	Shri Shantadurga Higher Secondary School, Bicholim Goa.	

Class: - **XI Science** | Max Marks:- 55

Day: – Tuesday | **(Subject:-Chemistry)** | Date:- 18-10-2016

Time: - 9.00 am. TO 11.30 am. | **ANSWER-KEY** | Duration: - 2 $\frac{1}{2}$Hours

Total No of Questions: -5 | First Terminal Examination- 2016 | Total No Of Printed pages: 12

Q No	*INSTRUCTIONS:*	Marks
Q 1 A	Elements in the same group have same_____ **Number of valence electrons** # Density # Nuclear charge # Atomic radius # Number of valence electrons	1
Q 1 B	Define the following terms and write their mathematical expression a) Mole fraction It is the ratio of number of moles of a particular component to the total number of moles of the solution. If a substance 'A' dissolves in substance 'B' and their number of moles are *n*A and *n*B respectively; then the mole fractions of A and B are given as Mole fraction of A $= \frac{\text{No. of moles of A}}{\text{No. of moles of solution}} = \frac{n_A}{n_A + n_B}$ Mole fraction of B $= \frac{\text{No. of moles of B}}{\text{No. of moles of solution}} = \frac{n_B}{n_A + n_B}$ b) Mass percentage It is the ratio of mass of solute to that of solution (weight by weight or volume by volume) multiplied by hundred. It is obtained by using the following relation: $\text{Mass per cent} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$ **c) Molality** It is defined as the number of moles of solute present in 1 kg of solvent. It is denoted by m. $\text{Thus, Molality (m)} = \frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}}$	3

Q 1 C — Marks: **2**

Calculate the mass of:-

a) **One atom of Potassium**

$6.023x10^{23}$ atoms of potassium will weigh=19 grams

..One atom of potassium will weigh=x gram

$X=1x19/6.023x10^{-23}$

$=3.15x10^{23}$ gram

Mass one atom of Potassium=$3.15x10^{23}$ gram

a) **One molecule of NH_3**

Molecular mass of NH_3=17 grams

$6.023x10^{23}$ molecules of Ammonia will weigh=17 grams

One molecule of Ammonia will weigh=x gram

$X=1x17/6.023x10^{-23}$

$=2.82\ x10^{-23}$ gram

b) Mass one molecule of Ammonia==$2.82\ x10^{-23}$ gram

Q 1 D — Marks: **3**

State the following

1. **First law of Thermodynamics**

The energy of an isolated system is constant.
It is commonly stated as the law of conservation of energy i.e., energy can neither be created nor be destroyed

2. **Standard enthalpy of vaporization**

Amount of heat required to vaporize one mole of a liquid at constant temperature and under standard pressure (1bar) is called its standard enthalpy of vaporization or molar enthalpy of vaporization, $\Delta_{vap}H^0$

3. **Hess's law of constant heat summation.**

If a reaction takes place in several steps then its standard reaction enthalpy is the sum of the standard enthalpies of the intermediate reactions into which the overall reaction may be divided at the same temperature.

Q 1 E — Marks: **2**

Identify and group the following properties into **intensive** and **extensive** properties

(temperature , pressure ,Mass , volume , enthalpy, viscosity)

intensive	**extensive**
Temperature , pressure & viscosity	Mass , volume , enthalpy

Q 2 A — Marks: **1**

The maximum number of electrons accommodated in 3d orbital is ____**10**_____

3 # 10 # 14 # 30

Q 2 B — Marks: **3**

Answer the following.

a) **State Pauli's exclusion principle**

No two electrons in an atom can have the same set of four quantum numbers.
Pauli exclusion principle can also be stated as : "Only two electrons may exist in the same orbital and these electrons must have opposite spin."

b) Write the detailed electronic configurations for the atoms of the following elements:

i) Ca (Z=20)-------- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

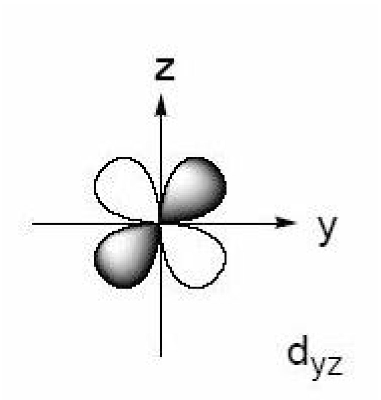
ii) Cu (Z=29) -------$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

iii) S (Z=16)------- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

iv) Si (Z=14)------- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

Q 2 C **3**

a) Draw the shape of d_{yz} orbital.



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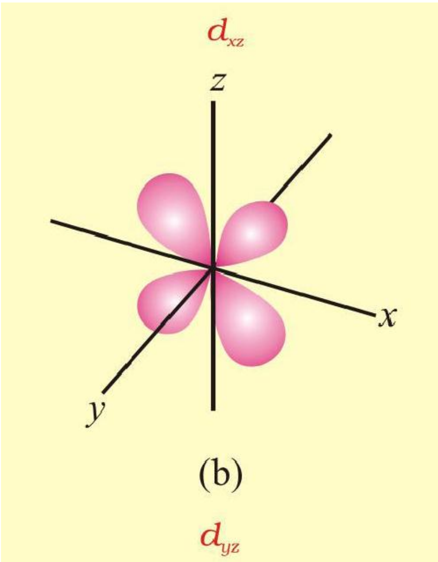


b) Explain, giving reasons, which of the following sets of quantum numbers are not possible.

I. **$n = 1, l = 0, m_l = 0, m_s = -½$------Possible**

II. **$n = 1, l = 0, m_l = 1, m_s = +½$----- Not Possible**

Because when $l = 0$, m_l cannot be equal to 1

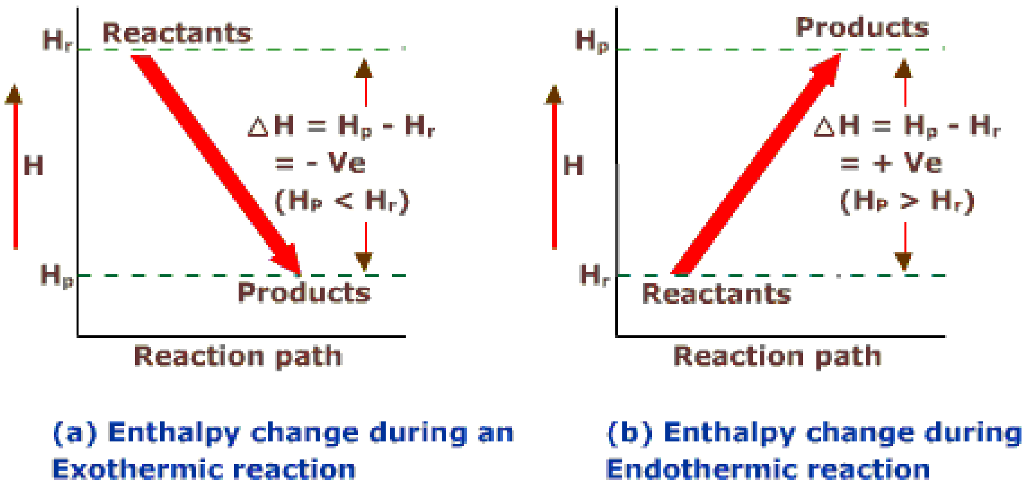
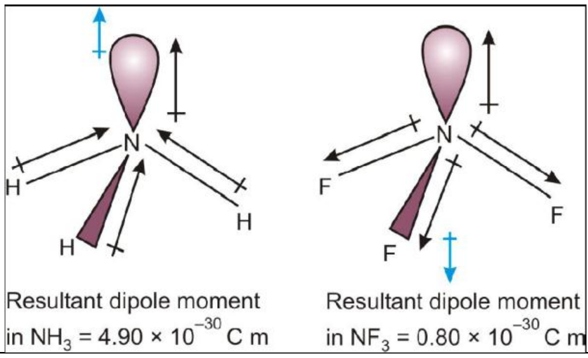
III. **$n = 2, l = 1, m_l = 0, m_s = -½$-----Possible**

IV. **$n = 3, l = 3, m_l = -3, m_s = +½$ Not Possible**

Because when **n = 3**, **l** cannot be equal to **3**

Q 2 D	Answer the following. I. Define Electronegativity of an element A qualitative measure of the ability of an atom in a **chemical compound** to attract shared electrons to itself is called **electronegativity**. II. The first ionization enthalpy of Oxygen is low compared to that of Nitrogen. Give reason. This arises because in the nitrogen atom, three 2p-electrons reside in different atomic orbitals (Hund's rule) whereas in the oxygen atom, two of the four 2p-electrons must occupy the same 2p-orbital resulting in increased electron-electron repulsion. Consequently, it is easier to remove the fourth 2p-electron from oxygen than it is, to remove one of the three 2p-electrons from nitrogen.	**2**
Q 2 E	Answer the following. I. Write two examples of species which are isoelectronic with Mg^{2+} **Al^{+3}** And **O^{-2}** **10** electrons II. F^{-} ion has a larger radii than F atom. Give reason. Anion has one or more electrons than its parent atom, resulting in an increased repulsion among the electrons and a decrease in the effective nuclear charge. As a result, the distance between the valence electrons and the nucleus is more in anions than in it's the parent atom. Hence, an anion is larger in radius than its parent atom.	**2**
Q 3 A	At constant volume, pressure of a fixed amount of a gas varies directly with the temperature, is_____ **Gay Lussac's law** _______________ # Charles' law #Gay Lussac's law # Avogadro law # Boyle's law	**1**
Q 3 B	Name the different types of van-dar-waals forces and write any three physical properties of gaseous state. Ans: different types of van-dar-waals forces are a. dispersion forces or London forces, b. dipole-dipole forces, and c. dipole-induced dipole forces. **Physical properties of gaseous state are as follows**.(any three) a. Gases are highly compressible. b. Gases exert pressure equally in all directions. c. Gases have much lower density than the solids and liquids. d. The volume and the shape of gases are not fixed. These assume volume and shape of the container. e. Gases mix evenly and completely in all proportions without any mechanical aid	**3**

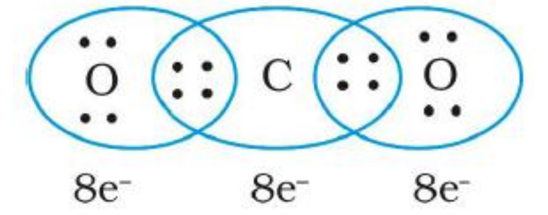
Q 3 C	Derive Ideal gas equation. The three Gas laws can be combined together in a single equation which is known as **ideal gas equation**. At constant T and n; $V \propto \frac{1}{p}$ **Boyleís Law** At constant p and n; $V \propto T$ **Charlesí Law** At constant p and T; $V \propto n$ **Avogadro Law** Thus, $V \propto \frac{nT}{p}$ (5.15) $\Rightarrow V = R\frac{nT}{p}$ (5.16) where R is proportionality constant. On rearranging the equation (5.16) we obtain $pV = nRT$............(5.17) R is called gas constant. It is same for all gases. Therefore it is also called **Universal Gas Constant**. Equation (5.17) is called **ideal gas equation.**	**2**
Q 3 D	Solve the following. 1. It is hard to begin inflating a balloon. A pressure of 800.0 Kpa is required to initially inflate the balloon to 225.0 mL. What is the final pressure when the balloon has reached its capacity of 1.2 L? ANS:- $P_2 = \frac{[V_1][P_1]}{[V_2]}$ $P_2 = \frac{[0.225L][800.0\ KPa]}{[1.2\ L]} = 150$ KPa 2. What is the temperature at which 80 cm^3 of a gas should be heated to increase its volume by 20% without changing the pressure? *(Given that the initial temperature of the gas is 25^oC)* Ans: The desired increase in the volume of the gas $= 20\%$ of $80\ cm^3 = \frac{80}{100} \times 20 = 16\ cm^3$ Final volume of the gas $= 80 + 16 = 96\ cm^3$ $V_1 = 80\ cm^3$; $V_2 = 96\ cm^3$ $T_1 = 25^\circ C = 298\ K$; $T_2 = ?$ Applying Charles law $T_2 = \frac{V_2 T_1}{V_1} = \frac{96\ cm^3 \times 298\ K}{80\ cm^3} = 357.6\ K$ or $84.6^\circ C$	**3**

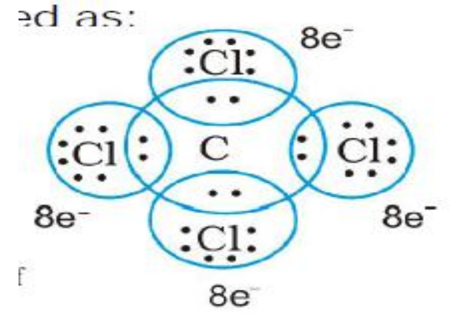
Q 3 E	Draw the graph showing enthalpy diagram for Exothermic and Endothermic reactions  	**2**
Q 4 A	A pi-bond is formed by the overlap of:____ <u>**p-p orbitals in sidewise manner**</u> ______ ➢ s-s orbitals ➢ s-p orbitals ➢ p-p orbitals in end to end fashion ➢ p-p orbitals in sidewise manner	**1**
Q 4 B	Draw the structures of NH_3 and NF_3 and explain which out of the two has higher dipole moment. Both the molecules have pyramidal shape with a lone pair of electrons on nitrogen atom. Although fluorine is more electronegative than nitrogen, the resultant dipole moment of NH_3 (4.90×10^{-30} C m) is greater than that of NF_3 (0.8×10^{-30} C m). This is because, in case of NH_3 the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N – H bonds, whereas in NF_3 the orbital dipole is in the direction opposite to the resultant dipole moment of the three N–F bonds. The orbital dipole because of lone pair decreases the effect of the resultant N – F bond moments, which results in the low dipole moment of NF_3 as represented below  	**2**

Q 4 C Draw the **3**

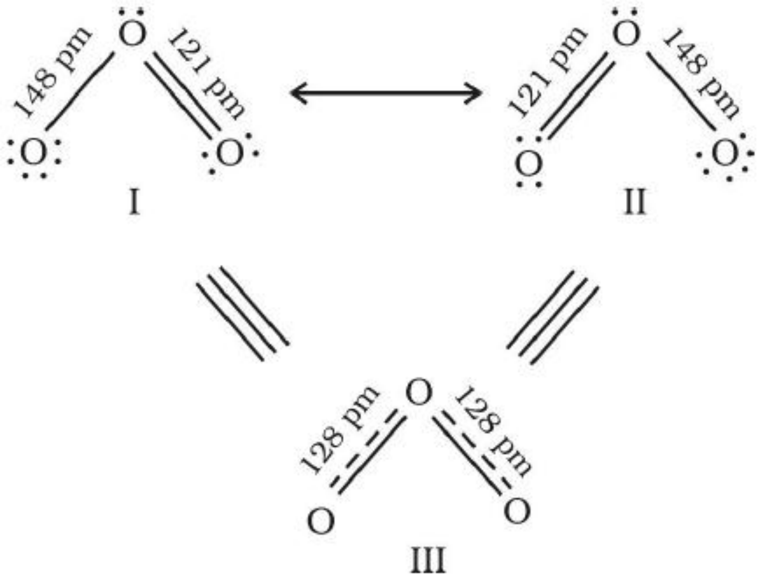
A. Lewis dot structure for each of the following molecules.

1) CCl_4 2) CO_2

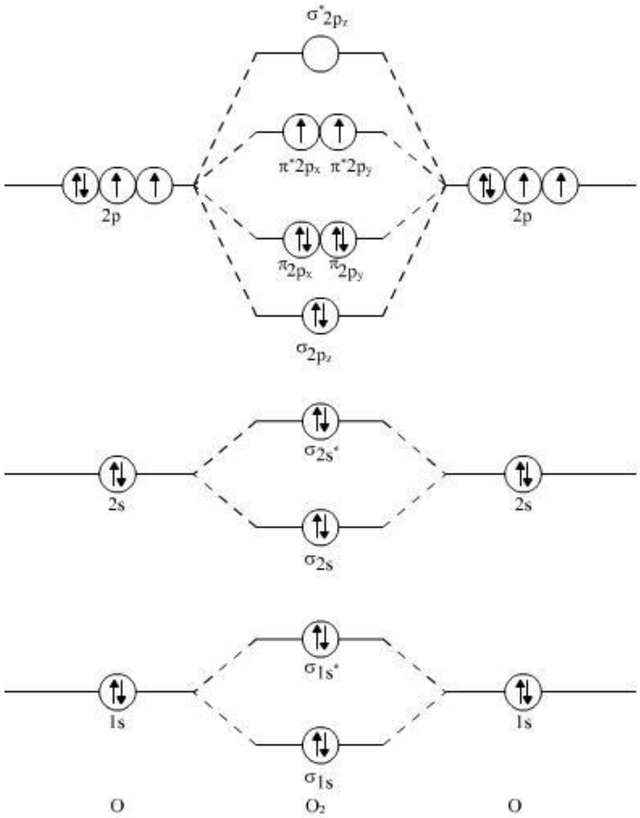




B. Resonating structures of Ozone molecule.



Q 4 D	Draw the Molecular diagram for O_2 Molecule and calculate its Bond order.	4



O_2: $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_z)^2$

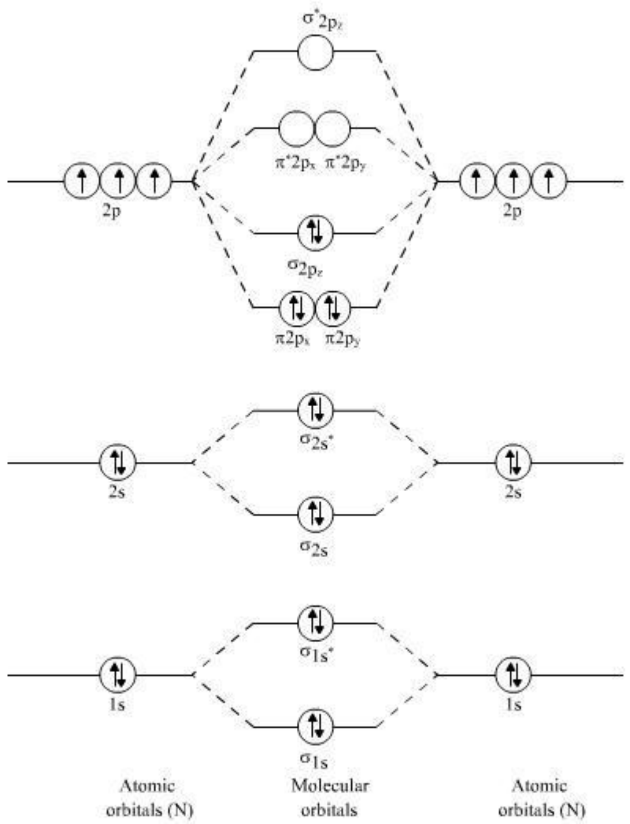
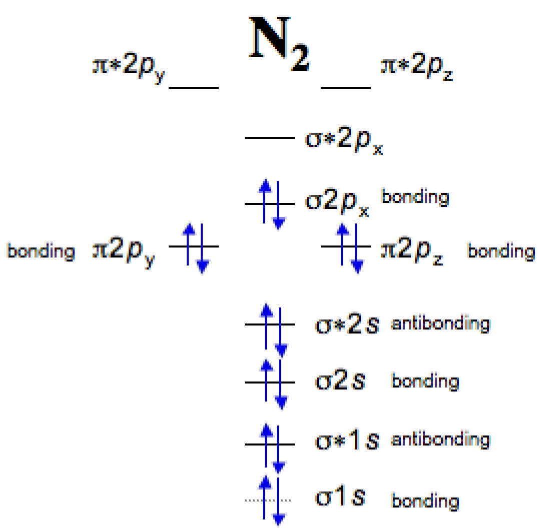
$(\pi\ 2p_x{}^2 \equiv \pi\ 2p_y{}^2)\ (\pi * 2p_x{}^1 \equiv \pi * 2p_y{}^1)$ or

$$O_2 : \begin{bmatrix} KK\ (\sigma 2s)^2(\sigma * 2s)^2(\sigma 2p_z)^2 \\ (\pi 2p_x^2 \equiv \pi 2p_y^2), (\pi * 2p_x^1 \equiv \pi * 2p_y^1) \end{bmatrix}$$

is

$$\text{Bond order} = \frac{1}{2}[N_b - N_a] = \frac{1}{2}[10 - 6] = 2$$

OR

Q 4 D	Draw the Molecular diagram for N_2 Molecule and calculate its Bond order.  **bond order =** $\dfrac{\left(\text{number of electrons in bonding MOs}\right) \quad \left(\text{number of electrons in anti-bonding MOs}\right)}{2}$  $\dfrac{10 - 4}{2} = 3$ **bond order = 3** **stable molecule**	**4**
Q 4 E	State the effect(increase/decrease) of the following processes on the total **energy** content of the system (i) Work done by the system------------**Decreases** (ii) Heat transferred to the surroundings------**Decreases**	**1**

Q 5 A (1)

The aromatic compound among the following is ___ **Benzene**_______

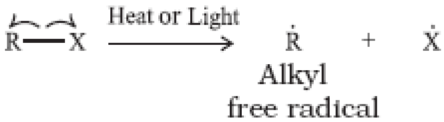
- Cyclohexene
- Cyclopentene
- Benzene
- Cyclohexane

Q 5 B (2)

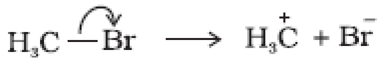
Answer the following.

a. Write a point of difference between Homolytic fission and Heterolytic fission.

A covalent bond can get cleaved either by : Homolytic cleavage and Heterolytic cleavage
In homolytic cleavage, one of the electrons of the shared pair in a covalent bond goes with each of the bonded atoms.. A homolytic cleavage can be shown as:



In heterolytic cleavage, the bond breaks in such a fashion that the shared pair of electrons remains with one of the fragments Thus, heterolytic cleavage of bromomethane will give $^{+}CH_3$ and Br^{-} as shown below.



b. Classify the given below species as Nucleophile and electrophile

BF_3, H_2O, NH_3 and H^+

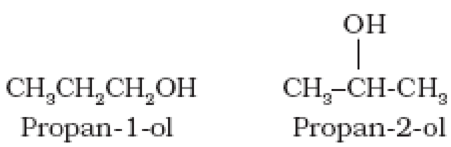
Nucleophile	H_2O and NH_3
Electrophile	BF_3 and H^+

Q 5 C (3)

Write an example representing below given isomerism.

i. Position isomerism

For example, the molecular formula **C_3H_8O** represents two alcohols:

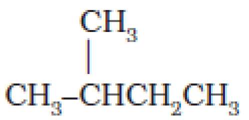


ii. **Chain isomerism**

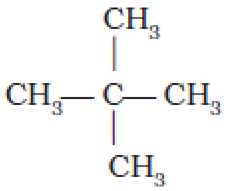
For example, C_5H_{12} represents three compounds:

$CH_3CH_2CH_2CH_2CH_3$

Pentane



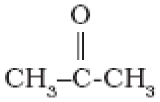
Isopentane
(2-Methylbutane)



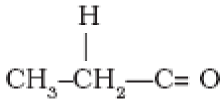
Neopentane
(2,2-Dimethylpropane)

iii. **Functional isomerism**

For example, the molecular formula **C_3H_6O** represents an aldehyde and a ketone:

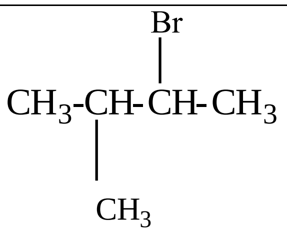


Propanone

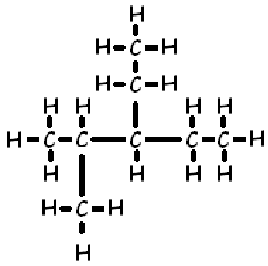
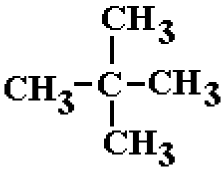
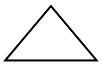


Propanal

Q 5 D Write the IUPAC names for the following compounds **4**

1. CH_3-CH_2-OH	Ethanol
2. CH_3-CHO	Ethanal
3. CH $_3COCH_3$	Propanone
	2-bromo-3-methylbutane

OR

Q 5 D	Write the structures for the following compounds by rewriting their IUPAC names I. 3-ethyl-2-methylpentane  II. 2,2-Dimethylpropane  III. Cyclobutene  IV. Cyclopropane 	**4**
Q 5 E	Write the general formula for the following functional group I. Aldehyde --------------CHO II. Cyanide----------------CN	**1**

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