

Sample Question Paper - 14
Chemistry (043)
Class- XII, Session: 2021-22
TERM II

Time allowed : 2 hours

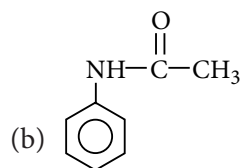
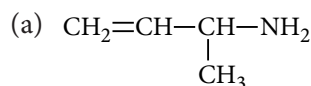
Maximum marks : 35

General Instructions :

1. There are 12 questions in this question paper with internal choice.
2. SECTION A - Q. No. 1 to 3 are very short answer questions carrying 2 marks each.
3. SECTION B - Q. No. 4 to 11 are short answer questions carrying 3 marks each.
4. SECTION C - Q. No. 12 is case based question carrying 5 marks.
5. All questions are compulsory.
6. Use of log tables and calculators is not allowed.

SECTION - A

1. State a condition under which a bimolecular reaction is kinetically first order reaction.
2. Give IUPAC names of the following compounds:



3. Why primary aromatic amines cannot be prepared by Gabriel phthalimide synthesis?

SECTION - B

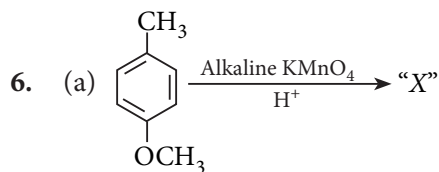
4. How would you account for the following :
 - (i) Cr^{2+} is reducing in nature while with the same d -orbital configuration (d^4) Mn^{3+} is an oxidising agent.
 - (ii) In a transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.

OR

Explain by giving a suitable reason for each of the following :

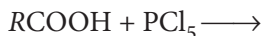
- (i) Transition metals and their compounds are generally found to be good catalysts.
 - (ii) Metal-metal bonding is more frequent for the $4d$ and the $5d$ series of transition metals than that for the $3d$ series.
5. What is meant by 'disproportionation'? Give two examples of a disproportionation reaction in aqueous solution.





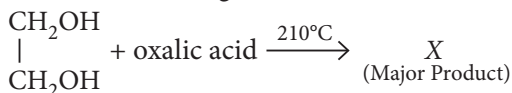
Consider the above chemical reaction, identify the product "X".

- (b) Identify the products of the given reaction.

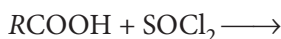


OR

- (a) What is 'X' in the given reaction?



- (b) Identify the products of the given reaction.



7. (a) Using IUPAC norms write the formulae for the following :

(i) Pentaamminenitrito-O-cobalt(III) chloride

(ii) Potassium tetracyanonickelate(II)

- (b) Why a solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green while a solution of $[\text{Ni}(\text{CN})_4]^{2-}$ is colourless? (At. no. of Ni = 28)

OR

- (a) Using IUPAC norms write the formulae for the following :

(i) *Tris*(ethane-1,2,diamine)chromium(III) chloride

(ii) Potassium tetrahydroxozincate(II)

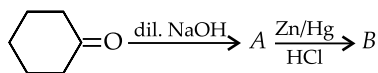
- (b) On treatment of 100 mL of 0.1 M solution of the complex $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ with excess of AgNO_3 , 4.305 g of AgCl was obtained. Identify formula of the compound.

8. What is product of the following sequence of reactions?

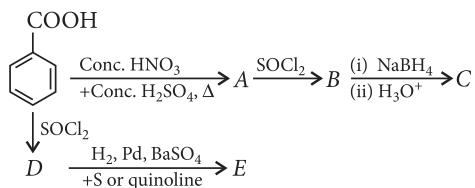


OR

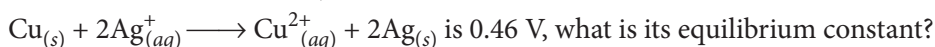
What will be the product B in the following sequence of reactions?



9. Identify A to E in the following reactions :

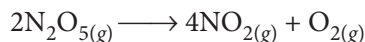


10. (a) The E° for the cell reaction,



- (b) At infinite dilution in the aqueous solution of BaCl_2 , molar conductivity of Ba^{2+} and Cl^- ions are $127.32 \text{ S cm}^2/\text{mol}$ and $76.34 \text{ S cm}^2/\text{mol}$, respectively. What is the molar conductivity for BaCl_2 at same dilution?

11. Nitrogen pentoxide decomposes according to the equation :



This first order reaction was allowed to proceed at 40°C and the data given below were collected :

$[\text{N}_2\text{O}_5] \text{ (M)}$	Time (min)
0.400	0.00
0.289	20.00
0.209	40.00
0.151	60.00
0.109	80.00

- Calculate the rate constant for the reaction. Include units with your answer.
- Calculate the initial rate of reaction.
- After how many minutes will $[\text{N}_2\text{O}_5]$ be equal to 0.350 M ?

SECTION - C

12. Read the passage given below and answer the questions that follow :

The higher the valency of the flocculating ion, the greater is its precipitating power. This is known as Hardy Schulze rule. Thus, for the precipitation of a -ve sol the flocculating power is in the order, $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$. Similarly, for precipitating a +ve sol the flocculating power in of the order, $[\text{Fe}(\text{CN})_6]^{3-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$. The minimum concentration of an electrolyte in millimoles per litre required to cause precipitation of a sol in 2 hours is called coagulating value. The smaller the quantity needed, the higher will be the coagulating power of the ion. The minimum mass of the protective colloid (lyophilic colloid) in milligrams that must be added to 10 mL of a standard red gold sol so that no coagulation occurs when 1 mL of 10% NaCl solution is rapidly added to it is called the gold number of the protective colloid.

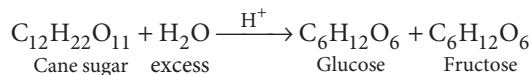
- Give one example of positively charged colloid.
- What is the correct order of flocculating power if coagulation powers are as follows?
 - $\text{NaCl} = 52$
 - $\text{KCl} = 50$
 - $\text{BaCl}_2 = 0.69$
 - $\text{MgSO}_4 = 0.72$
- What will be the charge on AgI colloidal particles when it is prepared by adding small amount of AgNO_3 solution to KI solution in water? What is responsible for the development of this charge?
- For the coagulation of 100 mL of arsenious sulphide solution, 5 mL of 1 M NaCl is required. What is the coagulating power of NaCl?

OR

The coagulation of 100 mL of a colloidal solution of gold is completely prevented by adding 0.25 g of starch to it before adding 10 mL of 10% NaCl solution. Find out the gold number of starch.



1. Bimolecular reactions become kinetically first order reactions when one of the reactants is in excess. Such reactions are called pseudo first order reactions e.g. inversion of cane sugar.

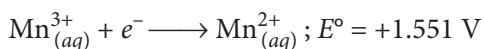
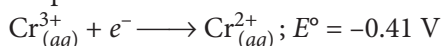


2. (a) But-3-en-2-amine

(b) *N*-Phenylethanamide

3. Primary aromatic amines cannot be prepared by Gabriel phthalimide synthesis because aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

4. (i) E° values for the $\text{Cr}^{3+}/\text{Cr}^{2+}$ and $\text{Mn}^{3+}/\text{Mn}^{2+}$ couples are



These E° values indicate that Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidising agent.

(ii) Middle of the transition series contains greater number of unpaired electrons in $(n-1)d$ and ns orbitals. Hence, exhibits the greatest number of oxidation states.

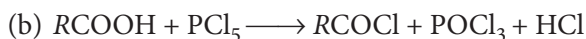
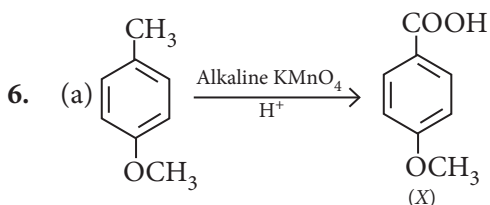
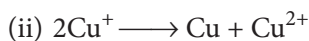
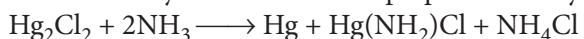
OR

(i) The transition metals and their compounds, are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states, ability to adsorb the reactant(s) and ability to form complexes. Vanadium (V) oxide (in Contact Process), finely divided iron (in Haber's Process), and nickel (in catalytic hydrogenation) are some of the examples. Catalysis involves the formation of bonds between reactant molecules and atoms at the surface of the catalyst.

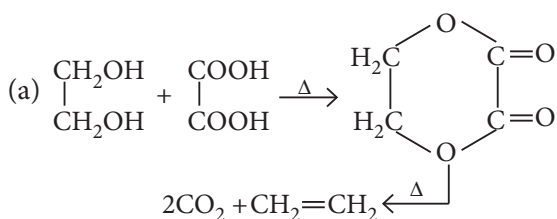
(ii) The metals of $4d$ and $5d$ -series have more frequent metal bonding in their compounds than the $3d$ -metals because $4d$ and $5d$ -orbitals are more exposed in space than the $3d$ -orbitals. So, the valence electrons are less tightly held and form metal-metal bonding more frequently.

5. Disproportionation reaction involves the oxidation and reduction of the same substance. The examples of disproportionation reaction are :

(i) Aqueous NH_3 when treated with Hg_2Cl_2 (solid) forms mercury aminochloride disproportionatively.

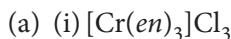


OR



(b) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is a high spin complex (Δ_o small) while $[\text{Ni}(\text{CN})_4]^{2-}$ is a low spin square planar complex. In $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ complex, $d-d$ transitions are taking place on absorbing low energy radiation (red component of spectrum) from visible region showing green as the complementary colour.

OR



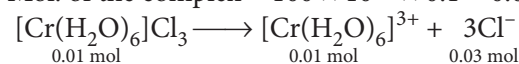
Tris(ethane-1,2-diamine)chromium(III) chloride



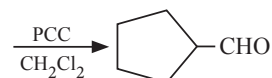
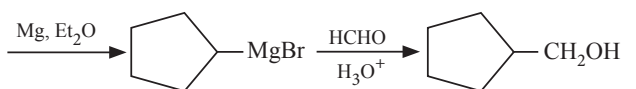
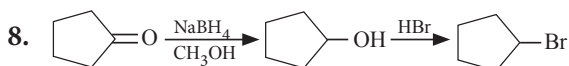
Potassium tetrahydroxozincate(II)

(b) Mol. of $\text{AgCl} = \frac{4.305}{143.5} = 0.03 = \text{mol of } \text{Cl}^- \text{ given by the complex.}$

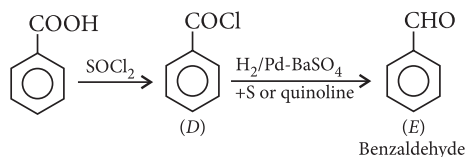
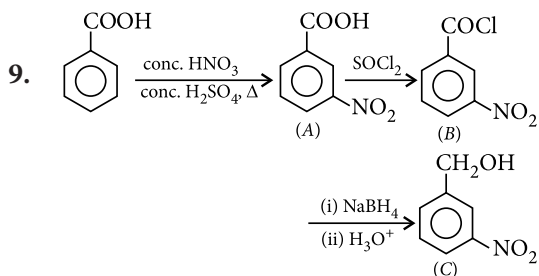
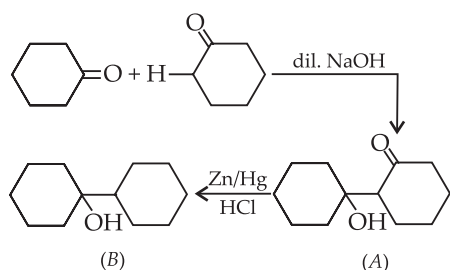
Mol. of the complex = $100 \times 10^{-3} \times 0.1 = 0.01$



Therefore the complex is $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$.



OR



10. (a) $E_{\text{cell}}^{\circ} = \frac{0.059}{2} \log K_c$ or $\log K_c = \frac{0.46 \times 2}{0.059} = 15.6$

$\therefore K_c = 4 \times 10^{15}$

(b) $\Lambda_m^{\circ} \text{BaCl}_2 = \lambda_{\text{Ba}^{2+}}^{\circ} + 2\lambda_{\text{Cl}^{-}}^{\circ}$
 $= 127.32 + 2(76.34) = 280 \text{ S cm}^2 \text{ mol}^{-1}$

11. (i) When $t = 20 \text{ min}$, $[R] = 0.289 \text{ mol L}^{-1}$
 $[R]_0 = 0.400 \text{ mol L}^{-1}$

For a first order reaction,

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\therefore k = \frac{2.303}{20} \log \frac{0.400}{0.289}$$

$$\Rightarrow k = \frac{2.303}{20} \log \frac{4.00}{2.89}$$

$$\Rightarrow k = \frac{2.303}{20} [\log 4.00 - \log 2.89]$$

$$\Rightarrow k = \frac{2.303}{20} [0.6021 - 0.4609]$$

$$\Rightarrow k = \frac{2.303}{20} \times 0.1412$$

$$\Rightarrow k = 2.303 \times 0.00706$$

$$\Rightarrow k = 1.626 \times 10^{-2} \text{ min}^{-1}$$

(ii) Initial rate, i.e., rate of reaction when $t = 0$

When $t = 0.00 \text{ min}$, $[R] = 0.400 \text{ mol L}^{-1}$

Also, $k = 1.626 \times 10^{-2} \text{ min}^{-1}$

$\therefore \text{Initial rate} = k[R]$

$$= 1.626 \times 10^{-2} \text{ min}^{-1} \times 0.400 \text{ mol L}^{-1}$$

$$= 6.504 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$$

(iii) $t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$

Here, $k = 1.626 \times 10^{-2} \text{ min}^{-1}$, $[R]_0 = 0.400 \text{ M}$,

$[R] = 0.350 \text{ M}$

Substituting these values in the equation, we get

$$t = \frac{2.303}{1.626 \times 10^{-2}} \log \frac{0.400}{0.350}$$

$$= \frac{2.303}{1.626 \times 10^{-2}} [\log 40 - \log 35]$$

$$= 141.635 [1.6021 - 1.5441] = 141.635 \times 0.0580$$

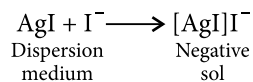
$$= 8.21 \text{ min}$$

12. (a) TiO_2 is an example of positively charged colloid.

(b) $\text{I} < \text{II} < \text{IV} < \text{III}$

$$\text{Coagulation power} \propto \frac{1}{\text{Flocculating power}}$$

(c) When AgNO_3 solution is added to aqueous KI solution, a negatively charged sol of AgI is formed. This is due to selective adsorption of I^- ions from the dispersion medium.



(d) Total volume after addition of 5 mL of 1 M NaCl solution = 105 mL

Thus, $105 \times \text{molarity of NaCl in colloidal solution} = 5 \times 1$

$$\text{Molarity of NaCl in colloidal solution} = \frac{5}{105}$$

$$\text{Concentration in millimole} = \frac{5}{105} \times 1000 = 47.6$$

OR

10 mL of 10% NaCl solution is added to 100 mL of solution of gold.

Thus, 1 mL of 10% NaCl solution has been added to 10 mL solution of gold.

Since, 100 mL gold solution required = 0.25 g starch
 $= 0.25 \times 10^3 \text{ mg starch}$

$$\text{So, 10 mL gold solution required} = \frac{0.25 \times 10^3}{100} \times 10$$

$$= 25 \text{ mg starch}$$

Thus, by definition, the gold number of starch is 25.