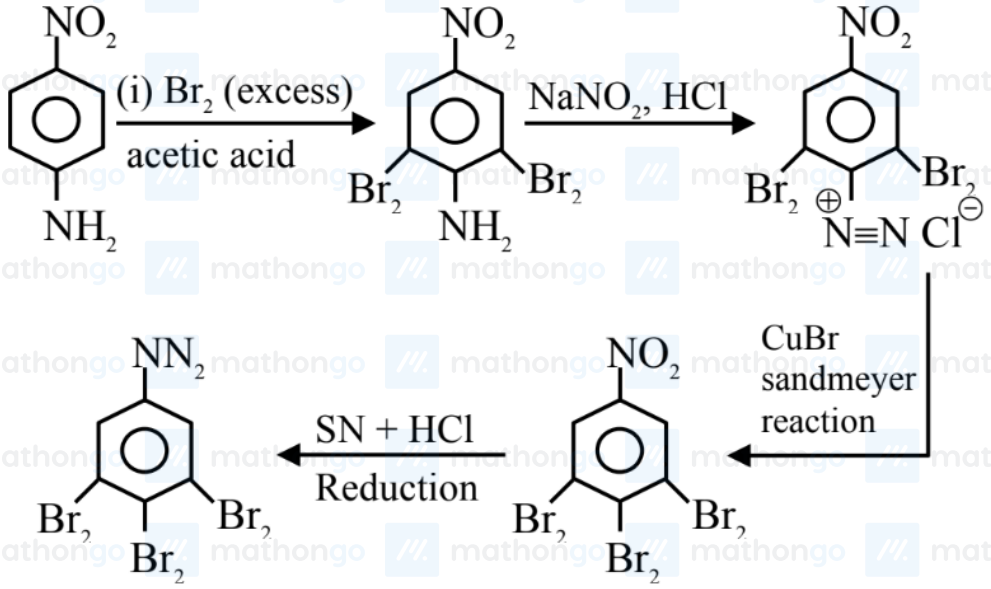
Q3.

(1)



Q4.

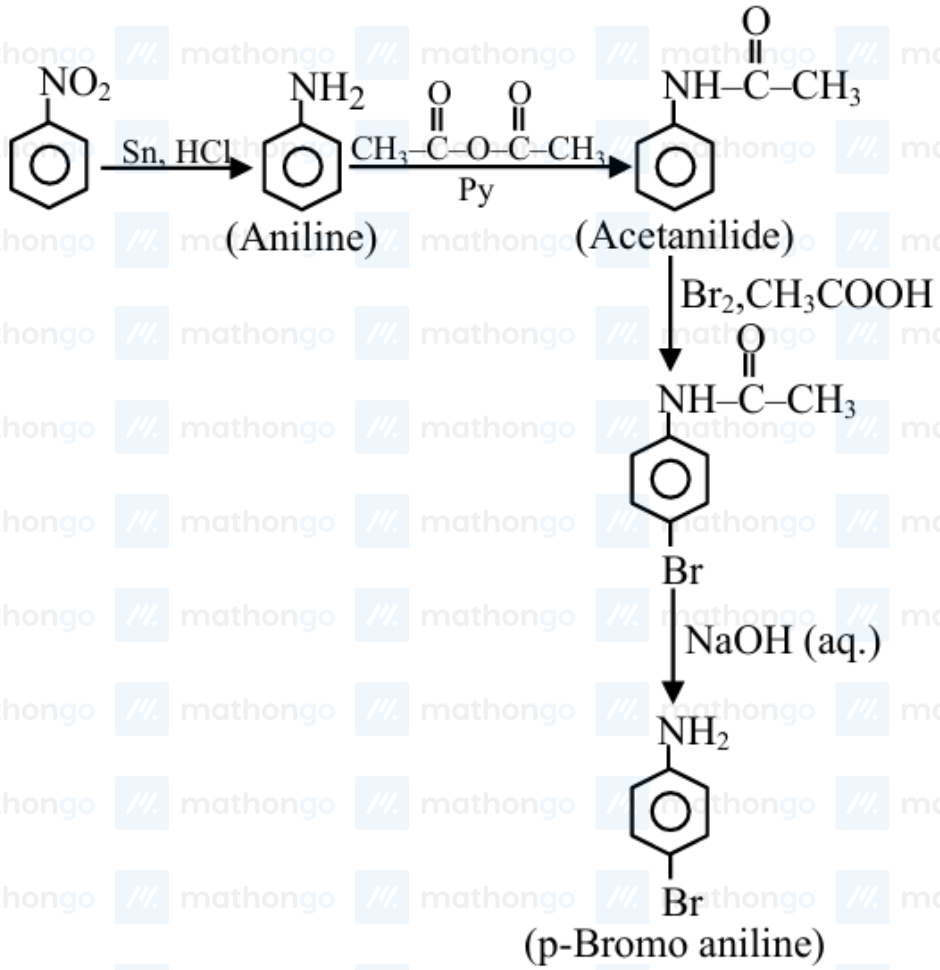
(3)



3,4,5-tri bromo aniline

Q5.

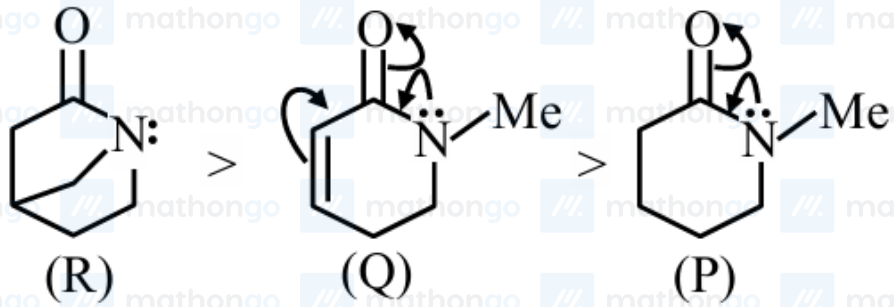
(1)



(p-Bromo aniline)

Q6.

(4)



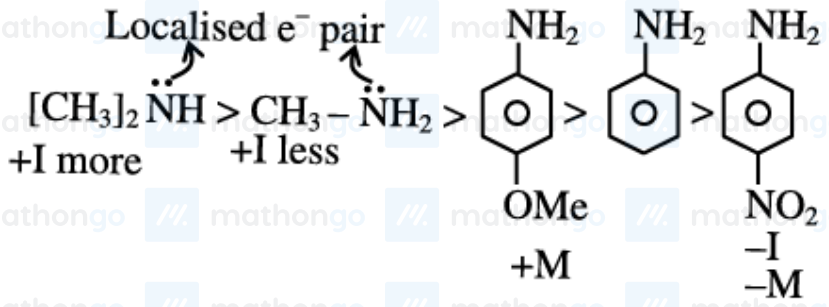
(R) > (Q) > (P)

According to Bredt's rule it is localised lone pair.

cross conjugation

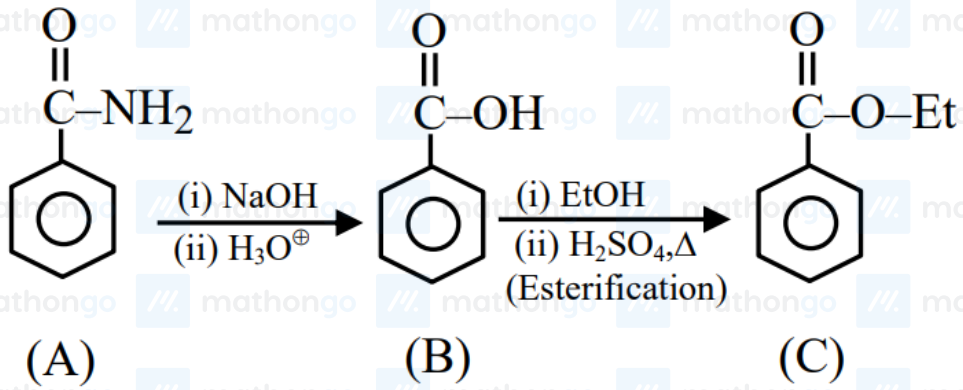
Q7. E > D > B > A > C

(2)



Q8.

(1)



(A) (B) (C)

Molar mass = 121

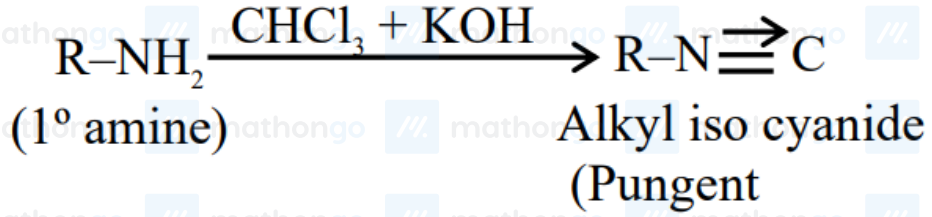
A → Benzamide Shows positive Lassaigh's test.

B → Benzoic acid gives effervescence with aq. $NaHCO_3$.

C → Ester gives fruity smell.

Q9. Only 1° or primary amines gives positive carbylamines test.

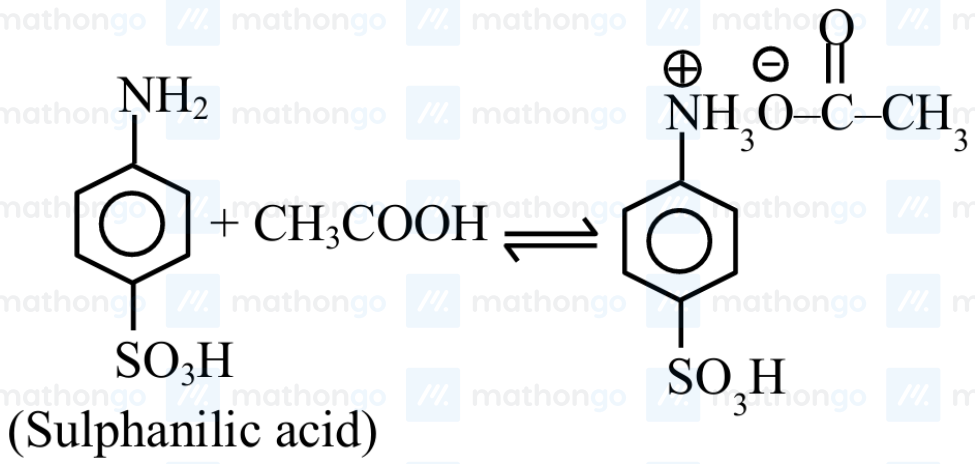
(3)

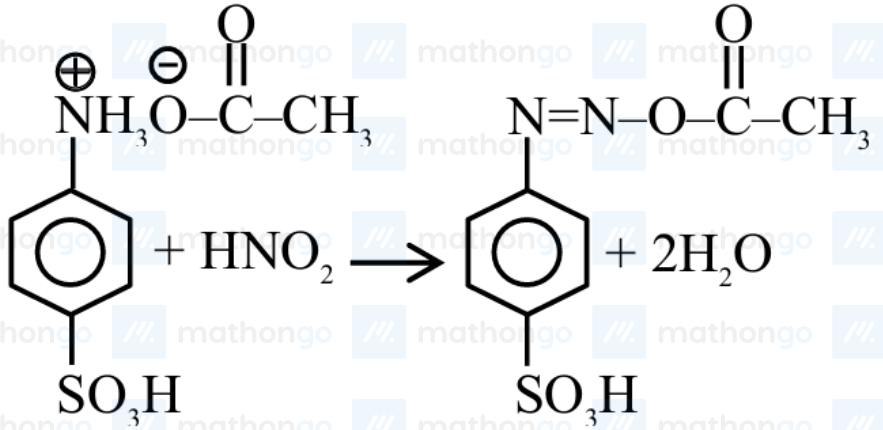


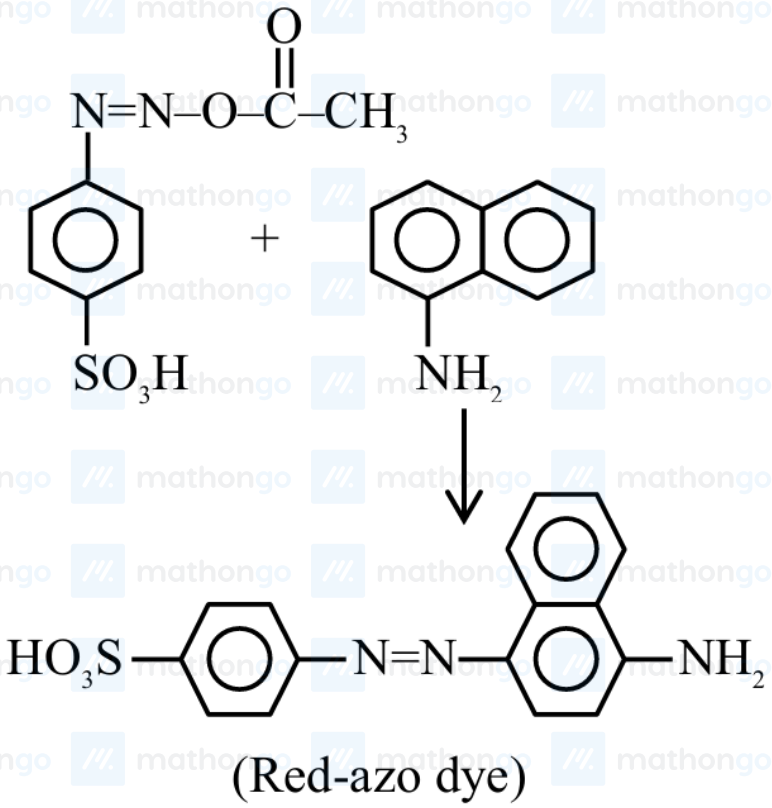
Option (A) and (C) are primary amine and given ⊕ve carbyl amine test

Q10.

(3)



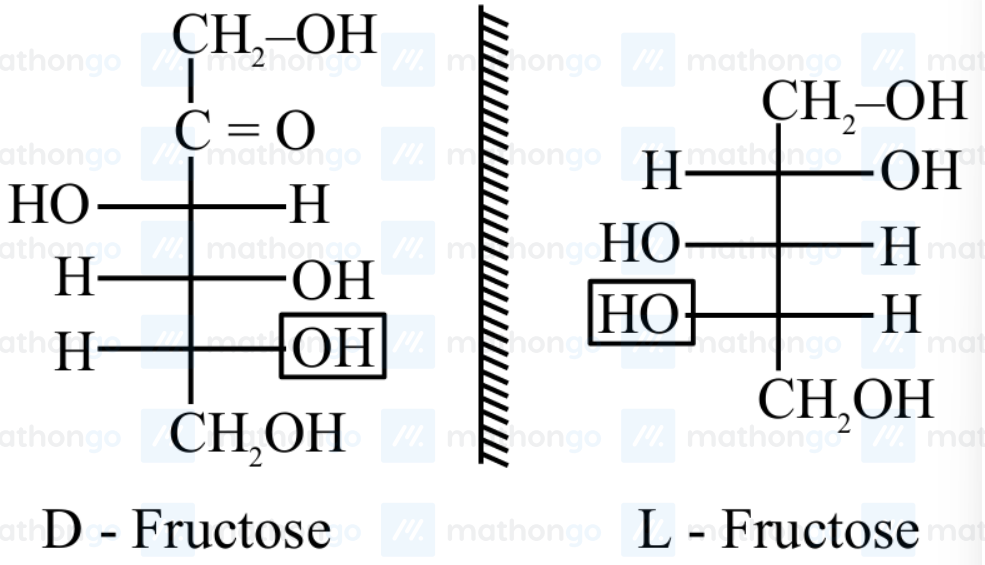




(Red-azo dye)

0.1 mole of red-azo dye (Molar Mass $= 327\text{gm/mol}$) will have 32.7 gm mass. Nearly 33 gm.

Q1.
(3)



D - Fructose L - Fructose

Q2. On hydrolysis of sucrose gives D-(+)-glucose and D-(-)-fructose while in St. (1) D-(+)-fructose is given evince
(2) St-(1) is incorrect.
St. II - It is correct because sucrose on hydrolysis gives invert sugar

Q3. Vit D, E, K. A are fat soluble vitamins.
(4)

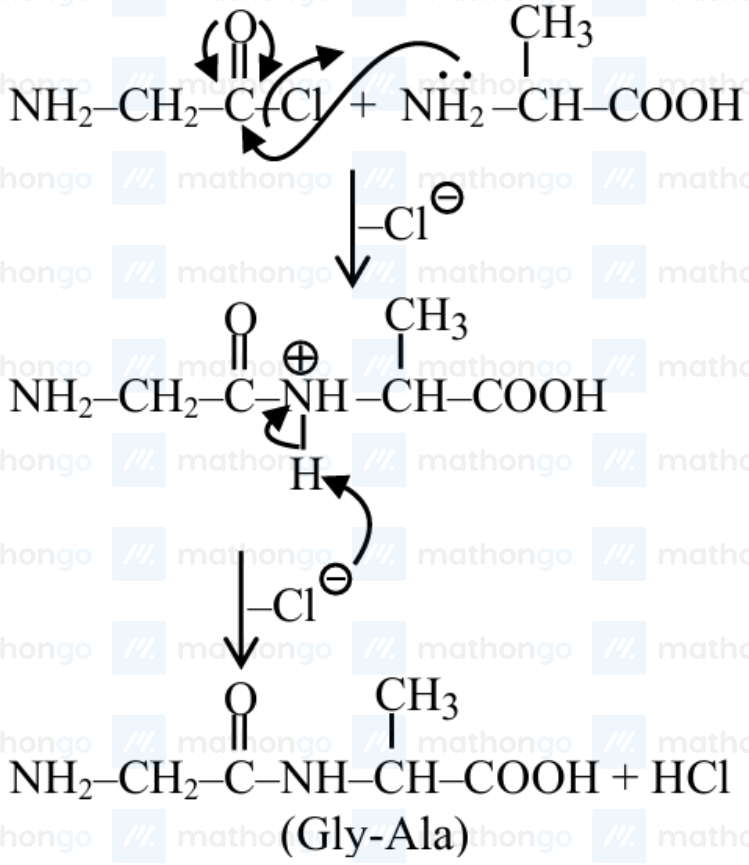
Q4. Cellulose derivcative has more number of hydroxy groups, so more H -bonding is present with water in cellulose
(2) derivatives cotton cloths.

Q5. * Isoleucine has 2 chiral centre
(4) * Glycine is optically inactive
* Aspartic acid also contain COOH group at the side chain.
* Cysteine easily dimmerise due to free SH group

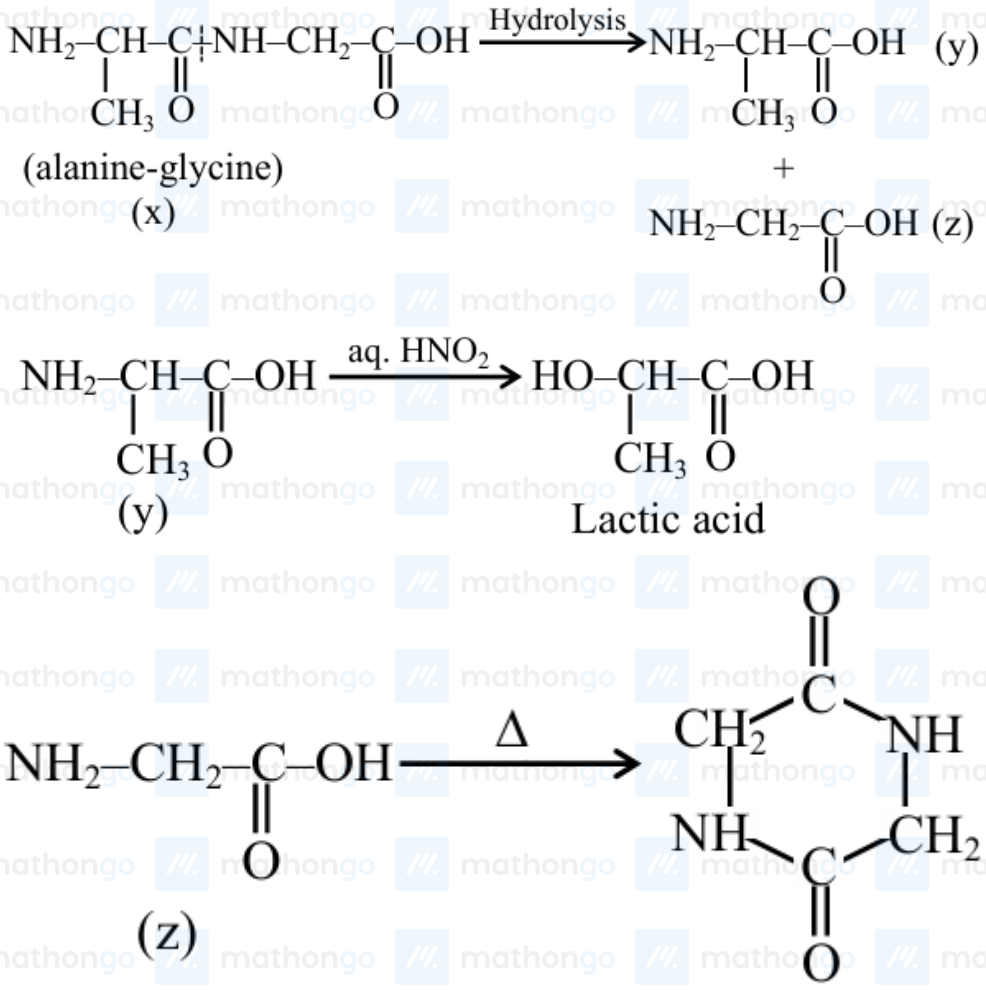
Q6. The number of tetrapeptides (sequences) possible involving each of these amino acids (glycine, alanine, valine,
(4) leucine) ; It has three (3) peptides linkage the number of permutations in which they can be arranged
$= 4 \times 3 \times 2 \times 1$
$= 24$

Q7.

(1)


O
CH3
NH2–CH2–C–Cl + NH2–CH–COOH
–Cl⊖
O
CH3
NH2–CH2–C–⊕NH–CH–COOH
H
–Cl⊖
O
CH3
NH2–CH2–C–NH–CH–COOH + HCl
(Gly-Ala)

Q8. **(2)**



Q9. **(3)** (i) Protein does not gives β-amino acid on hydrolysis

(ii) Fibrous protein are not water soluble

So both statement's are wrong

Q10. **()** Two nucleic acid chains are wound about each other and held together by H bonds between pair of bases.

Adenine from two hydrogen bonds with thymine and Guanine form three hydrogen bond with cytosine.

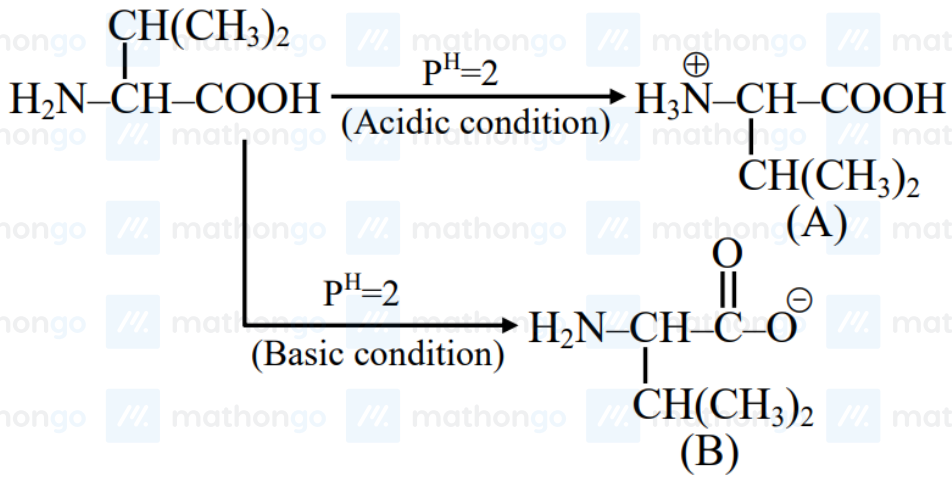
$5'G-G-C-A-A-A-T-C-G-G-C-T-A-3'$

In given DNA strand total seven guanine and cytosine bases which form total 21 H -bonds and six adenine and thymine base which will form total 12 H-bonds with other DNA strand.

Total no. of H bonds $= 7 \times 3 + 6 \times 2 = 33$

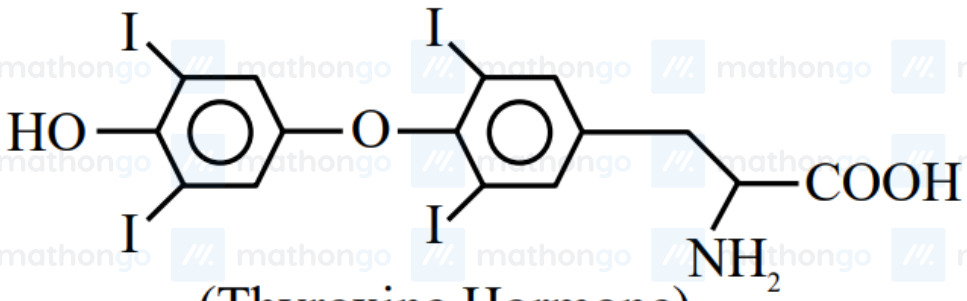
Q11.

(1)


CH(CH3)2
H2N–CH–COOH
PH=2
(Acidic condition)
H3N–CH–COOH
CH(CH3)2
(A)
PH=2
(Basic condition)
O
H2N–CH–C–O
CH(CH3)2
(B)

Q1.

0



(Thyroxine Hormone)

$\rightarrow$ Molecular formula of Thyroxine $\Rightarrow C_{15}H_{11}O_4NI_4$

$\rightarrow$ Molecular mass of Thyroxine -

$C \rightarrow 15 \times 12 = 180$

$H \rightarrow 11 \times 1 = 11$

$O \rightarrow 16 \times 4 = 64$

$N \rightarrow 14 \times 1 = 14$

$I \rightarrow 127 \times 4 = 508$

$\rightarrow$ Molecular mass of Thyroxine $\Rightarrow 777$

$\rightarrow$ % of Iodine $= \frac{508}{777} \times 100$

$= 65.38\%$

Nearest integer $= 65$