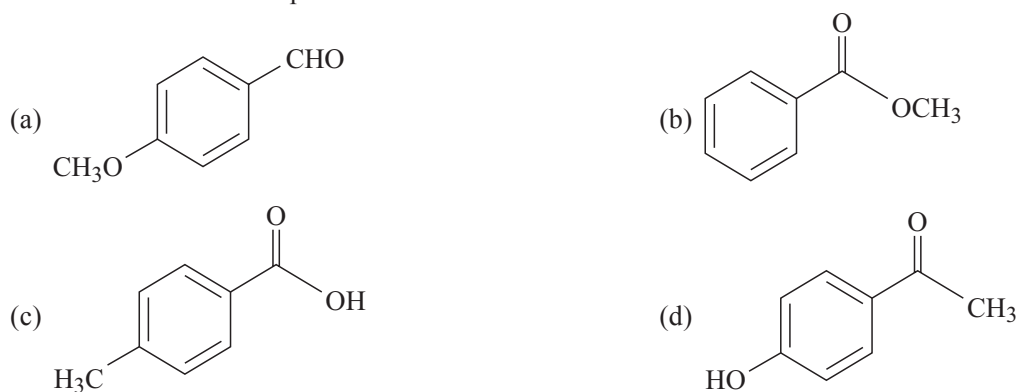


JEE (Main) Chemistry

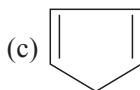
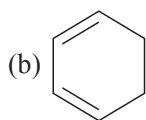
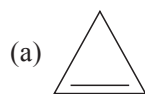
Online Solved Paper 2—2017

1. A compound of molecular formula $C_8H_8O_2$ reacts with acetophenone to form a single cross-aldol product in the presence of base. The same compound on reaction with conc. NaOH forms benzyl alcohol as one of the products. The structure of the compound is:



2. Which of the following ions does not liberate hydrogen gas on reaction with dilute acids?
 (a) V^{2+} (b) Ti^{2+} (c) Mn^{2+} (d) Cr^{2+}
3. The rate of a reaction quadruples when the temperature changes from 300 K to 310 K. The activation energy of the reaction is: (Assume activation energy and pre-exponential factor are independent of temperature; $\ln 2 = 0.693$; $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$.)
 (a) 53.6 kJ mol^{-1} (b) $214.4 \text{ kJ mol}^{-1}$ (c) $107.2 \text{ kJ mol}^{-1}$ (d) 26.8 kJ mol^{-1}
4. The group having triangular planar structure is:
 (a) BF_3, NF_3, CO_3^{2-} (b) CO_3^{2-}, NO_3^-, SO_3 (c) NH_3, SO_3, CO_3^{2-} (d) NCl_3, BCl_3, SO_3
5. The electronic configuration with the highest ionization enthalpy is:
 (a) $[Ar] (3d)^{10} (4s)^2 (4p)^3$ (b) $[Ne] (3s)^2 (3p)^1$ (c) $[Ne] (3s)^2 (3p)^3$ (d) $[Ne] (3s^2) (3p)^2$
6. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. The transition is associated with
 (a) Lyman series (b) Balmer series (c) Brackett series (d) Paschen series
7. Which one of the following is an oxide?
 (a) SiO_2 (b) KO_2 (c) BaO_2 (d) CsO_2
8. 50 mL of 0.2 M ammonia solution is treated with 25 mL of 0.2 M HCl. If pK_b of ammonia solution is 4.75, the pH of the mixture is:
 (a) 8.25 (b) 9.25 (c) 3.75 (d) 4.75

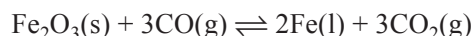
9. Which of the following compounds is most reactive to an aqueous solution of sodium carbonate?



10. The number of P—OH bonds and the oxidation state of phosphorus atom in pyrophosphoric acid ($\text{H}_4\text{P}_2\text{O}_7$) respectively are:

- (a) five and four (b) four and five (c) five and five (d) four and four

11. The following reaction occurs in the Blast furnace where iron ore is reduced to iron metal:



Using the Le Chatelier's principle, predict which one of the following will not disturb the equilibrium?

- (a) Addition of CO_2 (b) Removal of CO_2 (c) Addition of Fe_2O_3 (d) Removal of CO

12. A solution is prepared by mixing 8.5 g of CH_2Cl_2 and 11.95 g of CHCl_3 . If vapour pressure of CH_2Cl_2 and CHCl_3 at 298 K are 415 mmHg and 200 mmHg, respectively, the mole fraction of CHCl_3 in vapour form is: (Molar mass of Cl = 35.5 g mol^{-1} .)

- (a) 0.162 (b) 0.675 (c) 0.325 (d) 0.486

13. The increasing order of the boiling points for the following compounds is:



- (a) (IV) < (III) < I < (II) (b) (III) < (II) < (I) < (IV) (c) (III) < (IV) < (II) < (I) (d) (II) < (III) < (IV) < (I)

14. An ideal gas undergoes isothermal expansion at constant pressure. During the process:

- (a) enthalpy remains constant but entropy increases (b) enthalpy decreases but entropy increases
(c) enthalpy increases but entropy decreases (d) Both enthalpy and entropy remains constant.

15. $[\text{Co}_2(\text{CO})_8]$ displays:

- (a) no Co—Co bond, six terminal CO and two bridging CO
(b) no Co—Co bond, four terminal CO and four bridging CO
(c) one Co—Co bond, six terminal CO and two bridging CO
(d) one Co—Co bond, four terminal CO and four bridging CO

16. The correct sequence of decreasing number of π -bonds in the structure of H_2SO_3 , H_2SO_4 and $\text{H}_2\text{S}_2\text{O}_7$ is:

- (a) $\text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_3 > \text{H}_2\text{SO}_4$ (b) $\text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_4 > \text{H}_2\text{SO}_3$
(c) $\text{H}_2\text{SO}_4 > \text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_3$ (d) $\text{H}_2\text{SO}_3 > \text{H}_2\text{SO}_4 > \text{H}_2\text{S}_2\text{O}_7$

17. At 300 K, the density of a certain gaseous molecules at 2 bar is double to that of dinitrogen (N_2) at 4 bar.

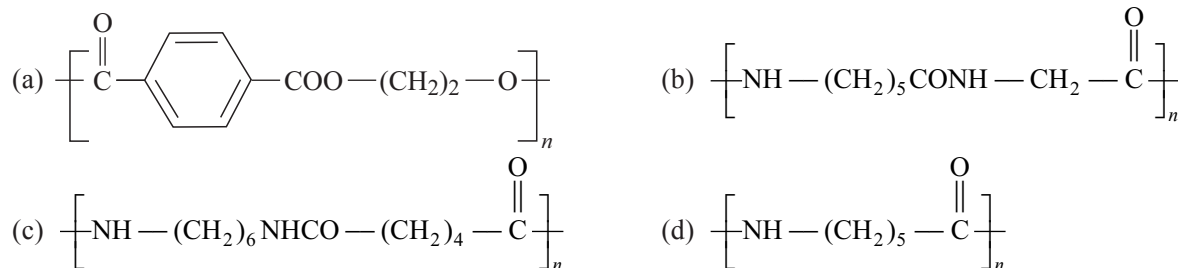
The molar mass of gaseous molecules is:

- (a) 224 g mol^{-1} (b) 112 g mol^{-1} (c) 56 g mol^{-1} (d) 28 g mol^{-1}

18. A gas undergoes change from state A to state B. In this process, the heat absorbed and work done by the gas is 5 J and 8 J, respectively. Now the gas is brought back to A by another process during which 3 J of heat is evolved. In this reverse process B to A:

- (a) 6 J of the work will be done by the gas
(b) 6 J of the work will be done by the surrounding on gas
(c) 10 J of the work will be done by the surrounding on the gas
(d) 10 J of the work will be done by the gas

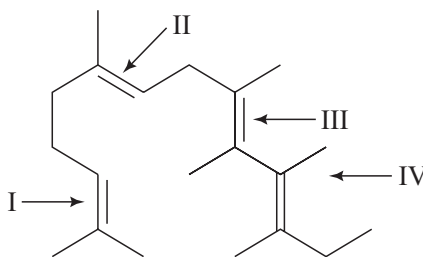
19. Which of the following is a biodegradable polymer?



20. XeF_6 on partial hydrolysis with water produces a compound X. The same compound X is formed where XeF_6 reacts with silica. The compound X is

- (a) XeF_4 (b) XeF_2 (c) XeO_3 (d) XeOF_4

21. In the following structure, the double bonds are marked as I, II, III and IV. Geometrical isomerism is not present at site(s):



- (a) I and II (b) III (c) I (d) III and IV

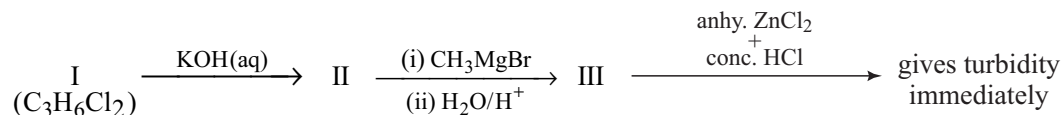
22. Adsorption of a gas on a surface follows Freundlich adsorption isotherm. Plot of $\log(x/m)$ versus $\log p$ gives a straight line with slope equal to 0.5, then: (x/m is the mass of gas adsorbed per gram of adsorbent.)

- (a) Adsorption is proportional to the square root of pressure
 (b) Adsorption is proportional to the square of pressure
 (c) Adsorption is proportional to the pressure
 (d) Adsorption is independent of pressure

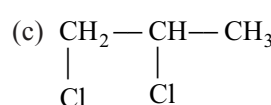
23. The incorrect statement among the following is:

- (a) α -D-glucose and β -D-glucose is enantiomers
 (b) The penta acetate of glucose does not react with hydroxylamine
 (c) α -D-glucose and β -D-glucose are anomers
 (d) Cellulose is a straight chain polysaccharide made up of only β -D-glucose units.

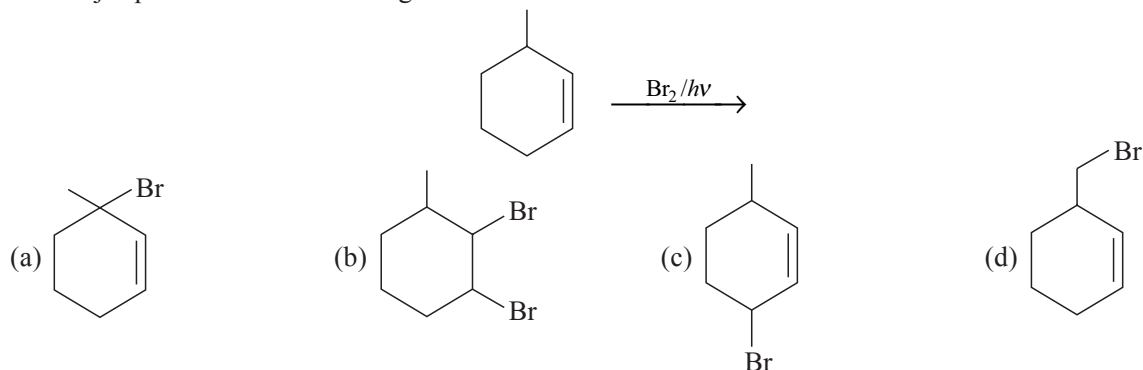
24. In the following reaction sequence:



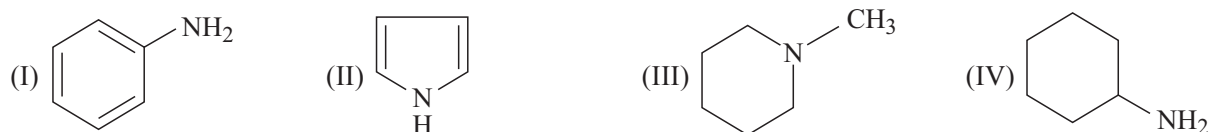
The compound I is:

- (a) 
- (b) 
- (c) 
- (d) 

25. The major product of the following reaction is:



26. Among the following compounds, the increasing order of their base strength is:

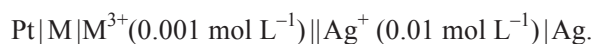


- (a) (II) < (I) < (III) < (IV) (b) (II) < (I) < (IV) < (III)
 (c) (I) < (II) < (IV) < (III) (d) (I) < (II) < (III) < (IV)

27. What quantity (in mL) of a 45% acid solution of a mono-protic strong acid must be mixed with a 20% solution of the same acid to produce 800 mL of a 29.875% acid solution?

- (a) 316 (b) 320 (c) 325 (d) 330

28. To find the standard potential of $M^{3+}|M$ electrode, the following cell is constituted:



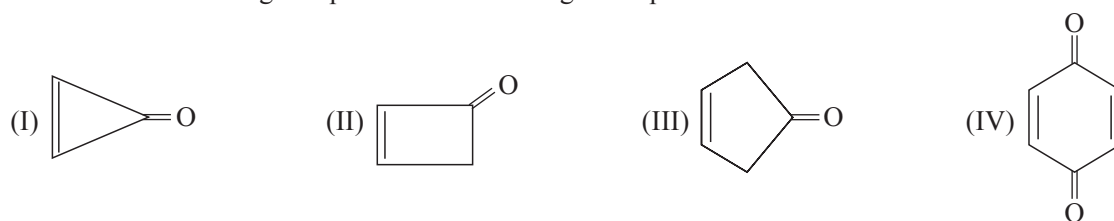
The cell potential is found to be 0.421 V at 298 K. The standard potential of half reaction $M^{3+} + 3e^- \rightarrow M$ at 298 K will be: (Given: $E_{\text{Ag}^+|\text{Ag}}^\circ = 0.80 \text{ V}$ at 298 K.)

- (a) 0.38 V (b) 1.28 V (c) 0.32 V (d) 0.66 V

29. Which of the following is a set of green house gases?

- (a) $\text{O}_3, \text{NO}_2, \text{SO}_2, \text{Cl}_2$ (b) $\text{CH}_4, \text{O}_3, \text{N}_2, \text{SO}_2$ (c) $\text{CO}_2, \text{CH}_4, \text{N}_2\text{O}, \text{O}_3$ (d) $\text{O}_3, \text{N}_2, \text{CO}_2, \text{NO}_2$

30. Which of the following compounds will show highest dipole moment?



- (a) (II) (b) (IV) (c) (III) (d) (I)

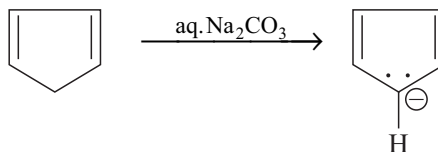
ANSWERS

- | | | | | | |
|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (c) | 3. (c) | 4. (b) | 5. (b) | 6. (b) |
| 7. (a) | 8. (b) | 9. (c) | 10. (b) | 11. (c) | 12. (c) |
| 13. (c) | 14. (a) | 15. (c) | 16. (b) | 17. (b) | 18. (b) |
| 19. (b) | 20. (d) | 21. (c) | 22. (a) | 23. (a) | 24. (a) |
| 25. (a) | 26. (a) | 27. (a) | 28. (c) | 29. (c) | 30. (d) |

JEEC.6 Complete Chemistry—JEE Main

we will have $\text{pOH} = 4.75$ and $\text{pH} = 14 - 4.75 = 9.25$.

9. Cyclopentadiene on treating with a base produces cyclopentadienyl anion. The resultant anion is planar and has 6π electrons and is thus an aromatic compound—a stable species.



10. The pyrophosphoric acid is
- $$\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{HO} - \text{P} - \text{O} - \text{P} - \text{OH} \\ | & & | \\ \text{OH} & & \text{OH} \end{array}$$

There are four P—OH bonds and the oxidation state of P is five.

Note: All acid in phosphoric acid has +V oxidation state of phosphorus. Choice (b) is correct because there cannot be five O—H bonds as there are only four hydrogen atoms.

11. The equilibrium constant of the reaction does not involve the concentration of condensed phases (i.e. solid and liquid). Hence, addition of Fe_2O_3 will not disturb the equilibrium.
12. Molar mass of CH_2Cl_2 , $M_1 = (12 + 2 + 2 \times 35.5) \text{ g mol}^{-1} = 85 \text{ g mol}^{-1}$

$$\text{Amount of } \text{CH}_2\text{Cl}_2, n_1 = \frac{m_1}{M_1} = \frac{8.5 \text{ g}}{85 \text{ g mol}^{-1}} = 0.1 \text{ mol}$$

$$\text{Molar mass of } \text{CHCl}_3, M_2 = (12 + 1 + 3 \times 35.5) = 119.5 \text{ g mol}^{-1}$$

$$\text{Amount of } \text{CHCl}_3, n_2 = \frac{m_2}{M_2} = \frac{11.95 \text{ g}}{119.5 \text{ g mol}^{-1}} = 0.1 \text{ mol}$$

$$\text{Mole fraction of } \text{CHCl}_3 = \frac{n_2}{n_1 + n_2} = \frac{0.1 \text{ mol}}{0.2 \text{ mol}} = 0.5$$

$$\text{Partial vapour pressure of } \text{CHCl}_3, p_2 = x_2 p_2^* = (0.5) (200 \text{ mmHg}) = 100 \text{ mmHg.}$$

$$\text{Partial vapour pressure of } \text{CHCl}_2, p_1 = (1 - x_2) p_1^* = (0.5) (415 \text{ mmHg}) = 207.5 \text{ mmHg}$$

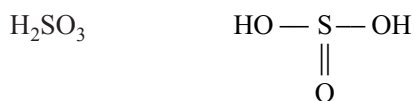
$$\text{Mole fraction of } \text{CHCl}_3 \text{ in vapour phase is } y_2 = \frac{p_2}{p_1 + p_2} = \frac{100 \text{ mmHg}}{307.5 \text{ mmHg}} = 0.325$$

13. Ethanol will have maximum boiling point due to the existence of hydrogen bondings. Next lower boiling point will be that of $\text{C}_2\text{H}_5\text{Cl}$ due to dipole-dipole interactions. The above order is satisfied by the Choice (c). From this choice, it may be concluded that the boiling point of $\text{C}_2\text{H}_5\text{CH}_3$ will be lesser than that of $\text{C}_2\text{H}_5\text{OCH}_3$.
14. Enthalpy of an ideal gas does not change due to constant temperature. Entropy will increase because of increase in volume imparting larger randomness.

15. The structure of $[\text{Co}_2(\text{CO})_8]$ is
-

There is one Co—Co bond, six terminal CO bonds and two bridging CO bonds.

16. $\text{H}_2\text{S}_2\text{O}_7$
- $$\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{HO} - \text{S} - \text{O} - \text{S} - \text{OH} \\ || & & || \\ \text{O} & & \text{O} \end{array}$$
- H_2SO_4
- $$\begin{array}{c} \text{O} \\ || \\ \text{HO} - \text{S} - \text{OH} \\ || \\ \text{O} \end{array}$$



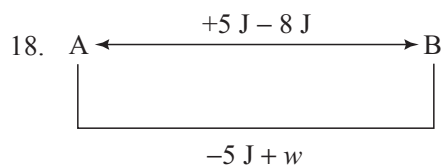
$\text{H}_2\text{S}_2\text{O}_7$ has four π -bonds (i.e. four $\text{S} = \text{O}$ bonds), H_2SO_4 has two while H_2SO_3 has one.

17. From ideal-gas equation of state, we have

$$pV = nRT \Rightarrow pV = \frac{m}{M} RT \Rightarrow pM = \frac{m}{V} RT \Rightarrow M = \frac{\rho RT}{p}$$

Thus
$$\frac{M_2}{M_1} = \left(\frac{\rho_2}{\rho_1} \right) \left(\frac{p_1}{p_2} \right) = (2) \left(\frac{4 \text{ bar}}{2 \text{ bar}} \right) = 4$$

Hence $M_2 = 4M_1 = 4(28 \text{ g mol}^{-1}) = 112 \text{ g mol}^{-1}$



For the cyclic process $\Delta U = 0$, we will have $+5 \text{ J} - 8 \text{ J} - 3 \text{ J} + w = 0$

This gives $w = 6 \text{ J}$, that is, 6 J of work is done by the surroundings on the gas

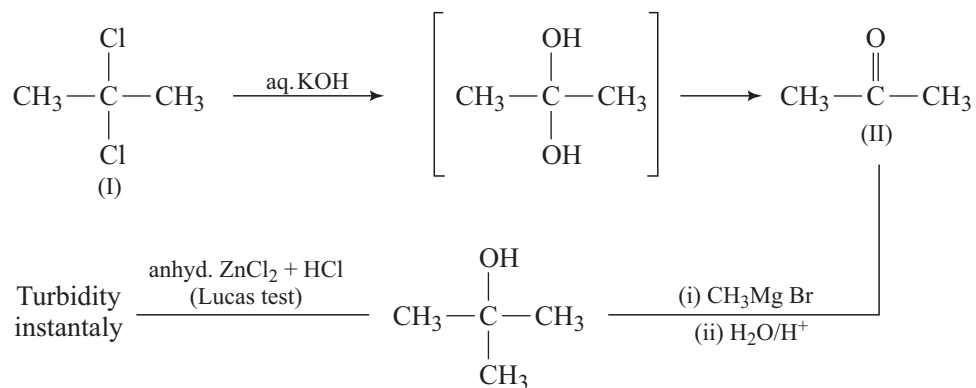
19. Polymer of choice (b) is biodegradable. It is known as nylon 2-nylon 6 polymer. It is a polyamide copolymerisation of glycine ($\text{H}_2\text{N} - \text{CH}_2 - \text{COOH}$) and amino caproic acid ($\text{H}_2\text{N} - (\text{CH}_2)_5 - \text{COOH}$).
20. The reactions are: $\text{XeF}_6 + \text{H}_2\text{O} \longrightarrow \text{XeOF}_4 + 2\text{HF}$ and $2\text{XeF}_6 + \text{SiO}_2 \longrightarrow 2\text{XeOF}_4 + \text{SiF}_4$
21. The site I contains two identical CH_3 groups attached to double bond. This site will not show geometrical isomerism.
22. The Freundlich adsorption isotherm is $\frac{x}{m} = kp^{1/n}$

Its logarithm form is

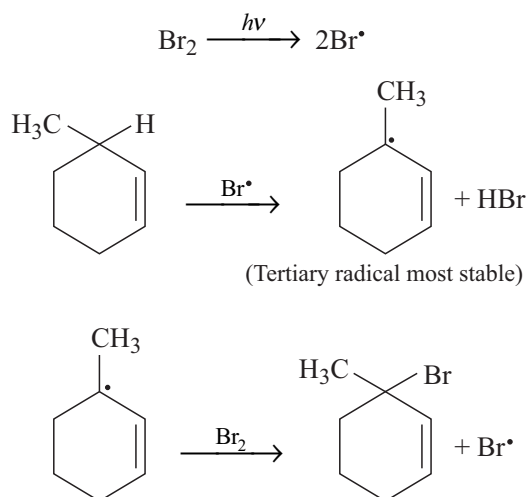
$$\log \left(\frac{x}{m} \right) = \log \left(\frac{k}{k^\circ} \right) + \frac{1}{n} \log (p/p^\circ); \quad (\text{where } p^\circ \text{ unit pressure and } k^\circ \text{ unit value of } k.)$$

It is given that $1/n = 0.5$. Hence $\frac{x}{m} = k\sqrt{p}$

23. α -D-Glucose and β -D-glucose are anomers. The choice (a) is incorrect.
24. Since the compound III gives turbidity immediately with anhyd. $\text{ZnCl}_2 + \text{conc. HCl}$, the compound must be a tertiary alcohol. Its explanation from the compound of choice (a) is



25. The reaction proceeds via free radical mechanism.



26. Aliphatic amine is more basic than aromatic amine

Primary aliphatic amine is more basic than tertiary aliphatic amine.

In pyrrole, lone pair is involved in the delocalisation over the ring and is thus least basic.

Based on the above facts, the order is (II) < (I) < (III) < (IV) — Choice (a).

27. Let V be the volume of 45% acid solution. Since 800 mL is the final volume, the volume of 20% acid solution will be $(800 \text{ mL} - V)$. Equating the amount of acids before and after mixing, we will have

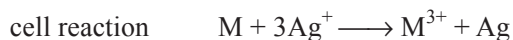
$$V \times \left(\frac{45}{100} \right) + (800 \text{ mL} - V) \left(\frac{20}{100} \right) = (800 \text{ mL}) \left(\frac{29.875}{100} \right)$$

or simply $45V + (800 \text{ mL} - V)(20) = (800 \text{ mL})(29.875)$

Solving for V , we get

$$(45V - 20V) = (800 \text{ mL})(29.875 - 20) \quad \text{i.e.} \quad V = \frac{(800 \text{ mL})(9.875)}{20} = 316 \text{ mL}$$

28. The cell reaction are:



Its Nernst equation is

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{3F} \ln \left[\frac{[\text{M}^{3+}]/c^{\circ}}{([\text{Ag}^+]/c^{\circ})^3} \right]$$

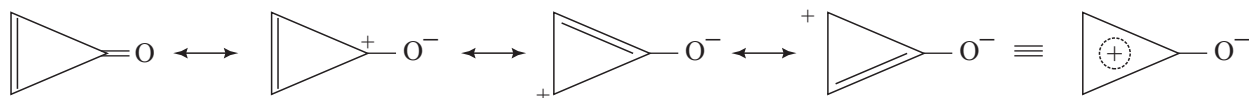
$$0.421 \text{ V} = E_{\text{cell}}^{\circ} - \frac{0.059 \text{ V}}{3} \log \frac{0.001}{(0.01)^3} = E_{\text{cell}}^{\circ} - \frac{0.059 \text{ V}}{3} \log (1000) = E_{\text{cell}}^{\circ} - 0.059 \text{ V}$$

Hence $E_{\text{cell}}^{\circ} = (0.421 + 0.059)\text{V} = 0.480 \text{ V}$

Now $E_{\text{cell}}^{\circ} = E_{\text{Ag}^+|\text{Ag}}^{\circ} - E_{\text{M}^{3+}|\text{M}}^{\circ}$

This gives $E_{\text{M}^{3+}|\text{M}}^{\circ} = E_{\text{Ag}^+|\text{Ag}}^{\circ} - E_{\text{cell}}^{\circ} = (0.80 - 0.48) \text{ V} = 0.32 \text{ V}$

29. The green house gases are CO_2 , CH_4 , N_2O and O_3 .
30. In cyclopropanone, there is a strong polarization of the carbonyl group, which gives a partial positive charge with aromatic stabilization on the ring and partial negative charge on oxygen



The resonance stabilization of charges give larger dipole moment to cyclopropanone. It is considered to be an aromatic molecules.