

# CLASS XI – ANNUAL EXAMINATION

## CHEMISTRY

### PAPER – 1

#### (THEORY)

(Maximum marks: 70)

(Time allowed: Three hours)

(Candidates are allowed additional 15 minutes for **only** reading the paper.  
They must NOT start writing during this time.)

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#### All questions are compulsory

Question 1 is of 20 marks having four sub parts, all of which are compulsory.  
Question numbers 2 to 8 carry 2 marks each, with **any two** questions having internal choice.  
Question numbers 9 to 15 carry 3 marks each, with **any two** questions having an internal choice.

Question numbers 16 to 18 carry 5 marks each, with an internal choice.  
All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [ ].  
Balanced equations must be given wherever possible and diagrams where they are helpful.  
When solving numerical problems, all essential working must be shown.

In working out problems, use the following data:

Gas constant  $R = 1.987 \text{ cal deg}^{-1} \text{ mol}^{-1} = 8.314 \text{ JK}^{-1} \text{ mol}^{-1} = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$

$1 \text{ l atm} = 1 \text{ dm}^3 \text{ atm} = 101.3 \text{ J}$ .  $1 \text{ Faraday} = 96500 \text{ coulombs}$ .

Avogadro's number =  $6.023 \times 10^{23}$ .

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#### Question 1

- (a) Fill in the blanks by choosing the appropriate word/words from those given in the [4×1] brackets:

(permanent, basic, less, ethene, mass, sigma, more, atomic, pi, temporary, acidic, ethane, Wurtz, Kolbe's electrolytic)

- (i) Isotopes are atoms of the same element having the same \_\_\_\_\_ number but different \_\_\_\_\_ number.
- (ii) Electromeric effect is a \_\_\_\_\_ effect and involves complete transfer of \_\_\_\_\_ electrons of a multiple bond.
- (iii) Aqueous solution of sodium acetate upon electrolysis yields \_\_\_\_\_ and this is known as \_\_\_\_\_ reaction.
- (iv) An aqueous solution of mixture of ammonium chloride and ammonium hydroxide is \_\_\_\_\_ buffer solution with pH \_\_\_\_\_ than seven.
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This Paper consists of 8 printed pages.

(b) Select the correct alternative from the choices given: [4×1]

(i) According to which of the following rule/principle, an orbital cannot have more than two electrons:

- (1) Aufbau principle.
- (2) Hund's rule of maximum multiplicity.
- (3) Pauli's exclusion principle.
- (4) Heisenberg's uncertainty principle.

(ii) Which of the following species has the highest bond order:

- (1)  $O_2^+$
- (2)  $O_2^-$
- (3)  $O_2$
- (4)  $O_2^{2-}$

(iii) Deuterium oxide is used in nuclear reactor as a:

- (1) source of neutron.
- (2) source of deuteron.
- (3) moderator.
- (4) fuel.

(iv) Which of the following compounds shows geometrical isomerism:

- (1) Propene
- (2) Ethene
- (3) But-1-ene
- (4) But-2-ene

(c) Match the following: [4×1]

- |                             |                       |
|-----------------------------|-----------------------|
| (i) Magnetic quantum number | (a) No-bond resonance |
| (ii) Silicon carbide        | (b) Gypsum            |
| (iii) Hyperconjugation      | (c) Orientation       |
| (iv) Plaster of Paris       | (d) Abrasive          |

- (d) Answer the following questions: [4×2]
- (i) (1) What are the two conditions that are necessary for the formation of hydrogen bond in compounds?
- (2) What change in energy takes place when a chemical bond is formed.
- (ii) (1) Which gas can be produced by the dehydrohalogenation of ethyl chloride?
- (2) Which alkene on reductive ozonolysis gives only propanone?
- (iii) (1) What is the entropy criteria for a process to be spontaneous?
- (2) A system transfers 20kJ of heat to the surroundings. Write the value of q (heat) for both the system and the surroundings.
- (iv) (1) Give two examples of species which are isoelectronic with  $\text{Ca}^{2+}$  ion.  
(Atomic No. of Ca = 20)
- (2) Aluminium atom loses electrons in successive steps to form  $\text{Al}^+$ ,  $\text{Al}^{2+}$  and  $\text{Al}^{3+}$  ions. Which step will have the highest ionisation potential?

**Question 2** [2]

- (a) In Carius method for estimation of iodine, 0.156g of an organic compound gives 0.235g of AgI. Calculate the percentage composition of iodine in the compound.  
(Atomic wt. of Ag = 108, I = 127)

**OR**

- (b) Draw the structures of all the isomers of tartaric acid ( $\text{C}_4\text{H}_6\text{O}_6$ ). Which amongst these isomers is optically inactive?

**Question 3** [2]

Complete and balance the following equations:



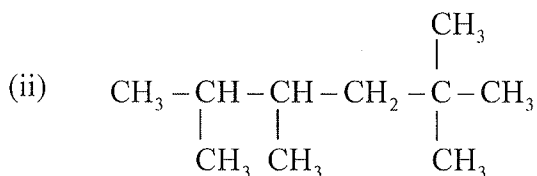
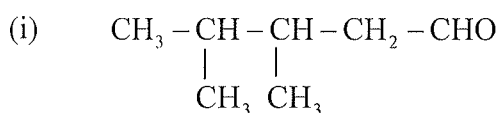
**Question 4****[2]**

When 34.2g of cane sugar ( $C_{12}H_{22}O_{11}$ ) is dissolved in water, the solution weighs 214.2g. Calculate:

- (i) Molality of cane sugar.
  - (ii) Mole fraction of cane sugar.
- (at. wt. of C = 12, H = 1, O = 16)

**Question 5****[2]**

Write the IUPAC name of the following compounds:

**Question 6****[2]**

Why is the second ionisation energy of an element much greater than its first ionisation energy?

**Question 7****[2]**

- (a) Reductive ozonolysis of an alkene 'A' gives a mixture of methanal and ethanal as products. Identify the alkene 'A' and write its IUPAC name.

**OR**

- (b) How will you convert the following (Give equations):
- (i) Ethyl magnesium bromide to ethane.
  - (ii) Calcium carbide to ethyne.

**Question 8****[2]**

What is meant by inert electron pair effect? Illustrate this effect by taking the example of Gallium ( $Z = 31$ ).

**Question 9****[3]**

- (i) A spectral line in the Balmer series of the hydrogen spectrum is associated with a wavelength of  $4862\text{\AA}$ . Find the energy level ( $n_2$ ) involved in this transition for the electron. (Rydberg's constant:  $R_H = 109677\text{ cm}^{-1}$ )
- (ii) Explain why the electronic configuration of Cu ( $Z = 29$ ) is  $[\text{Ar}] 4s^1 3d^{10}$  and not  $[\text{Ar}] 4s^2 3d^9$ .

**Question 10****[3]**

- (a) At constant temperature, 250ml of nitrogen gas at 760mm pressure and 500ml of oxygen gas at 600mm pressure are put together in one litre flask. What will be the partial pressures of the two gases and the total pressure of mixture of the above non-reacting gases in one litre flask.

**OR**

- (b) (i) 10ml of sulphur dioxide gas is diffused through a porous pot in 18 seconds. How much time will it take to diffuse 10ml of helium gas through the same porous pot at the same temperature?  
(Atomic wt. of S = 32, O = 16, He = 4)
- (ii) Ammonia ( $\text{NH}_3$ ) and HCl gases are being prepared simultaneously in two corners of a laboratory. Which amongst these two gases will be detected first by a student working in the middle of the laboratory? Give a reason why.

**Question 11****[3]**

Write balanced equations for the following:

- (i) Cold and dilute sodium hydroxide is treated with chlorine.
- (ii) Sodium thiosulphate solution is treated with iodine solution.
- (iii) Chlorine gas is passed through slaked lime.

**Question 12****[3]**

- (a) The entropy change ( $\Delta S$ ) and enthalpy change ( $\Delta H$ ) are  $+ 285 \text{ J mol}^{-1}\text{K}^{-1}$  and  $+ 177 \text{ kJ mol}^{-1}$  respectively for a chemical reaction  $\text{NH}_4\text{Cl}_{(s)} \rightarrow \text{NH}_3_{(g)} + \text{HCl}_{(g)}$  at  $25^\circ\text{C}$ . Calculate the free energy change ( $\Delta G$ ) at  $25^\circ\text{C}$ . Give a reason as to whether the reaction will be spontaneous or non-spontaneous.

**OR**

- (b) (i) Define *Hess' law of constant heat summation*.
- (ii) The heat of formation of  $\text{CO}_{2(g)}$  and  $\text{H}_2\text{O}_{(l)}$  is  $-395 \text{ kJ mol}^{-1}$  and  $-285 \text{ kJ mol}^{-1}$  respectively. The heat of combustion of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) is  $-2900 \text{ kJ mol}^{-1}$ . Calculate the heat of formation of glucose.

**Question 13****[3]**

Answer the following questions:

- (i) Define *green chemistry*.
- (ii) How are pathogenic water pollutants harmful in nature?
- (iii) What is the effect of acid rain on nitrogen fixing bacteria in the soil?

**Question 14****[3]**

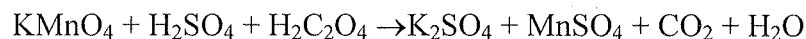
- (i) Write the name or formula of *any two* possible functional isomers represented by the molecular formula  $\text{C}_3\text{H}_6\text{O}$ .
- (ii) What do you understand by  $\text{S}_\text{N}^1$  and  $\text{S}_\text{N}^2$  reactions? Give one suitable example each for the two reactions.

**Question 15****[3]**

- (a) Which homonuclear molecules of the second period (Li to Ne) should have zero bond order?
- (b) Explain why the bond angles in  $\text{CH}_4$  ( $109.5^\circ$ ),  $\text{NH}_3$  ( $107^\circ$ ) and  $\text{H}_2\text{O}$  ( $104.5^\circ$ ) are different although they have the same type of hybridisation, i.e.  $\text{sp}^3$ .

**Question 16****[5]**

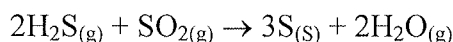
- (a) (i) Balance the following equation by oxidation number method:



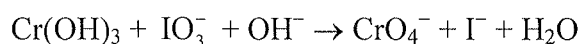
- (ii) Calculate the oxidation number of the underlined elements in the following ions:



- (iii) Determine the change in oxidation number of S in  $\text{H}_2\text{S}$  and  $\text{SO}_2$  in the following reaction:

**OR**

- (b) (i) Balance the following equation by ion electron method:



- (ii) Why is,  $\text{NaCl}_{(\text{aq})} + \text{AgNO}_3_{(\text{aq})} \rightarrow \text{AgCl}_{(\text{s})} + \text{NaNO}_3_{(\text{aq})}$  not a redox reaction?  
(iii) Name the type of reaction that occurs at anode in an electrochemical cell. Give an example.

**Question 17****[5]**

- (a) (i) Explain why:

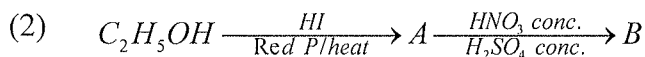
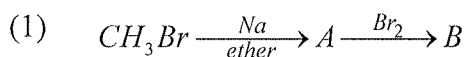
- (1) Benzene is highly unsaturated but does not undergo addition reaction.  
(2) Iodination of methane occurs in presence of iodic acid.

- (ii) How will you convert the following? (Give the equations.)

- (1) Propene to propan-2-ol.  
(2) 1, 1, 2, 2-tetrabromo ethane to ethyne.  
(3) Benzene to acetophenone.

**OR**

- (b) (i) Identify the compounds A and B in the following equations:

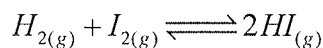


- (ii) State an appropriate chemical test that is used to distinguish between the following pairs of compounds:

- (1) Propane and Propene.  
(2) Ethane and Ethyne.

**Question 18****[5]**

- (a) (i) For the following reaction:



the amount of  $H_2$ ,  $I_2$  and  $HI$  are 0.2g, 9.525g and 44.8g respectively at equilibrium at  $25^\circ C$ . Calculate the equilibrium constant ( $K_c$ ) of the reaction.

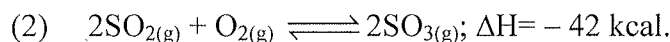
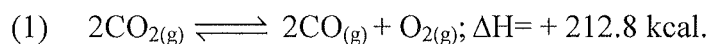
(Atomic wt.  $H=1$ ,  $I = 127$ )

- (ii) Explain why:

- (1) In qualitative inorganic analysis, the cations of group II are precipitated in acidic medium while those of group IV in alkaline medium when  $H_2S$  gas is passed.
- (2) The aqueous solution of  $NH_4Cl$  is acidic whereas aqueous solution of  $Na_2CO_3$  is alkaline.

**OR**

- (b) (i) On increasing the temperature, in which direction is the equilibrium expected to shift for the following reactions:



- (ii) The solubility of  $PbI_2$  is  $0.7g L^{-1}$  at  $25^\circ C$ . Calculate the solubility product of  $PbI_2$  at the same temperature.

(Atomic wt. of  $Pb = 207$ ,  $I = 127$ )