OSDAV Public School, Kaithal

December Exams (2024-25)

Class : XI

Subject : CHEMISTRY

SET- A

Time: 3 Hrs . **M.M. : 70**

General Instructions:-

All questions are compulsory.

(a) There are 33 questions in this question paper.

(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.

(c) SECTION B consists of 5 short answer questions carrying 2 marks each.

(d) SECTION C consists of 7 short answer questions carrying 3 marks each.

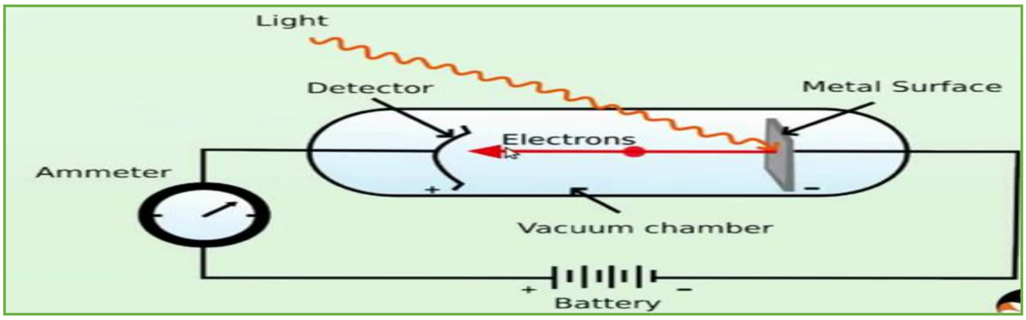
(e) SECTION D consists of 2 case - based questions carrying 4 marks.

(f) SECTION E consists of 3 long answer questions carrying 5 marks.

(g) Use of log tables and calculators is not allowed.

Q.No.	Questions	Marks
	SECTION -A **The following questions are multiple choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section**	
1	How many molecules are present in 2.8L of a diatomic gas at STP? a. 6.02×10^{23} b. 7.5×10^{22} c. 15×10^{22} d. 1.25×10^{22}	**1**
2	The series of lines appearing in UV region of electromagnetic spectrum of Hydrogen is called: a. Bracket series b. Pfund Series c. Lyman series d. Paschen series	**1**
3	The ionisation energy of nitrogen is more than oxygen because of: a. More attraction of electrons by nucleus. b. The extra stability of half filled p orbitals c. The ionic radius of nitrogen atom is smaller d. All of the above are correct.	**1**
4	Which of the following has bond angle of 120^0? a. PH_3 b. ClF_3 c. NCl_3 d. BCl_3	**1**
5	Identify the intensive property: a. Density b. Volume c. Mass d. Heat capacity	**1**
6	Acetone(CH_3COCH_3) and Propanal (CH_3CH_2CHO) are: a. Functional isomers b. Position isomers c. Geometrical isomers d. Optical isomers	**1**
7	In the reaction $2Na + S \longrightarrow 2Na_2S$ sulphur: a. Oxidised b. reduced c. Reducing agent d.None of these	**1**
8	Choose the correct statement: a. A reaction with negative entropy change may be spontaneous b. Lattice energy can be directly determined by experiment c. Gibbs energy change is negative for a non spontaneous process. d. Decrease in enthalpy is the only criterion for spontaneity.	**1**
9	The IUPAC name of the following compound $HOCH_2(CH_2)_3CH_2COCH_3$: a. 7 – Hydroxyheptan-2-ol b. 7-Hydroxyheptan-2-one c. 2 -Oxoheptan-7-ol d. Heptan-2-oxo-7-ol	**1**
10	Which of the following atoms has the highest first ionisation energy? a. Rb b.Na c. K d. Li	**1**

11	What is the technological applications of fractional distillation: a. To separate different fractions of crude oil in petroleum industry b. To separate different fractions of volatile and non volatile solvents. c. To separate mixture of amino acids d. No technological application of fractional distillation.	**1**
12	The process of elimination of carbon dioxide from carboxylic acid is termed as: a. Carboxylation b. decarboxylation c. Hydrogenation d. None of these.	**1**
13	**In the following questions (Q.13-16) a statement of assertion followed by a statement of reason is given. Choose the correct out of following:** **a. Both A and R are true and R is the correct explanation of A** **b. Both A and R are true but R is not the correct explanation of A** **c. A is true but R is false** **d. A is false but R is true** Assertion: The peroxide effect is not observed in addition reaction of HI to an asymmetrical alkene Reason: The H-I bond is weaker and iodine free radicals combine to form iodine molecules.	**1**
14	Assertion: Water in liquid state is more stable than ice at room temperature Reason: Water in liquid form has higher entropy than ice.	**1**
15	Assertion: Noble gases have highest ionisation energies in their respective periods Reason: Noble gases have stable electronic configuration	**1**
16	Assertion: pent-1-ene and pent-2-ene are position isomers Reason: Position isomers differ in the position of functional group or a substituent.	**1**
17	**SECTION B** **This section contains 5 questions. The following questions are very short answer type and carry 2 marks each.** The velocity of a proton accelerated by a potential difference of 500KV is 2.11×10^5 m/s. If a ball of mass 100g is moving with this velocity. Calculate the wavelength associated with this velocity.	**2**
18	a. The radius of Na^+ cation is less than that of Na atom. b. Why the electron gain enthalpy of fluorine is less negative than that of chlorine?	**1** **1**
19	A 5 litre cylinder contained 10 moles of oxygen gas at 27^0C. Due to sudden leakage through the hole, all the gas escaped into the atmosphere and cylinder got empty. If the atmospheric pressure is 1.0 atm. Calculate the work done by the gas (1 L atm= 101.3J)	**2**
20	Balance the redox reaction by ion electron method: Fe^{+2} (aq) + $Cr_2O_7^{-2}$ ⟶ Fe^{+3} + Cr^{+3} (Acidic Medium)	**2**
21	State First law of thermodynamics and derive its mathematical expression .	**2**
22	**SECTION C** **This section contains 7 questions. The following questions are short answer type and carry 3 marks each.** a. Calculate the molality of sulphuric acid solution in which mole fraction of water is 0.85 b. How are 0.50 mol NaOH and 0.50M NaOH different?	2 1
23	Account for the following: a. Second Ionization enthalpy of sodium is more than that of second ionization enthalpy of Magnesium. b. Define Modern periodic law. c. Why Ne has maximum Ionisation energy	**1** **1** **1**
24	a. Draw the structure of isomer of pentane with the lowest boiling point among its isomers b. How many sigma and Pi bonds are there in Buta-1,3- diene	**1** **1**

	c. Explain about inductive effect by giving example.	**1**
25	a. Calculate the mass of iron which will be converted into its oxide (Fe_3O_4) by the action of 18g of steam on it. b. Define atomic mass unit	**2** **1**
26	a. An alkene on ozonolysis gives a mixture of Propanal and pentan-3 one. Write the structure and IUPAC name of A b. Arrange hexane, benzene and ethyne in the decreasing order of acidic behaviour.	**2** **1**
27	a. Why axial bonds of PCl5 are longer than equatorial bonds? b. On the basis of VBT explain why HSH bond angle in H_2S is closer to 90^0 than HOH bond angle in H_2O c. List two main conditions for forming hydrogen bonds.	1 1 1
28	Calculate the enthalpy of combustion of ethylene (gas) to form CO_2 (gas) and H_2O(gas) at 298 K and 1 atm pressure. The enthalpies of formation of CO_2, H_2O and C_2H_4 are -393.7 , -241.8 and +52.3 KJ/mol respectively	3
29	**SECTION-D** **The following questions are case based questions. Each question carries 4 marks each. Read the passage carefully and answer the questions that follow.** Alkenes contains a carbon carbon double bond. These are usually prepared by dehydration of alcohols or by dehydrohalogenation of alkyl halide with alc. KOH. These can also be formed by birch reduction of alkynes or by using Lindlar's catalyst. The dehydration of alcohols can occur by the formation of carbocations whereas the dehydrohalogenation can occur by concerted mechanism.. In case the initially formed carbocation is less stable, it first undergoes rearrangement by 1,2 hydride shift.The most characteristic reaction of alkenes is electrophilic addition reactions where an electrophile adds to form stable carbocation which is subsequently attacked by a nucleophile to complete the addition reaction. In case of unsymmetrical alkene MR rule is followed. ***Answer the following questions:*** a. Give the product of dehydration of 1 butanol with conc.H_2SO_4 b. Write the reactions involved in Birch Reduction c. Write the product of the following reaction: CH_3-CH_2-CH_2-CH_2-Cl $\xrightarrow{\text{Alc. KOH}}$ d. Define Markovnikov rule.	1 1 1 1
30	 ***Answer the following questions:*** a. State the phenomena depicted above? b. If a photon of wavelength 150pm strikes an atom and one of its inner bound electron is ejected out with a velocity of 1.5 x 10^7 m/s, Calculate the energy with which it is bound to nucleus. c. When we heat the iron bar, it first become red, then yellow and finally begins to glow with white light then blue light. Why?	1 2 1

	SECTION-E **The following questions are long answer type and carry 5 marks each.**	
31	a. Draw the MOT diagram of N_2, write its magnetic nature and also find the bond order. **b.** According to VSEPR theory predict the shape and geometry of following molecules: SF_4, PH_3	**3** **2**
32	a. Draw the resonating structure of C_6H_5Cl b. In sulphur estimation by carius method, 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound? c. Define the term homolytic fission with example.	**1** **2** **2**
33	a. Write the mechanism of Chorination of benzene b. Bring out the following conversions: 1. Hexane to Benzene 2. Benzene to acetophenone	**3** **1** **1**

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SET- B

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2	The series of lines appearing in Visible region of electromagnetic spectrum of Hydrogen is called: a. Bracket series b. Pfund Series c. Lyman series d. Balmer series	1
3	Acetone(CH_3COCH_3) and Propanal (CH_3CH_2CHO) are: a. Functional isomers b. Position isomers c. Geometrical isomers d. Optical isomers	1
4	Which of the following has bond angle of $109^0 28'$? a. NH_3 b. CH_4 c. H_2O d. CO_2	1
5	Identify the work function: a. Heat b. Internal energy c. Pressure d. Entropy	1
6	The ionisation energy of nitrogen is more than oxygen because of: a. More attraction of electrons by nucleus. b. The extra stability of half filled p orbitals c. The ionic radius of nitrogen atom is smaller d. All of the above are correct.	1
7	In the reaction $2Na + S \longrightarrow 2Na_2S$ sulphur: a. Oxidised b. reduced c. Reducing agent d.None of these	1
8	Choose the correct statement: a. A reaction with negative entropy change may be spontaneous b. Lattice energy can be directly determined by experiment c. Gibbs energy change is negative for a non spontaneous process. d. Decrease in enthalpy is the only criterion for spontaneity.	1
9	The IUPAC name of the following compound $HOCH_2(CH_2)_3CH_2COCH_3$: a. 7 – Hydroxyheptan-2-ol b. 7-Hydroxyheptan-2-one	1

	c. 2 -Oxoheptan-7-ol d. Heptan-2-oxo-7-ol	
10	Which of the following element is most electronegative a. N b.Na c. O d. F	**1**
11	What is the technological applications of fractional distillation: a. To separate different fractions of crude oil in petroleum industry b. To separate different fractions of volatile and non volatile solvents. c. To separate mixture of amino acids d. No technological application of fractional distillation.	**1**
12	The process of elimination of carbon dioxide from carboxylic acid is termed as: a. Carboxylation b. decarboxylation c. Hydrogenation d. None of these.	**1**
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16	Assertion: Water in liquid state is more stable than ice at room temperature Reason: Water in liquid form has higher entropy than ice.	**1**
	SECTION B **This section contains 5 questions. The following questions are very short answer type and carry 2 marks each.**	
17	A swimmer coming out from the pool is covered with a film of water weighing about 18g. How much heat must be supplied to evaporate this water at 298K ? Calculate the internal energy of vaporisation at 100^0C. ΔH_{vap} for water at 373K = 40.66 KJ/mol	**2**
18	a. The radius of Cl^- anion is more than that of Cl atom. b. Would you expect the first ionisation energy of two isotopes of the same element to be same or different? Justify your answer	**1** **1**
19	The velocity of a proton accelerated by a potential difference of 500KV is 2.11 x 10^5 m/s. If a ball of mass 100g is moving with this velocity. Calculate the wavelength associated with this velocity.	**2**
20	Balance the redox reaction by ion electron method: Fe^{+2} (aq) + $Cr_2O_7^{-2}$ ⟶ Fe^{+3} + Cr^{+3} (Acidic Medium)	**2**
21	a. State Second law of thermodynamics b. For a reaction 2Cl (g)⟶ Cl_2 (g) , what are the signs of ΔH and ΔS	**1** **1**
	SECTION C **This section contains 7 questions. The following questions are short answer type and carry 3 marks each.**	2

22	a. The density of 3M solution of NaCl is 1.25g/ml. Calculate the molality of the solution. b. How are 0.50 mol NaOH and 0.50M NaOH different?	1
23	Calculate the enthalpy of combustion of ethylene (gas) to form CO_2 (gas) and H_2O(gas) at 298 K and 1 atm pressure. The enthalpies of formation of CO_2, H_2O and C_2H_4 are -393.7 , -241.8 and +52.3 KJ/mol respectively	**3**
24	a. Why axial bonds of PCl_5 are longer than equatorial bonds? b. On the basis of VBT explain why HSH bond angle in H_2S is closer to 90^0 than HOH bond angle in H_2O c. List two main conditions for linear combination of atomic orbitals to form molecular orbitals.	**1** **1** **1**
25	a. Calculate the mass of iron which will be converted into its oxide (Fe_3O_4) by the action of 18g of steam on it. b. Define Law of multiple proportions.	**2** **1**
26	a. An alkene on ozonolysis gives a mixture of Propanal and pentan-3 one. Write the structure and IUPAC name of A b. Arrange hexane, benzene and ethyne in the decreasing order of acidic behaviour.	**2** **1**
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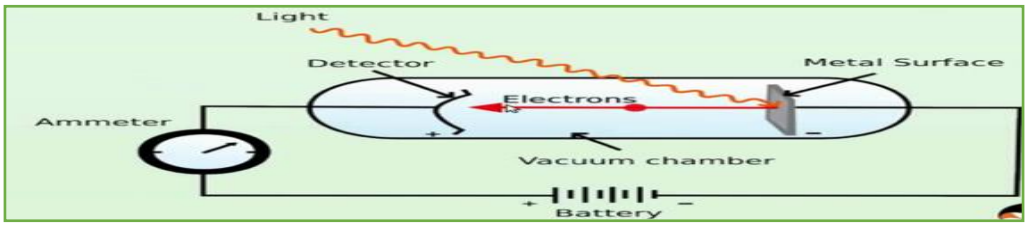
28	Account for the following: a. Second Ionization enthalpy of sodium is more than that of second ionization enthalpy of Magnesium. b. Define Modern periodic law. c. Why Ne has maximum Ionisation energy	 1 1 1
29	**SECTION-D** **The following questions are case based questions. Each question carries 4 marks each. Read the passage carefully and answer the questions that follow.** Alkenes contains a carbon carbon double bond. These are usually prepared by dehydration of alcohols or by dehydrohalogenation of alkyl halide with alc. KOH. These can also be formed by birch reduction of alkynes or by using Lindlar's catalyst. The dehydration of alcohols can occur by the formation of carbocations whereas the dehydrohalogenation can occur by concerted mechanism.. In case the initially formed carbocation is less stable, it first undergoes rearrangement by 1,2 hydride shift.The most characteristic reaction of alkenes is electrophilic addition reactions where an electrophile adds to form stable carbocation which is subsequently attacked by a nucleophile to complete the addition reaction. In case of unsymmetrical alkene MR rule is followed. ***Answer the following questions:*** a. Give the product of dehydration of Ethanol with conc.H_2SO_4 b. Write the reactions involved in Birch Reduction c. Write the product of the following reaction: CH_3-CH_2-CH_2-CH_2-Cl $\xrightarrow{\text{Alc. KOH}}$ **d.** Define Anti Markovnikov rule.	 1 1 1 1

30	 ***Answer the following questions:*** a. State the phenomena depicted above? b. If a photon of wavelength 150pm strikes an atom and one of its inner bound electron is ejected out with a velocity of 1.5×10^7 m/s, Calculate the energy with which it is bound to nucleus. c. When we heat the iron bar, it first become red, then yellow and finally begins to glow with white light then blue light. Why?	 1 2 1
31	**SECTION-E** **The following questions are long answer type and carry 5 marks each.** a. Draw the MOT diagram of O_2, write its magnetic nature and also find the bond order. **b.** According to VSEPR theory predict the shape and geometry of following molecules: SF_6, CH_4	 **3** **2**
32	a. Draw the resonating structure of C_6H_5OH b. In sulphur estimation by carius method, 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound? c. Define the term heterolytic fission with example.	**1** **2** **2**
33	a. Write the mechanism of Friedel craft alkylation of benzene b. Bring out the following conversions: 1. Hexane to Benzene 2. Benzene to p-nitrochlorobenzene	**3** **1** **1**

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Class : XI
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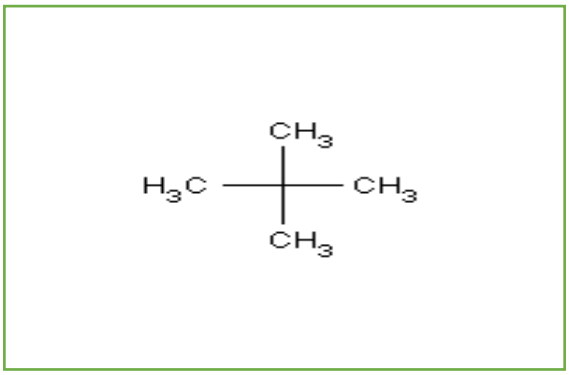
SET- A

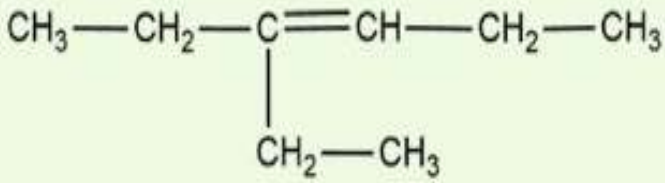
Marking Scheme

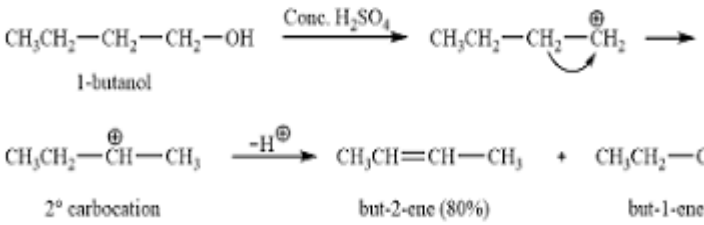
.No.	Questions	Marks
	SECTION -A	
1	b. 7.5×10^{22}	**1**
2	c. Lyman series	**1**
3	a. The extra stability of half filled p orbitals	**1**
4	d. BCl_3	**1**
5	a. Density	**1**
6	a. Functional isomers	**1**
7	b. reduced	**1**
8	a. A reaction with negative entropy change may be spontaneous	**1**
9	a. 7-Hydroxyheptan-2-one	**1**
10	d. Li	**1**
11	a. To separate different fractions of crude oil in petroleum industry	**1**
12	b. decarboxylation	**1**
13	a. Both A and R are true and R is the correct explanation of A	**1**
14	a. Both A and R are true and R is the correct explanation of A	**1**
15	a.Both A and R are true and R is the correct explanation of A	**1**
16	a.Both A and R are true and R is the correct explanation of A	**1**
	SECTION B	
17	Calculating the momentum 'p' of the ball, we get: $\rightarrow p = (0.1\,\text{kg}) \times (2.11 \times 10^5\,\text{m/s})$ $\rightarrow p = \mathbf{2.11 \times 10^4\,kg \cdot m/s}$ Now, we can calculate the de Broglie wavelength 'λ' using the formula. Hence we get: $\rightarrow \lambda = \frac{h}{p}$ $\rightarrow \lambda = \frac{6.626 \times 10^{-34}\,\text{m}^2\,\text{kg/s}}{2.11 \times 10^4\,\text{kg} \cdot \text{m/s}}$ $\rightarrow \lambda = 3.140 \times 10^{(-34-4)}\,\text{m} = \mathbf{3.140 \times 10^{-38}\,m}$ **Therefore, the wavelength associated with the velocity of the ball is 3.14×10^{-38}m.**	**2**
18	a. When an atom loses an electron to form cation, its radius decreases. In a cation , per electron nuclear forces increases due to decrease in number of electrons. As a result of this , effective nuclear charge increases and the radius of cation decreases.	**1**

	b. It is because fluorine has smaller size than chlorine and there occurs high inter electronic repulsion in case of fluorine so in order to add electron we have to supply energy and thus electron gain energy becomes less negative than fluorine.	**1**
19	- When the gas escapes, it expands to fill the atmosphere. We can calculate the final volume using the ideal gas law: $PV = nRT$ - Rearranging gives: $V_f = \frac{nRT}{P}$ - Substituting the values: - $n = 10\,\text{moles}$ - $R = 0.0821\,\text{L atm K}^{-1}\text{mol}^{-1}$ - $T = 300\,\text{K}$ - $P = 1.0\,\text{atm}$ - Thus: $V_f = \frac{10 \times 0.0821 \times 300}{1.0} = 246.3\,\text{L}$ 3. **Calculate the Change in Volume ΔV:** - The change in volume is given by: $\Delta V = V_f - V_i$ - Substituting the values: $\Delta V = 246.3\,\text{L} - 5\,\text{L} = 241.3\,\text{L}$ 4. **Calculate the Work Done W:** - Now we can calculate the work done by the gas: $W = -P\Delta V$ - Substituting the values: $W = -1.0\,\text{atm} \times 241.3\,\text{L} = -241.3\,\text{L atm}$ 5. **Convert Work Done to Joules:** - To convert L atm to Joules, we use the conversion factor $1\,\text{L atm} = 101.3\,\text{J}$: $W = -241.3\,\text{L atm} \times 101.3\,\text{J/L atm} = -24437.69\,\text{J}$	**2**
		2

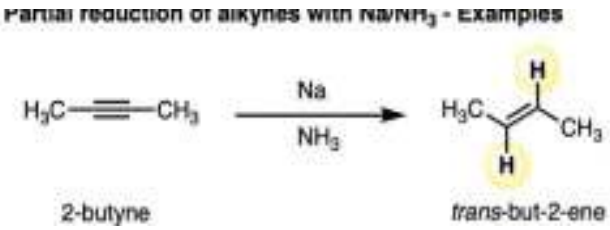
20	$Fe^{2+} + Cr_2O_7^{2-} + H^+ \longrightarrow Fe^{3+} + Cr^{3+} + H_2O$ (1) Oxidation: $Fe^{2+} \longrightarrow Fe^{3+}$ Reduction: $\overset{+6}{Cr_2O_7^{2-}} \longrightarrow \overset{+3}{Cr^{3+}}$ (2) Balancing the atoms $Fe^{2+} \longrightarrow Fe^{3+}$ $Cr_2O_7^{2-} + 14H^+ \longrightarrow 2Cr^{3+} + 7H_2O$ (3) Balance the charge $Fe^{2+} \longrightarrow Fe^{3+} + e^- \longrightarrow (1)$ $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O \longrightarrow (2)$ (4) Equation (1) ×6+ Equation (2) ×1 Balancing electrons $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 6e^- + 7H_2O$ (5) Simplifying; $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$	
21	According to first law of thermodynamics energy can neither be created nor be destroyed it can be changed from one form to another. Expression: Suppose a system has internal energy U_1, Let heat q is added to the system then the internal energy becomes $U_1 + q$ Now the work w is done on the system and the expression becomes: $U_2 = U_1 + q + w$ **Therefore: $\Delta U = q + w$**	**2**
22	**SECTION C** Mole fraction of water in solution = 0.85 mole fraction H_2SO_4 in solution $= 1 - 0.85 = 0.15$. If n_1 is the number of moles of water and n_2 is the number of moles H_2SO_4 in the solution, then Mole fraction of $H_2SO_4 = \frac{n_2}{n_1 + n_2} = 0.15$ Molality of H_2SO_4 solution means the number of moles of H_2SO_4 present in 1000 of H_2O. Thus, we have, $w_1 = 1000$ g or $n_1 = \frac{1000}{18} = 55.55$, $n_2 = 1$ $\frac{n_2}{55.55 + n_2} = 0.15$ $n_2 = 0.15n_2 + 8.3325$ or $n_2 = 9.8$ $\therefore$ Molality = 9.8m.	2 1

	b. 0.5 mol of NaOH means 20g of NaOH and 0.5 M NaOH means 0.5 moles of NaOH dissolved in 1L solution (or 20g of NaOH in 1000 ml solution)	
23	a. Because after the loss of 1 electron sodium attains stable noble core electronic configuration so removal of second electron becomes difficult that is why second ionisation energy of sodium is higher than magnesium. b. According to this law the physical and chemical properties of the element are the periodic function of their atomic numbers. c. Ne has maximum ionisation energy because of stable full filled electronic configuration.	**1** **1** **1**
24	a.  Neo pentane has lowest b.pt b. Sigma bonds = 9 , Pi bonds = 2 c. The inductive effect is an electronic effect in organic molecules that occurs when the distribution of electrons shifts along a chain of atoms. This shift is caused by the presence of an atom or group that is more electronegative, or has a greater tendency to withdraw electrons. The inductive effect results in a permanent dipole in the bond and polarizes the molecule.	**1** **1** **1**
25	a. The balanced equation is $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$ Moles of steam = $\frac{\text{mass}}{\text{Molar mass}}$ $\frac{18}{18} = 1$ mole Moles of Fe = $\frac{3}{4} \times$ moles of H_2O $= \frac{3}{4} \times 1.0 = 0.75$ Mass of Fe = mole × molar mass $0.75 \times 56 = 42$ $= 42$ g	**2** **1**

	b. An atomic mass unit is defined as accurately 1/12 the mass of a carbon-12 atom	
26	a. The ozonolysis of 4-Ethylhex-3-ene gives propanal and pentan-3-one. The structural formula of the alkene is as shown.  b. Ethyne > Benzene > Hexane	**2** **1**
27	a. In order to minimise the repulsion the axial bonds are longer than the equatorial bonds b. Bond angle of H2O is larger because oxygen is more electronegative than sulphur therefore bond pair electron of O–H bond will be closer to oxygen and there will be more bond-pair bond-pair repulsion between bond pairs of two O–H bonds. c. - **Condition 1**: The atom bonded to hydrogen must be highly electronegative (e.g.,F,O,N). - **Condition 2**: The electronegative atom must be of small size to ensure strong attraction and bond polarity.	1 1 1
28	We are given : (i) $C(s) + O_2(g) \rightarrow CO_2(g)$, $\Delta H^\circ_1 = -393.5$ kJ mol^{-1} (ii) $H_2(s) + 1/2\ O_2(g) \rightarrow H_2O(g)$ $\Delta H^\circ_2 = -241.8$ kJ mol^{-1} (iii) $2C(s) + 2H_2(g) \rightarrow C_2H_4(g)$, $\Delta H^\circ_3 = +52.3$ kJ mol^{-1} We aim at : $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$ $\Delta H = -\Delta H_3 + 2\Delta H_1 + 2\Delta H_2$ $= -1322.9$ kJ mol^{-1}	3
	SECTION-D	
29	***Answer the following questions:***	



a.



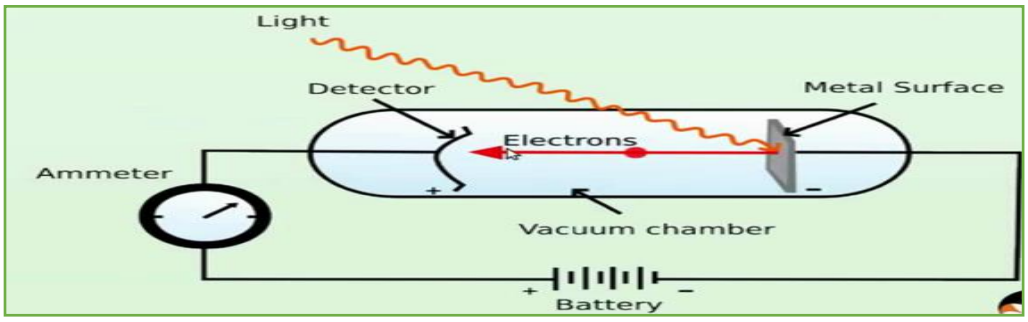
1
1
1
1

b.

c. $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}Cl \xrightarrow{\text{Alc. KOH}} CH_3\text{-}CH_2\text{-}CH{=}CH_2$

d. According to Markovnikov's Rule, when hydrogen halide or protic acid (HX) is added to an asymmetric alkene, the acid hydrogen gets attached to the carbon with more hydrogen substituents and the halide group gets attached to the carbon with a greater number of alkyl substituents

30



a. Photoelectric effect

1

The energy of the photon,

2

$$E = \frac{hc}{\lambda}$$

1

$$= \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{150 \times 10^{-12}}$$

$= 1.325 \times 10^{-15}$J.

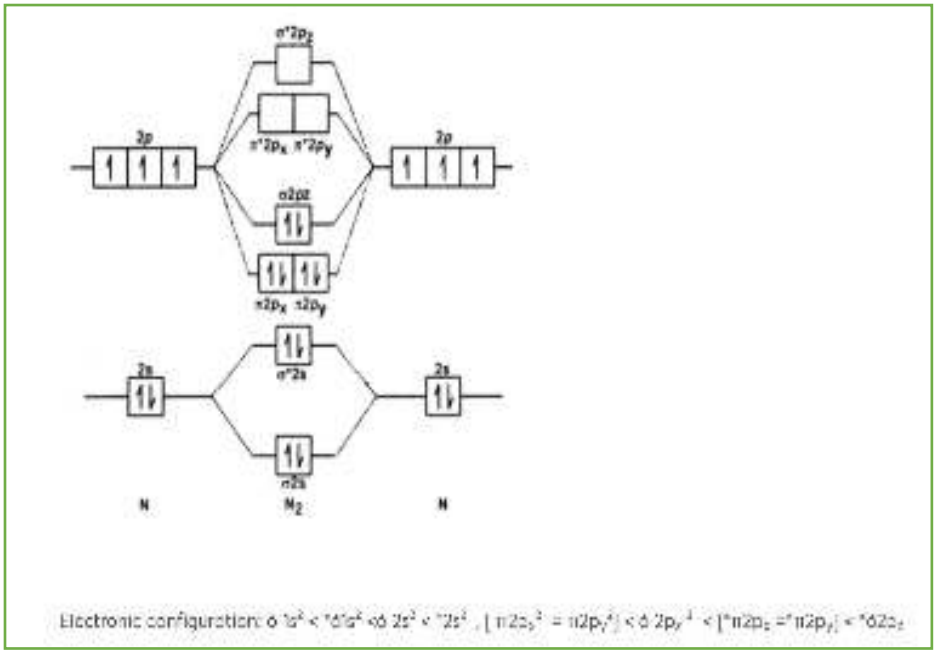
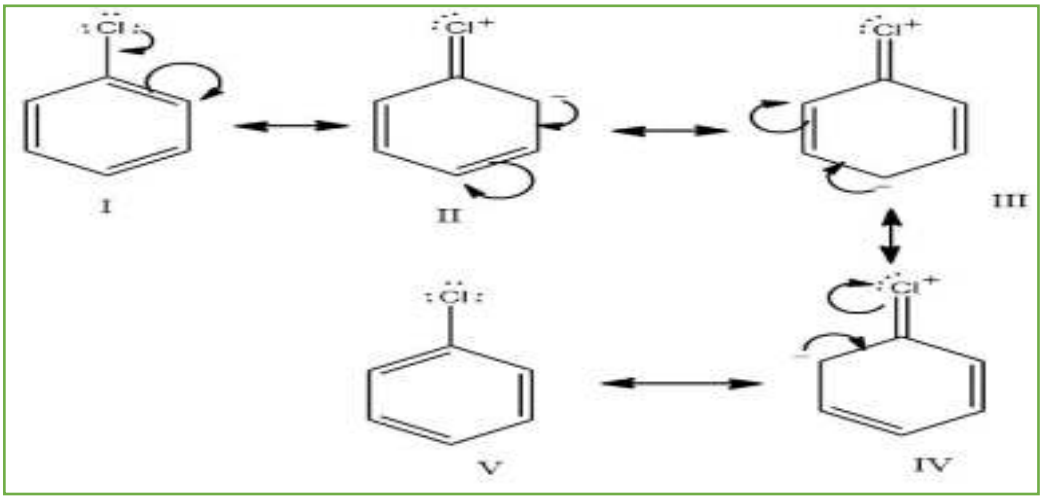
The energy of the ejected electron is

$$\frac{1}{2}mv^2 = \frac{1}{2} \times 9.11 \times 10^{-31} \times (1.5 \times 10^{7})^2 = 1.025 \times 10^{-16}.$$

The energy with which the electron was bound to the nucleus is:

Energy of photon − Energy ejected by electron

$= 13.25 \times 10^{-16} - 1.025 \times 10^{-16} = 12.225 \times 10^{-16}$J

	b. The change in colour is due to increase in the frequency of radiation emitted on heating as red colour lies in the lower frequency region while blue colour lies in the high frequency region	
	SECTION-E **The following questions are long answer type and carry 5 marks each.**	
31	a.  Bond order = 10-4/2 = 3 **b.** Shape of SF_4 = See saw and Shape of PH_3 = Pyramidal	**3** **2**
32	a. 	**1** **2** **2**

Mass of organic compound = 0.157g

Mass of $BaSO_4$ = 0.4813g

$$\text{Percentage of Sulphur} = \frac{32}{233} \times \frac{\text{Mass of } BaSO_4}{\text{Mass of organic compound}} \times 100$$

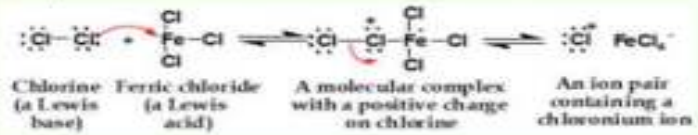
$$\%S = \frac{32}{233} \times \frac{0.4813}{0.157} \times 100 = 42.10\%$$

c. Homolytic fission, also known as homolysis or homolytic cleavage, is a type of bond fission where a covalent bond between two atoms breaks and each atom receives one of the bonding electrons

33 **3**

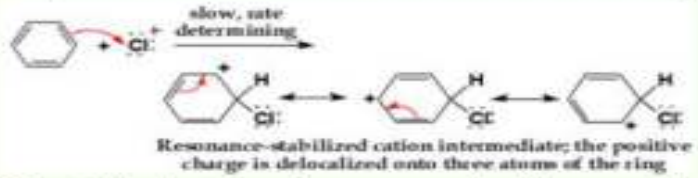
Mechanism of chlorination of benzene:

Step 1: Formation of a chloronium ion.



1

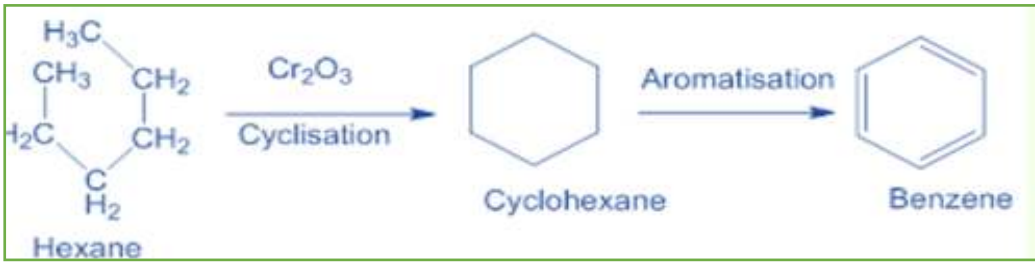
Step 2: Attack of the chloronium ion on the ring



1

Step 3: Proton transfer regenerates the aromatic character of the ring.

Conversions:



Marking Scheme
(SET-B)
Different Questions

1 c. 15×10^{22}

2 d. Balmer series

4 b. CH_4

5 a. Heat

10 d. F

17

$$\underset{1\text{mol}}{H_2O(l)} \xrightarrow{\text{vaporisation}} \underset{1\text{mol}}{H_2O(g)} \quad \Delta_{vap}H^{\ominus} = 40.66\text{kJ mol}^{-1}$$

As ideal gas, $\Delta_{vap}U^{\ominus} = \Delta_{vap}H^{\ominus} - p\Delta V$

$= \Delta_{vap}H^{\ominus} - \Delta n_g RT$

Here $\Delta n_g = 1 - 0 = 1\text{mol}$

$\Delta_{vap}U^{\ominus} = 40.66\text{kJ mol}^{1} - (1\text{mol})(8.314 \times 10^{-3}\text{kJ mol}^{-1}\text{k}^{1}) \times (373\text{k})$

$= 40.66\text{kJ mol}^{-1} - 3.10$

$= 37.56\text{kJ mol}^{-1}$

18 When chlorine (Cl) accepts an electron it forms an anion that is Cl-.

a. Cl- has a greater number of electrons (18) as compared to protons (17). So, the electronic repulsion in Cl- ion is high.Hence the size of the Cl- ion becomes larger than the chlorine (Cl) atom.

b. Hence the ionization energy required to remove an electron from both the elements and its isotope will be the same because ionization energy does not depend on neutrons; it depends on the number of protons and electrons. Thus the ionization enthalpies for two isotopes of the same element should be the same.

21 a.The total entropy of the universe always increase during a spontaneous process.

b. Both will have negative signs.

22 a.

Molarity 3M means 3 moles of NaCl are in 1000 ml or 1 L water

Molality means the number of moles of solute present per kg of solvent

The density of solution is 1.25 g/ml

Density= weight/volume

=>weight of solution = density x volume=1.25 ×1000 = 1250 gm

Weight of NaCl is = mole x molecular weight=3×58.5 = 175.5 [molecular weight = 58.5]

Weight of solvent = 1250-175.5= 1074.5 gm= 1.0745 kg

Molality=

$= \frac{\text{Number of moles of solute}}{\text{weight of solvent in kg}}$

$= \frac{3}{1074.5} \times 1000$

$= 2.79\text{m}$

25 (b) The law of multiple proportions states that whenever the same two elements form more than one compound, the different masses of one element that combine with the same mass of the other element are in the ratio of small whole numbers.

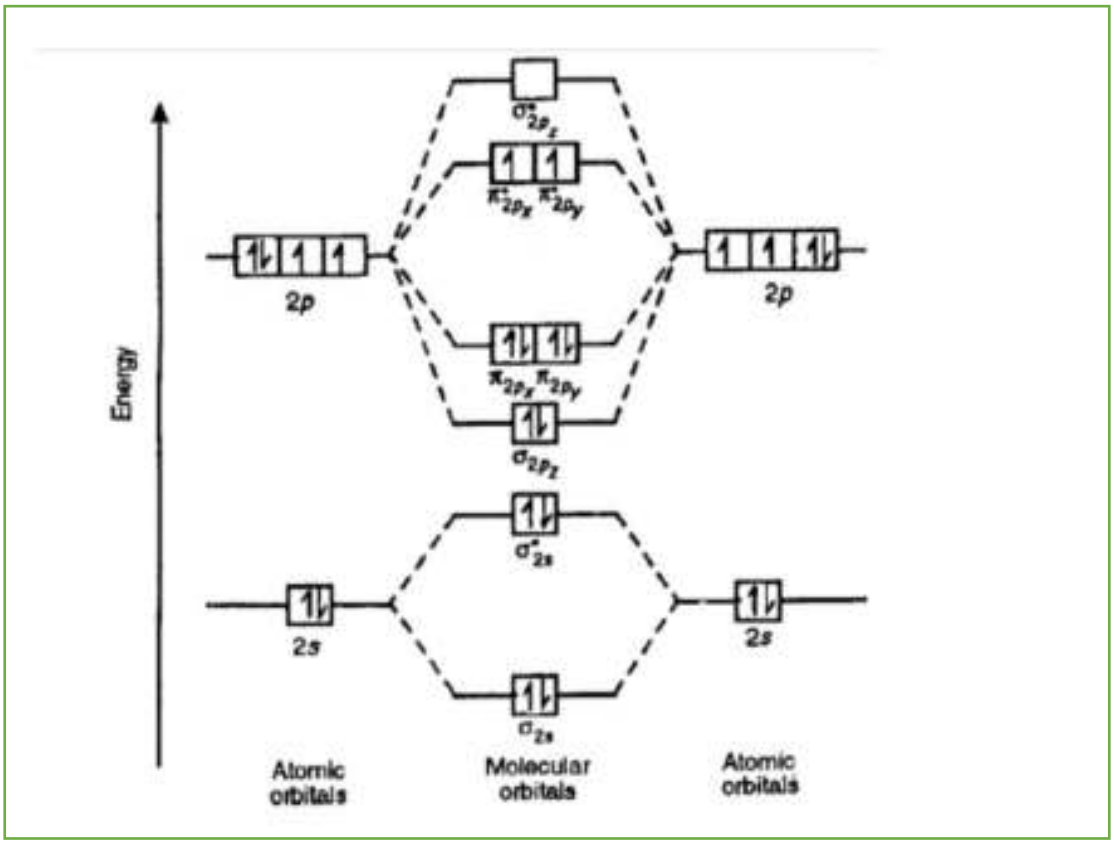
27 © Here, π electrons of the multiple bonds are transferred to the atom to which the reagent gets attached. A negative electromeric effect is observed when the shared pair of electrons is transferred away from the attacking reagent.

29

a. $CH_2=CH_2$ Ethene will be formed.
b. Anti- Markovnikov Rule is also called the peroxide effect and the kharasch effect.

According to this rule, in an unsymmetrical alkene when the addition of halogen acid (HX) takes place, then the negative part of the halogen acid is attached to that carbon atom which is double bonded as well have the more hydrogen atoms.

31



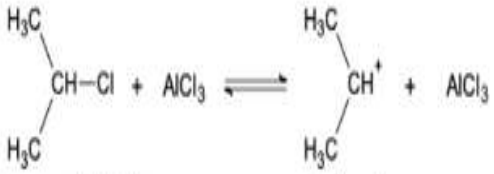
32 Bond order = 2

SF_6 = shape is octahedral
CH_4 = shape is tetrahedral

33

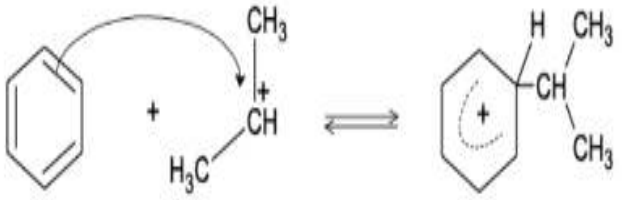
Reaction Mechanism of Friedel-Crafts alkylation involve formation of carbocation by the help of lewis acid. The following reaction mechanims of Friedel-Crafts alkylation explain for isopropyl chloride.

Step 1:



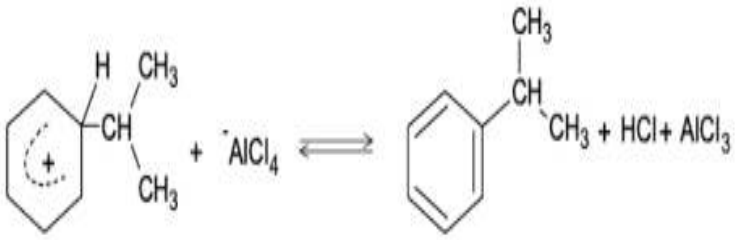
Isopropyl chloride Carbocation

Step 2:



Arenium ion

Step 3:



Isopropylbenzene

B