

## Half Yearly Test

(2019-20)

Date : _____	<b>Chemistry</b>	<b>BATCH</b>
Duration: 3 Hours	(Set-1)	<b>XII</b>
Max. Marks : 80		

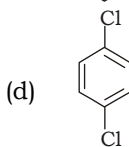
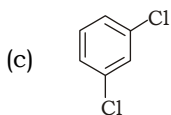
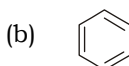
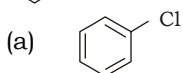
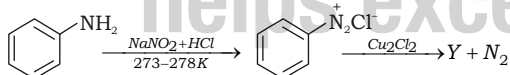
**General instruction:**

1. This question paper consists of 40 questions divided into four sections; A, B, C and D.
2. Section A contains 20 multiple choice questions carrying 1 mark each.
3. Section B contains 6 questions carrying 2 marks each.
4. Section C contains 8 questions carrying 3 marks each.
5. Section D contains 6 questions carrying 4 marks each.
6. There is no overall choice. However, an internal choice has been provided in two questions of 2 marks each, two questions of 3 marks each and two questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.
7. 15 minutes extra time will be given only for reading question paper.

### Section – A

1. 0.1 M NaCl and 0.05 M BaCl<sub>2</sub> solutions are separated by a semi-permeable membrane in a container. For this system, choose the correct answer.
  - (a) There is no movement of any solution across the membrane
  - (b) Water flows from BaCl<sub>2</sub> solution towards NaCl solution
  - (c) Water flows from NaCl solution towards BaCl<sub>2</sub> solution
  - (d) Osmotic pressure of 0.1 M NaCl is lower than the osmotic pressure of BaCl<sub>2</sub> (Assume complete dissociation)

2. Identify the compound Y in the following reaction.



3. An electrolyte
  - (a) gives ions only when dissolved in water.
  - (b) gives ions only when electric current is passed
  - (c) has ions even in the solid state
  - (d) does not give complex ions in the solution.
4. Conductivity stands for
 

(a) conductance	(b) specific conductance
(c) equivalent conductance	(d) molar conductance.
5. Ketones are the first oxidation products of
 

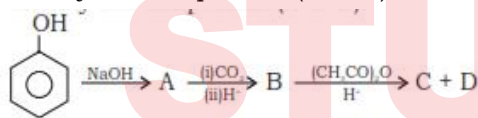
(a) Primary alcohols	(b) Secondary alcohols
(c) Tertiary alcohols	(d) None of these

**Directions for 6 to 10 : Fill in the blanks**

- Molal elevation constant is equal to elevation in boiling point when \_\_\_\_\_ of the solution is unity.
- A substance which is added to water to lower its freezing point is called \_\_\_\_\_.
- Solutions having equal \_\_\_\_\_ are called isotonic.
- If \_\_\_\_\_ molecules of a solute are present in 100 mL of its solution, the concentration would be 0.01 M.
- Scuba divers use mixture of oxygen and inert gas \_\_\_\_\_ for breathing inside water.

**Directions for 11 to 13 : State whether the following statements are true or false.**

- Secondary cells are rechargeable.
- Daniell cell is a electrolytic cell.
- The electrolysis of aqueous NaCl solution gives hydrogen at cathode and chlorine at anode.
- Which compound  $(\text{CH}_3)_3\text{CCl}$  or  $\text{CH}_3\text{Cl}$  will react faster in  $\text{S}_{\text{N}}2$  reaction with  $-\text{OH}^-$ ?
- Give IUPAC name of  $\text{CH}_3\text{OCH}_2\text{OCH}_3$ .
- How many grams of KCl should be added to 1kg of water to lower its freezing point to  $-8.00\text{ }^\circ\text{C}$ ? ( $k_{\text{f}} = 1.86\text{ K kg / mol}$ )
- Out of 1- Propanol and 2-Propanol which one is more acidic?
- Why rate of reaction does not remain constant throughout?
- Why is He used in diving apparatus?
- Why grignard reagent should be prepared under anhydrous conditions?
- Identify the compounds (A to D):



- Write the products formed when  $\text{CH}_3\text{CHO}$  reacts with the following reagents:
    - HCN
    - $\text{CH}_3\text{CHO}$  in the presence of dilute NaOH.
- OR**
- p-nitro chlorobenzene undergoes nucleophilic substitution faster than chlorobenzene. Explain.
  - Phenol does not undergo protonation readily. Explain
    - Give chemical test to distinguish between the following pairs of compounds. 2-butanol and 2-methyl-2-propanol.
  - Explain the following observations
    - In aqueous solution the  $K_{\text{b}}$  order is  $(\text{CH}_3\text{CH}_2)_2\text{NH} > (\text{CH}_3\text{CH}_2)_3\text{N} > \text{CH}_3\text{CH}_2\text{NH}_2$ .
    - Amines are more basic than comparable alcohols.

**OR**

The decomposition of hydriocarbon follows the equation  $k = (4.5 \times 10^{11}\text{ s}^{-1})e^{-28000k/T}$ . calculate activation energy.

- Which of the following isomers is more volatile? o-nitrophenol or p-nitrophenol. Explain.
  - Why are aquatic species more comfortable in cold water in comparison to warm water?
- What is expected value of van't hoff factor for  $\text{K}_3[\text{Fe}(\text{CN})_6]$  in dilute solution?
  - What is the role of  $\text{ZnCl}_2$  in a dry cell?
- Arrange the following compounds in increasing order of  $\text{S}_{\text{N}}1$  reactivity
 

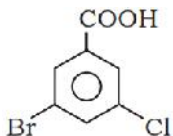
$\text{ClCH}_2\text{CH} = \text{CH} - \text{CH}_2\text{CH}_3$ ,  $\text{CH}_3 - \underset{\text{Cl}}{\text{C}} = \text{CH} - \text{CH}_2\text{CH}_3$ ,  
 $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2\text{CH}_2 - \text{Cl}$ ,  $\text{CH}_3 - \underset{\text{Cl}}{\text{CH}} = \text{CH} - \text{CH} - \text{CH}_3$
- Derive the relationship between relative lowering of vapour pressure and mole fraction of the volatile liquid.

- (ii) Calculate the osmotic pressure of a solution obtained by mixing 100 cm<sup>3</sup> of 0.25 m solution of urea and 100 cm<sup>3</sup> of 0.1 m solution of cane sugar at 293K. [R = 0.082 h atm k<sup>-1</sup> mol<sup>-1</sup>]

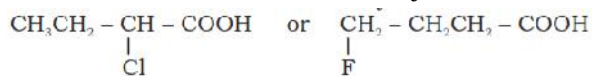
30. Convert the following only in two steps :

- (i) Chlorobenzene to p-nitrophenol. (ii) Benzene to Biphenyl.  
 (iii) Ethanol to propanenitrile

31. (a) Write the IUPAC name for :

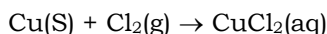


- (b) Sodium bisulphite is used for the purification of aldehydes and ketones. Explain.  
 (c) Which one is more acidic and why?



32. (a) Name a metal that can be used in cathodic protection of iron.

(b) Calculate the equilibrium constant for the following reaction at 298k:

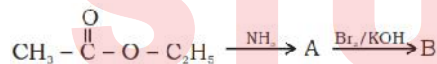


Given, R = 8.314 J K<sup>-1</sup> mol<sup>-1</sup>, E<sup>o</sup><sub>Cu<sup>2+</sup>/Cu = 0.34V,</sub>

1F = 96500 C mol<sup>-1</sup>, E<sup>o</sup><sub>1/2Cl<sub>2</sub>/Cl<sup>o</sup></sub> = 1.36 V (Antilog 0.5177 = 3.294)

33. Describe the mechanism of alcohols reacting both as nucleophiles and as electrophiles in their reaction.

34. (a) Identify A and B in the following sequence:



(b) Ammonolysis of alkyl halide does not give a corresponding amine in pure state. Explain.

OR

(a) For a zero order reaction will the molecularity be equal to zero? Explain.

(b) Show that the half-life of a first order reaction is independent of the initial concentration of the reactant.

35. (a) When 2.56 g of sulphur was dissolved in 100g of CS<sub>2</sub>, the freezing point lowered by 0.383 K. Calculate the formula of sulphur (S<sub>x</sub>).

K<sub>f</sub> for CS<sub>2</sub> = 3.83 K kg/mol

Atomic mass of sulphur = 32 g/mol

(b) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing:

- (i) 1.2% NaCl solution (ii) 0.4% NaCl solution?

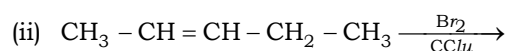
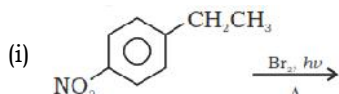
OR

(a) Why is it necessary to avoid even traces of moisture during the use of a Grignard reagent?

(b) What is the IUPAC name of DDT?

(c) Define chirality

(d) Complete the reactions: (Major product only)



36. (a) Give the chemical tests to distinguish between the following :

- (i) Benzoic acid and ethyl benzoate.  
 (ii) Benzaldehyde and acetophenone

- (b) How would you obtain the following:  
 (i) But-2-enal from ethanal  
 (ii) Butanoic acid from butanol
- (c) Draw the structure of the ethylene ketal of hexan-3-one

OR

- (a) How are the following conversions carried out?  
 (i) Ethylmagnesium chloride  $\rightarrow$  Propan-1-ol  
 (ii) Methylmagnesium bromide  $\rightarrow$  2-Methylpropan-2-ol
- (b) Explain the following observations:  
 (i) The boiling point of ethanol is higher than that of methoxymethane  
 (ii) Phenol is more acidic than ethanol.  
 (iii) o- and p- nitrophenols are more acidic than phenol
37. (a) Why is  $\text{NH}_2$  group of aniline acetylated before carrying out nitration?  
 (b) Why is aniline soluble in aqueous HCl?  
 (c) Complete the following reactions:



OR

- (i) Why does the rate of any reaction generally decrease during the course of the reaction?  
 (ii) Draw the graph of  $t_{1/2}$  with initial concentrations of the reactants for a first order reaction.  
 (iii) The decomposition of A into products has a value of K as  $4.5 \times 10^3 \text{ s}^{-1}$  at  $10^\circ\text{C}$  and energy of activation  $60 \text{ kJ/mol}$ . At what temperature would the rate constant (k) be  $1.5 \times 10^4 \text{ s}^{-1}$ ? ( $\log 3.333 = 0.5228$ ).

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## Hints/Solution to Half Yearly Test

(2019-20)

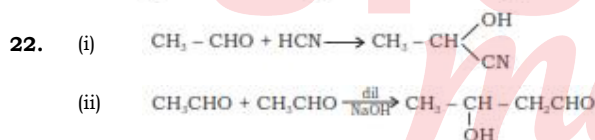
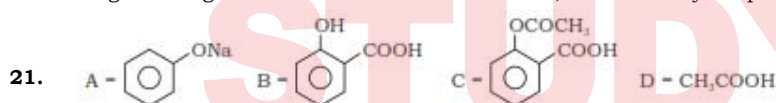
Date : _____	<b>Chemistry</b>	<b>BATCH</b>
Duration: 3 Hours	(Set-1)	<b>XII</b>
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- |                            |                            |                      |                      |
|----------------------------|----------------------------|----------------------|----------------------|
| 1. (c)                     | 2. (a)                     | 3. (a)               | 4. (b)               |
| 5. (b)                     | 6. Molality.               | 7. Antifreeze.       | 8. Osmotic pressure. |
| 9. $6.02 \times 10^{20}$ . | 10. Nitrogen               | 11. True             | 12. False            |
| 13. True                   | 14. $\text{CH}_3\text{Cl}$ | 15. Dimethoxymethane |                      |
16. Since KCl dissociate in water completely  $i = 2$

$$m = \frac{8}{2} \times 1.86 = 2.15 \text{ mol/kg.}$$

$$\text{Grams of KCl} = 2.15 \times 74.5 = 160.2 \text{ g.}$$

17. 1-Propanol
18. The reaction rate depends on concentration of the reactants
19. It is not soluble in blood even under high pressure.
20. Grignard reagent react with  $\text{H}_2\text{O}$  to form alkanes, therefore they are prepared under anhydrous condition.



23. This is because the anion formed after the attack of nucleophile is stabilised more in case of p-nitro chlorobenzene due to electron withdrawing effect of  $\text{NO}_2$  group.
24. (a) In phenol, there is the charge on oxygen in its resonating structure, therefore, it does not undergo protonation easily.
- (b) Iodeform test: 2-butanol will give yellow ppt.
25. (i) It is the combination of electron releasing nature of alkyl group, H-bonding and steric factors that determine the stability of ammonium cations formed in solution.
- (ii) Amines are more basic than alcohols due to greater stabilisation by hyperconjugation of ammonium cation. Oxygen being more electronegative has lower tendency to donate electrons than nitrogen.

**OR**

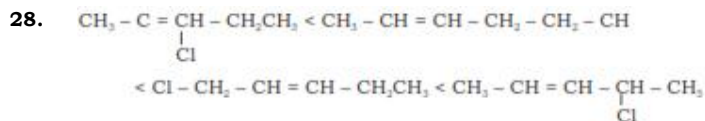
$$K = A e^{-E_a/RT}$$

$$\frac{E_a}{RT} = - \frac{28000}{T}$$

$$E_a = 28000 \text{ K} \times R$$

$$= 232.79 \text{ kJ/mol.}$$

26. (a) o-nitrophenol because of intramolecular hydrogen bonding.
- (b) The solubility of oxygen in water increasing with decrease in temperature. Presence of more  $\text{O}_2$  at lower temperature makes the aquatic species more comfortable in cold water compared to warm water which would contain less oxygen.
27. (a)  $i = 4$  as one particle dissociates to four particles  
 $\text{K}_3[\text{Fe}(\text{CN})_6] \rightleftharpoons 3\text{K}^+ + [\text{Fe}(\text{CN})_6]^{3-}$ .
- (b) It combines with  $\text{NH}_3$  gas to form a complex  $[\text{Z}(\text{NH}_3)_2\text{Cl}_2]$ .



29. (i)  $P_A \times X_A$   
 $P_A = P_A^\circ X_A$   
 $P_A = P_A^\circ (1 - X_B)$

$$\frac{P_A}{P_A^\circ} = 1 - X_B, X_B = 1 - \frac{P_A}{P_A^\circ}$$

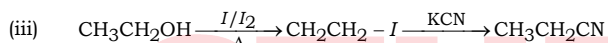
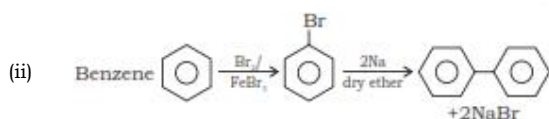
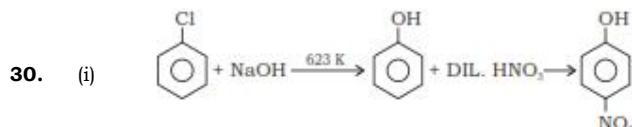
$$\therefore \frac{P_A^\circ - P_A}{P_A^\circ} = X_B$$

(ii)  $\pi V = nRT$

$$\pi \times 0.2 = \left( \frac{0.25 + 0.10}{2} \right) (0.082) \times 293$$

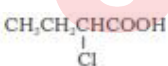
As the volume becomes double, no. of moles becomes half

$$\pi = \frac{4.20455}{0.2} = 21.022 \text{ atm.}$$



31. (i) 5-Bromo-3-chlorobenzoic acid

(ii) Aldehydes and ketones react with  $\text{NaHSO}_3$  to form an adduct. The salt obtained can be hydrolysed to get pure aldehydes and ketones back.

(iii)  due to strong -I effect of Cl, which stabilizes the anion of the acid.

32. (a) Zinc, as it is more reactive than iron

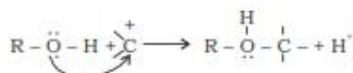
(b)  $E^\circ_{\text{Cell}} = 1.36 - 0.34 = 1.02 \text{ V}$

$$E^\circ = \frac{0.0591}{n} \log K$$

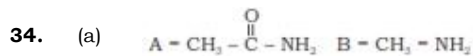
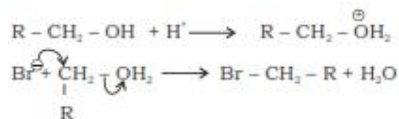
$$\log K = \frac{nE^\circ}{0.0591} = \frac{2 \times 1.02}{0.0591} = \frac{2.04}{0.0591}$$

$$K = \text{antilog } 34.5177 = 3.294 \times 10^{34}$$

33. Alcohols as nucleophiles :



Alcohols as electrophiles :



(b) This is because the amine formed reacts further with more of alkyl halide to give 2°, 3° amines and finally quaternary salt. Thus, mixture of amines is obtained.

OR

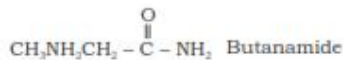
(a) No, the molecularity can never be equal to zero or a fractional number.

(b)  $K = \frac{2.303}{t} \log \frac{[A]^\circ}{[A]}, [A] = \frac{1}{2} [A]^\circ \text{ for } t = \frac{1}{2}$

$$t \frac{1}{2} = \frac{2.303}{K} \log 2 = \frac{2.303}{K} \times 0.3010$$

$$t \frac{1}{2} = \frac{0.693}{K}$$

34.  $\text{CH}_3 - \text{CO} - \text{NH}_2$ ,  $\text{CH}_3 - \text{NH}_2$ ,  $\text{CH}_2 = \text{N} = \text{C}$ ,  $\text{CH}_3\text{NHCH}_3$   
 (A) (B) (C) (D)



$$\frac{(\text{Rate})_1}{(\text{Rate})_4} = \frac{6 \times 10^{-3}}{2.4 \times 10^{-2}} = \frac{K(0.1)^\alpha (0.1)^\beta}{K(0.4)^\alpha (0.1)^\beta} = \left(\frac{1}{4}\right)^\alpha = \alpha = 1$$

$$\frac{(\text{Rate})_2}{(\text{Rate})_3} = \frac{7.2 \times 10^{-2}}{2.88 \times 10^{-1}} = \frac{K(0.3)^\alpha (0.2)^\beta}{K(0.3)^\alpha (0.4)^\beta} = \left(\frac{1}{2}\right)^\beta = \beta = 2$$

OR

$$\text{Rate} = K[\text{A}][\text{B}]^2, \quad K = \frac{6 \times 10^{-3}}{0.1 \times (0.1)^2} = 6.0 \text{ mol}^{-2} \text{ L}^2 \text{ min}^{-1}$$

35. (a) Molality of the solution =  $\frac{2.56}{32} \times \frac{1000}{100} = 0.8\text{m}$

$$\text{DTf} = i \text{KF} \times m$$

$$0.383 = i \times 3.83 \times 0.8 \quad i = \frac{1}{8}$$

Hence, 8 sulphur atoms are undergoing association  $8\text{S} \rightleftharpoons \text{S}_8$

- (b) (i) 1.2% NaCl solution is hypertonic, therefore water flows out of the cells and the cell shrink.  
 (ii) 0.4% NaCl solution is hypotonic, therefore, water flows into the cells and the cells swell.

OR

- (a) Grignard reagents react with water to give the corresponding hydrocarbons.

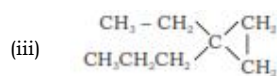
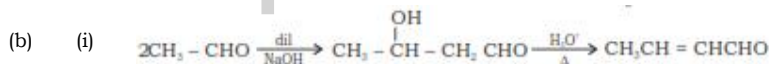


- (b) 2, 2 - bis(4 - chlorophenyl) - 1, (,) -trichloroethane

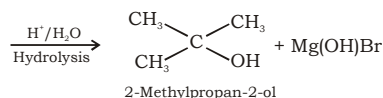
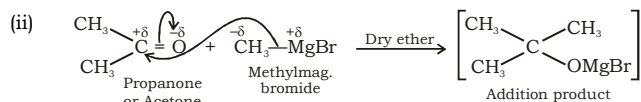
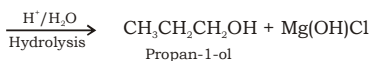
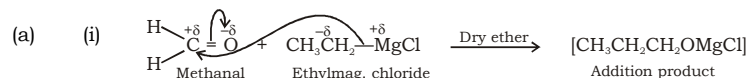
- (c) The property of non-superimposability of mirror images with each other.



36. (a) (i) Sodium bicarbonate test : Benzoic acid give brisk effervescence with  $\text{Na}_2\text{CO}_3$ . But ethylbenzoate do not give  $\text{CO}_2$   
 (ii) Iodoform test : acetophenone give yellow ppt. of  $\text{CHI}_3$ .



OR



- (b) (i) Due to hydrogen bonding in ethanol

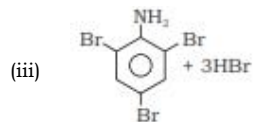
- (ii) Due to greater stabilisation of phenoxide ion phenol is more acidic than ethanol  
 (iii) Due to combined effect of -I and -R effect of the  $\text{NO}_2$  group, electron density in the O-H bond decreases.

Hence, bond become weaker.

37. (a) Due to the strong activating effect of  $\text{NH}_2$  group, aromatic amines undergo electrophilic substitution reactions and it is difficult to stop the reaction at the monosubstitution stage. To reduce the activating effect, acetylation is done due to which the lone pair of electrons get involved in resonance with  $-\overset{\text{O}}{\parallel}{\text{C}}-$  group.

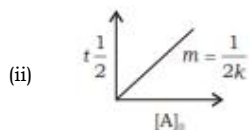
- (b) Aniline reacts with HCl to form anilinium chloride which is water soluble.

- (c) (i)  $\text{C}_6\text{H}_5\text{NO}_2 + \text{BF}_3 + \text{NaF}$  (ii)  $\text{C}_6\text{H}_5\text{NH}_2$



OR

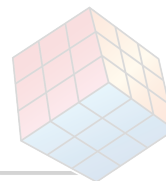
- (i) The rate of reaction depends upon concentrations of reactants. As the reaction proceeds and so the rate of reaction decreases.



- (iii) 
$$\log \frac{K_2}{K_1} = \frac{E_a}{2.303 \times R} \left[ \frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$\log \frac{1.5 \times 10^4}{4.5 \times 10^3} = \frac{60,000}{2.303 \times 8.314} \left[ \frac{1}{283} - \frac{1}{T_2} \right]$$

$$\frac{T_2 - 283}{283T_2} = \frac{0.5228}{3133.63}, T_2 = 297\text{K} = 24^\circ\text{C}$$



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