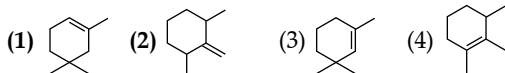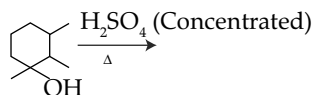## Section A

**Q. 1.** When the hydrogen ion concentration $[H^+]$ changes by a factor of 1000, the value of pH of the solution
(1) increases by 2 units
(2) increases by 1000 units
(3) decreases by 2 units
(4) decreases by 3 units

**Q. 2.** Find out the major product from the following reaction.



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

**Q. 3.** Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R
**Assertion A:** Carbon forms two important oxides –CO and $CO_2$. CO is neutral whereas $CO_2$ is acidic in nature
**Reason R:** $CO_2$ can combine with water in a limited way to form carbonic acid, while CO is sparingly soluble in water
In the light of the above statements, choose the most appropriate answer from the options given below
(1) Both A and R are correct but R is NOT the correct explanation of A
(2) A is correct but R is not correct
(3) Both A and R are correct and R is the correct explanation of A
(4) A is not correct but R is correct.

**Q. 4.** Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R
**Assertion A:** The alkali metals and their salts impart characteristic colour to reducing flame.
**Reason R:** Alkali metals can be detected using flame tests.
In the light of the above statements, choose the most appropriate answer from the options given below
(1) A is not correct but R is correct
(2) Both A and R are correct but R is NOT the correct explanation of A
(3) A is correct but R is not correct
(4) Both A and R are correct and R is the correct explanation of A

**Q. 5.** Potassium dichromate acts as a strong oxidizing agent in acidic solution. During this process, the oxidation state changes from
(1) +2 to +1    (2) +3 to +1
(3) +6 to +2    (4) +6 to +3

**Q. 6.** Match List I with List II

| LIST I (Name of polymer) | | LIST II (Uses) | |
|---|---|---|---|
| A. | Glyptal | I. | Flexible pipes |
| B. | Neoprene | II. | Synthetic wool |
| C. | Acrilan | III. | Paints and Lacquers |
| D. | LDP | IV. | Gaskets |

Choose the correct answer from the options given below:
(1) A-III, B-IV, C-I, D-II    (2) A-III, B-II, C-IV, D-I
(3) A-III, B-I, C-IV, D-II    (4) A-III, B-IV, C-II, D-I

**Q. 7.** Which of the following represents the correct order of metallic character of the given elements ?
(1) Si < Be < Mg < K    (2) Be < Si < K < Mg
(3) Be < Si < Mg < K    (4) K < Mg < Be < Si

**Q. 8.** Match List I with List II

| | LIST I | | LIST II |
|---|---|---|---|
| A. | Cobalt catalyst | I. | $(H_2 + Cl_2)$ production |
| B. | Syngas | II. | Water gas production |
| C. | Nickel catalyst | III. | Coal gasification |
| D. | Brine solution | IV. | Methanol production |

Choose the correct answer from the options given below:
(1) A-IV, B-I, C-II, D-III    (2) A-IV, B-III, C-II, D-I
(3) A-II, B-III, C-IV, D-I    (4) A-IV, B-III, C-I, D-II

**Q. 9.** Match List I with List II

| LIST I (Amines) | | LIST II (pK$_b$) | |
|---|---|---|---|
| A. | Aniline | I. | 3.25 |
| B. | Ethanamine | II. | 3.00 |
| C. | N-Ethylethanamine | III. | 9.38 |
| D. | N. N-Diethylethanamine | IV. | 3.29 |

Choose the correct answer from the options given below:
(1) A-III, B-IV, C-II, D-I    (2) A-III, B-II, C-I, D-IV
(3) A-I, B-IV, C-II, D-III    (4) A-III, B-II, C-IV, D-I

**Q. 10.** Match List I with List II

| LIST I Isomeric pairs | | LIST II Type of isomers | |
|---|---|---|---|
| A. | Propanamine and N-Methylethanamine | I. | Metamers |
| B. | Hexan-2-one and Hexan-3-one | II. | Positional isomers |
| C. | Ethanamide and Hydroxyethanimine | III. | Functional isomers |
| D. | o-nitrophenol and p-nitrophenol | IV. | Tautomers |

Choose the correct answer from the options given below:
(1) A-II, B-III, C-I, D-IV   (2) A-III, B-I, C-IV, D-II
(3) A-III, B-IV, C-I, D-II   (4) A-IV, B-III, C-I, D-II

**Q. 11.** What is the mass ratio of ethylene glycol ($C_2H_6O_2$, molar mass = 62 g/mol) required for making 500 g of 0.25 molal aqueous solution and 250 mL of 0.25 molal aqueous solution?
(1) 1 : 1   (2) 2 : 1   (3) 1 : 2   (4) 3 : 1

**Q. 12.** Match list I with List II

| | LIST I<br>Coordination entity | | LIST II<br>Wavelength of light absorbed in nm |
|---|---|---|---|
| A. | $[CoCl(NH_3)_5]^{2+}$ | I. | 310 |
| B. | $[Co(NH_3)_6]^{3+}$ | II. | 475 |
| C. | $[Co(CN)_6]^{3-}$ | III. | 535 |
| D. | $[Cu(H_2O)_4]^{2+}$ | IV. | 600 |

Choose the correct answer from the options given below:
(1) A-III, B-I, C-II, D-IV   (2) A-IV, B-I, C-III, D-II
(3) A-III, B-II, C-I, D-IV   (4) A-II, B-III, C-IV, D-I

**Q. 13.** Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R

**Assertion A:** Butylated hydroxy anisole when added to butter increases its shelf life.

**Reason R:** Butylated hydroxy anisole is more reactive towards oxygen than food.

In the light of the above statements, choose the most appropriate answer from the options given below:
(1) A is correct but R is not correct.
(2) A is not correct but R is correct.
(3) Both A and R are correct and R is the correct explanation of A.
(4) Both A and R are correct but R is NOT the correct explanation of A.

**Q. 14.** The isomeric deuterated bromide with molecular formula $C^4H^8DBr$ having two chiral carbon atoms is
(1) 2 - Bromo - 2 – deuterobutane
(2) 2 - Bromo-1-deuterobutane
(3) 2 - Bromo - 1 - deutero - 2 – methylpropane
(4) 2 - Bromo −3 – deuterobutane

**Q. 15.** A chloride salt solution acidified with dil. $HNO_3$ gives a curdy white precipitate, [A], on addition of $AgNO_3$. [A] on treatment with $NH_4OH$ gives a clear solution, B. A and B are respectively
(1) $AgCl \& (NH_4)[Ag(OH)_2]$
(2) $AgCl \& [Ag(NH_3)_2]Cl$
(3) $H[AgCl_3] \& (NH_4)[Ag(OH)_2]$
(4) $H[AgCl_3] \& [Ag(NH_3)_2]Cl$

**Q. 16.** **Statement I:** Dipole moment is a vector quantity and by convention it is depicted by a small arrow with tail on the negative centre and head pointing towards the positive centre.
**Statement II:** The crossed arrow of the dipole moment symbolizes the direction of the shift of charges in the molecules.

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

**Q. 17.** ' A ' in the given reaction is
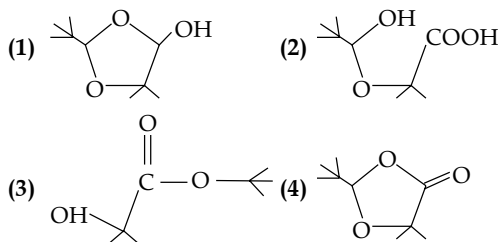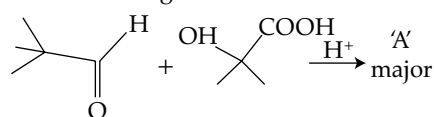


**Q. 18.** A. Ammonium salts produce haze in atmosphere.
B. Ozone gets produced when atmospheric oxygen reacts with chlorine radicals.
C. Polychlorinated biphenyls act as cleansing solvents.
D. 'Blue baby' syndrome occurs due to the presence of excess of sulphate ions in water.
Choose the correct answer from the options given below:
(1) A and D only   (2) A, B and C only
(3) A and C only   (4) B and C only

**Q. 19.** Given below are two statements:
**Statement I :** In froth floatation method a rotating paddle agitates the mixture to drive air out of it.
**Statement II :** Iron pyrites are generally avoided for extraction of iron due to environmental reasons.
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

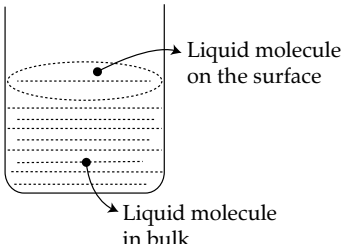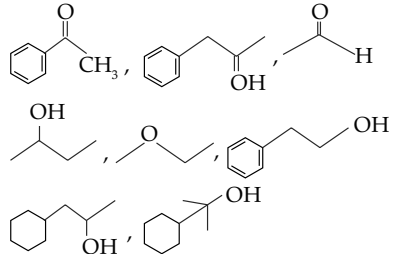**Q. 20.** Which one among the following metals is the weakest reducing agent?
(1) Li   (2) K   (3) Rb   (4) Na

## Section B

**Q. 21.** Total number of moles of AgCl precipitated on addition of excess of $AgNO_3$ to one mole each of the following complexes $[Co(NH_3)_4Cl_2]Cl$, $[Ni(H_2O)_6]Cl_2$, $[Pt(NH_3)_2Cl_2]$ and $[Pd(NH_3)_4]Cl_2$ is

**Q. 22.** The number of incorrect statement/s from the following is/are
A. Water vapours are adsorbed by anhydrous calcium chloride.
B. There is a decrease in surface energy during adsorption.

C. As the adsorption proceeds, ΔH becomes more and more negative.

D. Adsorption is accompanied by decrease in entropy of the system.

**Q. 23.** Number of hydrogen atoms per molecule of a hydrocarbon A having 85.8% carbon is (Given: Molar mass of A = 84 g mol$^{-1}$)

**Q. 24.** The number of given orbitals which have electron density along the axis is $p_x$, $p_y$, $p_z$, $d_{xy}$, $d_{yz}$, $d_{xz}$, $d_{z^2}$, $d_{x^2-y^2}$

**Q. 25.** 28.0 L of $CO_2$ is produced on complete combustion of 16.8 L gaseous mixture of ethene and methane at 25°C and 1 atm. Heat evolved during the combustion process is_____ kJ.

Given : $\Delta H_C(CH_4) = $ -900 kj mol$^{-1}$

$\Delta H_C(C_2H_4) = $ -1400 kj mol$^{-1}$

**Q. 26.** $Pt(s)|H_2(g)(1bar)||H^+(aq)(1M)\|M^{3+}(aq), M^+(aq)|Pt(s)$

The $E_{cell}$ for the given cell is 0.1115 V at 298 K

when $\dfrac{\left[M^+(aq)\right]}{\left[M^{3+}(aq)\right]} = 10^a$

The value of $a$ is Given : $E^\theta M^{3+}/M^+ = 0.2$ V

$\dfrac{2.303RT}{F} = 0.059$ V

**Q. 27.** The number of pairs of the solutions having the same value of the osmotic pressure from the following is (Assume 100% ionization)

A. 0.500 M $C_2H_5OH$ (aq) and 0.25 M KBr (aq)

B. 0.100 M $K_4[Fe(CN)_6]$ (aq) and 0.100 M $FeSO_4(NH_4)_2SO_4$ (aq)

C. 0.05 M $K_4[Fe(CN)_6]$ (aq) and 0.25 M NaCl (aq)

D. 0.15 M NaCl(aq) and 0.1 M $BaCl_2$ (aq)

E. 0.02 M KCl · $MgCl_2$ · $6H_2O$ (aq) and 0.05 M KCl (aq)

**Q. 28.** A first order reaction has the rate constant, = 4.6 × $10^{-3}$ s$^{-1}$. The number of correct statement/s

from the following is/are (Given: log 3 = 0.48)

A. Reaction completes in 1000 s.

B. The reaction has a half-life of 500 s.

C. The time required for 10% completion is 25 times the time required for 90% completion.

D. The degree of dissociation is equal to $(1-e^{-kt})$

E. The rate and the rate constant have the same unit.

**Q. 29.** Based on the given figure, the number of correct statement/s is/are _____



A. Surface tension is the outcome of equal attractive and repulsive forces acting on the liquid molecule in bulk.

B. Surface tension is due to uneven forces acting on the molecules present on the surface.

C. The molecule in the bulk can never come to the liquid surface.

D. The molecules on the surface are responsible for vapours pressure if system is a closed system.

**Q. 30.** Number of compounds giving (i) red colouration with ceric ammonium nitrate and also (ii) positive iodoform test from the following is



# Answer Key

| Q. No. | Answer | Topic Name | Chapter Name |
|--------|--------|------------|--------------|
| 1 | (4) | pH of the solution | Ionic equilibrium |
| 2 | (4) | Dehydration of alcohol | Alcohol phenol and ether |
| 3 | (3) | Compounds of carbon | p-block |
| 4 | (1) | Properties of alkali metals | s-block |
| 5 | (4) | Oxidation number | Redox reaction |
| 6 | (4) | Uses of polymers | Polymers |
| 7 | (1) | Order of metallic character | s-block |
| 8 | (2) | Uses of catalyst | s-block |
| 9 | (1) | Basic strength of substances | Amines |
| 10 | (2) | Structural isomers | General organic chemistry |
| 11 | (2) | Concentration terms | Some basic concept of chemistry |
| 12 | (3) | Wavelength of light absorbed | Coordination chemistry |
| 13 | (3) | Rancidity of the substances | Environmental chemistry |

| 14 | (1) | Number of isomers | General organic. Chemistry |
|---|---|---|---|
| 15 | (2) | Qualititative analysis | Coordinationchemistry |
| 16 | (2) | Dipole moment | Chemical bonding |
| 17 | (4) | Properties of carboxylic acid | Carboxylic acid |
| 18 | (3) | Water pollution and air pollution | Environmental chemistry |
| 19 | (1) | Concentration of pres | Metallurgy |
| 20 | (4) | Reducing agent | s-block |
| 21 | [5] | Stoichimoetric relationship | Some basic concept of chemistry |
| 22 | [2] | Adsorption | Surface chemistry |
| 23 | [12] | Empirical and molecular formula | Some basic concept of chemistry |
| 24 | [5] | Types of orbital | Structure of atom |
| 25 | [847] | Enthalpy change | Thermodynamics |
| 26 | [3] | EMF of the cell | Electro chemistry |
| 27 | [4] | Osmotic pressure | Liquid solution |
| 28 | [1] | First order reaction | Chemical kinetics |
| 29 | [2] | Surface tension | States of matter |
| 30 | [3] | Practical organic chemistry | General organic chemistry |

# Solutions

## Section A

**1. Option (4) is correct.**

$pH = -\log[H^+]$

It is clear from the above equation that $[H^+]$ ion is inversely proportional from pH.

Here if $[H^+]$ ion changes by a factor of 1000, then pH can change by 3 unit.

Suppose if $[H^+]$ ion increases by 1000 times, the pH decreases by 3 units.

Let initial $[H^+] = 10^{-6}$ M

$pH = -\log[10^{-6}] = 6$

Now $[H^+]$ increases by 1000 factor i.e., $10^{-3}$ M

$pH = -\log[10^{-3}] = 3$

So, pH decreases by 3 units.
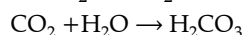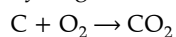
**2. Option (4) is correct.**

The dehydration of alcohol in presence of concentrated sulphuric acid give rise to an unsaturated compound called alkene. The formation of alkene from alcohol is an example of elimination reaction in which that alkene is formed which is highly substituted.



Zeitsev Product (high stable alkene)
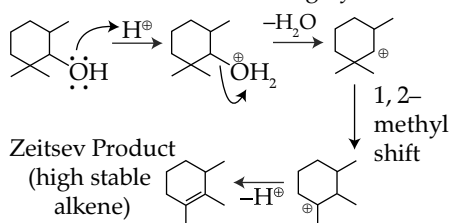
**3. Option (3) is correct.**

Those oxides which forms an acidic solution on dissolution in water are called acidic oxide. Here carbon forms two oxides out of which carbon dioxide is acidic in nature while Carbon monoxide is neutral in nature.

Carbon dioxide on reaction with water forms an acid called carbonic acid which on dissociation liberates hydrogen ion while CO is sparingly soluble in water.

$C + O_2 \rightarrow CO_2$

$CO_2 + H_2O \rightarrow H_2CO_3$ Carbonic acid

**4. Option (1) is correct.**

**Assertion is not correct:** The alkali metals and their salts impart characteristics colour to the oxidising flame due to oxidizing nature, being electro positive in nature electrons of alkali metal gets excited to a higher energy level and when the excited electron comes back to the ground state emits radiation in the visible region.

**Reason is correct:** Each alkali metals have their own characteristics colour due to the difference in their ionisation enenergy. Thus can be detected by flame test.

**5. Option (4) is correct.**

The balanced chemical reaction of dichromate ion in an acidic solution is shown as follows:-

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$
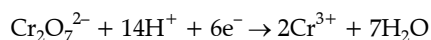
From above it is clear that, the change in oxidation state of chromium atom takes place from +6 to +3.
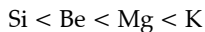
**6. Option (4) is correct.**

| LIST I (Name of polymer) | | LIST II (Uses) | |
|---|---|---|---|
| A. | Glyptal | III. | Paints and Lacquers |
| B. | Neoprene | IV. | Gaskets |
| C. | Acrilan | II. | Synthetic wool |
| D. | LDP | I. | Flexible pipes |

**7. Option (1) is correct.**

In a periodic table, metallic character increases down the group while moving left to right in a period, it decreases.

Here among the given elements, Potassium(K) has highest metallic character because it is present on the extreme left of the periodic table while Silicon has least metallic character as it is present on the right of the periodic table.
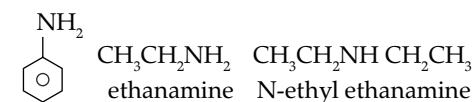
The correct order of the metallic character of the given elements is shown as follows:
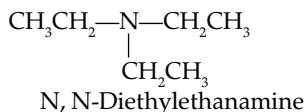
$Si < Be < Mg < K$

**8. Option (2) is correct.**

| | LIST I | | LIST II |
|---|---|---|---|
| A. | Cobalt catalyst | IV. | Methanol production |
| B. | Syngas | III. | Coal gasification |
| C. | Nickel catalyst | II. | Water gas production |
| D. | Brine solution | I. | $(H_2 + Cl_2)$ production |

**9. Option (1) is correct.**

NH₂ (Aniline)

$CH_3CH_2NH_2$ ethanamine

$CH_3CH_2NH\,CH_2CH_3$ N-ethyl ethanamine

$CH_3CH_2—N—CH_2CH_3$
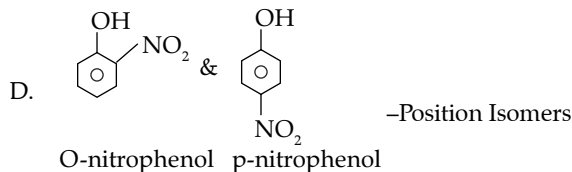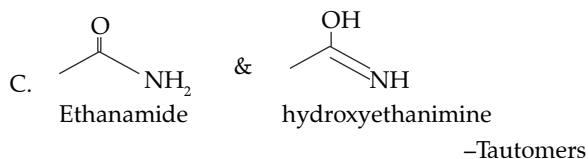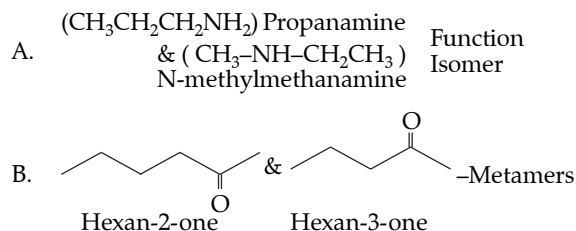$\qquad\quad |$
$\qquad CH_2CH_3$
N, N-Diethylethanamine

In an aqueous solution the basic nature of ethyl derivative of $NH_3$ is a follows $2 > 3 > 1$

Similarly, the basic nature of aliphatic amine is greater than aromatic amines.

The strength of base is explained by the help of $pK_b$ and the relation of $pK_b$ with the strength of base in shown as follows

Strength of base $\propto \dfrac{1}{pK_b}$

A. Aniline    III. 9.38
B. Ethanamine    IV. 3.29
C. N-ethyl ethanamine    II.3.00
D. N, N-dietinylethanamine    I. 3.25

**10. Option (2) is correct.**

A. $(CH_3CH_2CH_2NH_2)$ Propanamine & $( CH_3–NH–CH_2CH_3 )$ N-methylmethanamine — Function Isomer

B. Hexan-2-one & Hexan-3-one —Metamers

C. Ethanamide & hydroxyethanimine —Tautomers

D. O-nitrophenol & p-nitrophenol —Position Isomers

**11. Option (2) is correct.**

Formula used: $molarity_{(M)} = \dfrac{weight \times 1000}{molecular\ weight \times V(L)}$

Assume mass of solvent $\approx$ mass of solution

**Case 1:** $0.25 = \dfrac{w_1}{62} \times \dfrac{1000}{500}$    ...(i)

**Case 2:** $0.25 = \dfrac{w_2}{62} \times \dfrac{1000}{250}$    ...(ii)

From i & ii

$\dfrac{w_1}{w_2} = \dfrac{2}{1}$

Mass ratio : 2 : 1

**12. Option (3) is correct.**

Formula : $E(\Delta_0) = \dfrac{hc}{\lambda}$

From the formula it is clear that, higher the value of $\Delta o$, lower will be the $\lambda$.

| | LIST I Coordination entity | | LIST II Wavelength of light absorbed in nm |
|---|---|---|---|
| A. | $[CoCl(NH_3)_5]^{2+}$ | III. | 535 |
| B. | $[Co(NH_3)_6]^{3+}$ | II. | 475 |
| C. | $[Co(CN)_6]^{3-}$ | I. | 310 |
| D. | $[Cu(H_2O)_4]^{2+}$ | IV. | 600 |

The value of $\lambda$ depends upon the strength and number of ligand also, if the strength of ligand is high the $\lambda$ absorbed will be less & vice versa.

strength of ligand $^-CN > NH_3 > H_2O$

**13. Option (3) is correct.**

The most familiar anti oxidants are butylated hydroxy toluene (BHT) and butylated hydroxy anisole (BHA), the addition of BHA to butter increases its shelf life.

Sometimes BHT and BHA along with citric acid are added to produce more effect.
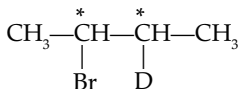
Similarly butylated hydroxy anisole is more reactive towards oxygen than food.

Here both Assertion and Reason are true and Reason is the correct explanation of Assertion.

**14. Option (1) is correct.**

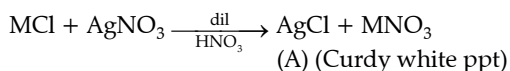The structural representation of $C_4H_8DBr$ having

two chiral carbon atoms is as follows:

$$CH_3 \overset{*}{-}CH \overset{*}{-}CH - CH_3$$
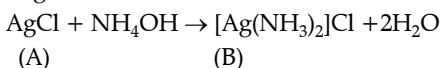$$\quad\quad | \quad\quad |$$
$$\quad\quad Br \quad\quad D$$

The IUPAC name of the following structure - 2-bromo-3-deuterobutane

15. **Option (2) is correct.**

The metal chloride on reaction with $AgNO_3$ gives a curdy percipitate of AgCl.

$$MCl + AgNO_3 \xrightarrow[\text{HNO}_3]{\text{dil}} AgCl + MNO_3$$
$$\quad\quad\quad\quad\quad\quad\quad \text{(A) (Curdy white ppt)}$$

The precipitate formed further reacts with $NH_4OH$ to give clear solution.

$$AgCl + NH_4OH \rightarrow [Ag(NH_3)_2]Cl + 2H_2O$$
$$\text{(A)} \quad\quad\quad\quad\quad\quad \text{(B)}$$
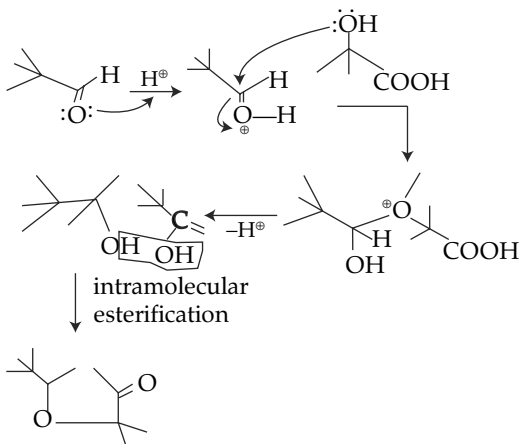
16. **Option (2) is correct.**

Statement (I) is correct

Dipole moment is a vector quantity which is represented by crossed arrow ($\rightarrow$)

Statement (II) is incorrect

The crossed arrow symbolises the direction of the shift of electron density in the molecule.

17. **Option (4) is correct.**



intramolecular esterification

18. **Option (3) is correct.**

(A) is correct

Ammonium salts are produced which can be seen as atmospheric haze (aerosol of fine particles). Aerosol particles of oxides or ammonium salts in rain drops results in wet deposition.

(B) is incorrect

ozone gets produced when atmospheric oxygen interacts with solar ultraviolet (UV)radiations

(C) is correct.

Various industrial chemical like Polychlorinated biphenyls used as a cleansing solvents, detergents and fertilisers add to the list of water pollutants.

(D) is incorrect.

Blue baby syndrome occurs due to the presence of nitrate ion. The maximum limit of nitrate ion in drinking water is 50 ppm, excess nitrate in drinking water can cause methemoglobinemia called Blue baby syndrome.

19. **Option (1) is correct.**

In Froth floatation method, rotating paddle draws in air & stirs the pulp.
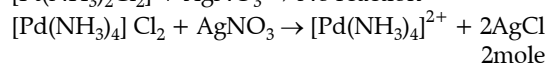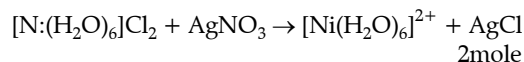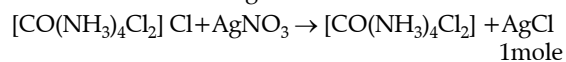
so statement(1) is false.

20. **Option (4) is correct.**

Sodium have lowest oxidation potential among alkali metals, hence it is a weakest reducing agent.

## Section B

21. **The correct answer is [5].**

Number of moles of AgCl formed = 5

$$[CO(NH_3)_4Cl_2]Cl + AgNO_3 \rightarrow [CO(NH_3)_4Cl_2] + AgCl$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 1mole$$

$$[Ni(H_2O)_6]Cl_2 + AgNO_3 \rightarrow [Ni(H_2O)_6]^{2+} + AgCl$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 2mole$$

$$[Pt(NH_3)_2Cl_2] + AgNO_3 \rightarrow No\ reaction$$
$$[Pd(NH_3)_4]Cl_2 + AgNO_3 \rightarrow [Pd(NH_3)_4]^{2+} + 2AgCl$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 2mole$$

Total 5 moles AgCl are formed.

22. **The correct answer is [2].**

A is incorrect

Water vapour are absorbed by $CaCl_2$ not adsorbed by anhydrous $CaCl_2$.

C is incorrect

Doing adsorption, energy releases so $\Delta H$ become less and less negative.

Remaining statements are correct.

23. **The correct answer is [12].**

| Element | Percentage | No. of Moles | Mole ratio |
|---------|-----------|--------------|-----------|
| C | 85.8 | $\frac{85.8}{12} = 7.15$ | $\frac{7.15}{7.15} = 1$ |
| H | 14.2 | $\frac{14.2}{1} = 14.2$ | $\frac{14.2}{7.15} = 2$ |

Empirical formula = $CH_2$

Empirical mass = 14

molecular mass = 84

$$n = \frac{\text{molecular mass}}{\text{Empirical mass}} = \frac{84}{14} = 6$$

Molecular formula = n × Empirical formula
$$= 6 \times CH_2 = C_6H_{12}$$

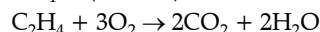Number of H-atom per molecule = 12

24. **The correct answer is [5].**

The number of orbitals which have $e^-$ density along the axis are 5
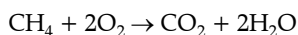
$p_x, p_y, p_z, d_{z^2}$ and $d_{x^2-y^2}$

25. **The correct answer is [847].**

Let the volume of $C_2H_4 = x$ L

$CH_4 = (16.8 - x)$ L

$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

Initial $\quad\quad\quad x \quad\quad\quad -$

Final $\quad\quad\quad\quad - \quad\quad (2x)$

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

Initial　　　　$16.8 - x$　$-$

Final　　　　　$-$　$(16.8 - x)$

Totalvolume of $CO_2 = 2x + 16.8 - x$

$28L = 16.8 + x$

$x = 1.2$ L

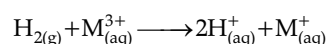$n_{CH_4} = \dfrac{PV}{RT} = \dfrac{1 \times 5.6}{0.0821 \times 298} = 0.229$ mol

$n_{C_2H_4} = \dfrac{PV}{RT} = \dfrac{1 \times 11.2}{0.0821 \times 298} = 0.458$ mol

$\therefore$ heat evolved during combustion

$= (0.229 \times 900) + (0.458 \times 1400) = 847$ kJ

**26. The correct answer is [3].**

The balanced chemical reaction of the following cell–

$H_{2(g)} + M^{3+}_{(aq)} \longrightarrow 2H^+_{(aq)} + M^+_{(aq)}$

$E^o_{cell} = E^o_{coathate} - E^o_{anode} = 0.2 - 0.00a = 0.2$ V

$E_{cell} = E^o_{cell} - \dfrac{0.059}{n} \log \dfrac{[H^+]^2[M^+]}{P_{H_2} \cdot [M^{3+}]}$

$0.1115 = 0.2 - \dfrac{0.059}{2} \log \dfrac{(1)^2[M^+]}{1[M^{3+}]}$

$\dfrac{0.0885 \times 2}{0.059} = \log \left[ \dfrac{M^+}{M^{3+}} \right]$

$\log \left[ \dfrac{M^+}{M^{3+}} \right] = 3 \Rightarrow \left[ \dfrac{M^+}{M^{3+}} \right] = 10^3$

$10^a = 10^3 \Rightarrow a = 3$

**27. The correct answer is [4].**

Solution　　　　　　　$\pi = iCRT$ (formula used)

A.　0.5 M $C_2H_5OH$ (i = 1)　$\pi = 1 \times 0.5$ RT = 0.5 RT

0.25 M KBr (i = 2)　　$\pi = 2 \times 0.25$ RT = 0.5 RT

B.　0.10 M $K_4[Fe(CN)_6]$ (i = 5)

$\pi = 5 \times 0.1$ RT = 0.5 RT

0.10 M $FeSO_4 (NH_4)_2 SO_4$ (i = 5)

$\pi = 5 \times 0.1$ RT = 0.5 RT

C.　0.05 M $K_4[Fe(CN)_6]$ (i = 5)

$\pi = 5 \times 0.05$ RT = 0.25 RT

0.25 M NaCl (i = 2)　$\pi = 2 \times 0.25$ RT = 0.5 RT

D.　0.15 M NaCl (i = 2)　$\pi = 0.15 \times 2$ RT = 0.30 RT

0.1 M $BaCl_2$ (i = 3)　$\pi = 0.1 \times 3$ RT = 0.30 RT

E.　0.02 M $KCl . MgCl_2 . 6H_2O$ (i = 5)

$\pi = 5 \times 0.02$ RT = 0.1 RT

0.05 M KCl (i = 2)　$\pi = 2 \times 0.05$ RT = 0.1 RT

-From the above it is clear that solution A, B, D and E have same value of osmotic pressure.

**28. The correct answer is [1].**

First order reaction never goes for completion

$\therefore$ option A is not correct.

Assume $t^{99.9\%} \approx t^{100\%}$　　　　$t^{99.9\%} = 10 \times \dfrac{t_1}{2}$

$t^{99.9\%} = 10 \times 150.65 = 1506.5$ s

From $K = \dfrac{0693}{t_{\frac{1}{2}}} \Rightarrow t_{\frac{1}{2}} = \dfrac{0.693}{4.6 \times 10^{-3}} = 150.65$ s

Option (B) is correct.

$\Rightarrow$ From $K = \dfrac{2.303}{t} \log \dfrac{a_0}{a_0 - x}$

$t_{10\%} = \dfrac{2.303}{k} \log \dfrac{100}{90}$ ... (i),　$t_{90\%} = \dfrac{2.303}{k} \log \dfrac{100}{10}$ ... (ii)

From (i) & (ii)

$\dfrac{t_{90\%}}{t_{10\%}} = \dfrac{\log_{100/10}}{\log_{100/90}} = \dfrac{\log 10}{\log \dfrac{10}{9}} = \dfrac{1}{0.04} = 25$

$t90\% = 25 \, t10\%$

Option C is correct.

$\rightarrow$ Given　　$K = 4.6 \times 10^{-3}$ s$^{-1}$

For 1st order Kinetics $a = a_0 e^{-kt}$

or　　　$a_0 - x = a_0 e^{-kt}$ or $-x = a_0 e^{-kt} - a_0$

$-x = a_0 (e^{-kt} - 1)$

or　　　$x = a_0 (1 - e^{-kt})$

Option D is correct.

$\rightarrow$ For First order kinetics

Rate = k[A]'

Unit of Rate = mol/L sec

Unit of Rate constant (K) = $\dfrac{Rate}{[A]} = \dfrac{mol/Ls}{mol/L} = \dfrac{1}{s}$

Unit of Rate and Rate constant are not same so option (E) is not correct.

**29. The correct answer is [2].**

Option A is incorrect

Surface tension is the out come of unequal attractive & repulsion forces acting on the liquid molecule S in the bulk.

Option B is correct.

Due to uneven forces acting on the molecules present on the surface, surface tension occurs.

Option C is incorrect.

Due to translatory motion, the molecules in the bulk will come to the liquid surface.

Option D is correct.

In a closed system, the molecule present on the liquid surface responsible for the vapour pressure.

So option B & D are correct.

**30. The correct answer is [3].**

Ceric ammonium nitrate test is used to detect the presence of alcoholic groups While iodoform test is used to detect the presence of $CH_3CO$ or $CH_3CH(OH)$ groups Thus following molecules will show red coloration with ceric ammonium nitrate & also give positive iodoform test are



□□