	Parvatibai Chowgule College of Arts & Science, Margao Goa.	
	(Higher Secondary Section)	

Class: - XI Science | **Max Marks:- 60**

Day: – Monday | **(Subject:-Chemistry)** | **Date:- 13-10-2014**

Time: - 10.30 a.m. TO 01.00 p.m. | **Answer-Key** | **Duration: - Three Hours**

Total No of Questions: - 6 | **First Terminal Examination-October-2014** | **Total No Of Printed pages: 10**

Q No	*INSTRUCTIONS:*	Marks
Q 1 A	Define the following 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) **Molarity** It is the most widely used unit and is denoted by M. It is defined as the number of moles of the solute in 1 litre of the solution. Thus, Molarity (M) = No. of moles of solute/ Volume of solution in litres c) **Mass percentage** It is obtained by using the following relation: $\text{Mass per cent} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$	3
Q 1 B	Write two points of difference between Homogenous and Heterogenous mixtures with two examples of each.	2

Homogeneous mixture	Heterogeneous mixture
In a **homogeneous mixture**, the components completely mix with each other and its composition is uniform throughout.	in **heterogeneous mixtures**, the composition is not uniform throughout and sometimes the different components can be observed.
Sugar solution, and air are thus, the examples of homogeneous mixtures.	For example, the mixtures of salt and sugar, grains and pulses along with some dirt (often stone) pieces, are heterogeneous mixtures.

Q 1 C — **2**

Dihydrogen and Iodine react with each other to produce hydrogen iodide according to the following chemical equation:

$H_{2\,(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$

Write the information available from the above balanced chemical equation.

Ans: According to the above chemical reaction,

- Hydrogen and iodine are reactants and Hydrogen iodide is a product.
- One **mole** of H_2(g) reacts with One **mole** of I_2(g) to give Two **moles** of HI(g)
- One **molecule** of H_2(g) reacts with One **molecule** of I_2(g) to give Two **molecules** of HI(g)
- 22.4 L of H_2(g) reacts with 22.4 L of O_2 (g) to give 44.8 L of HI(g)
- 2g of H_2 (g) reacts with 254g of I_2 (g) to give216g of HI(g)
- It also tells us that all the reactants and products are in gaseous state.

Q 1 D — **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

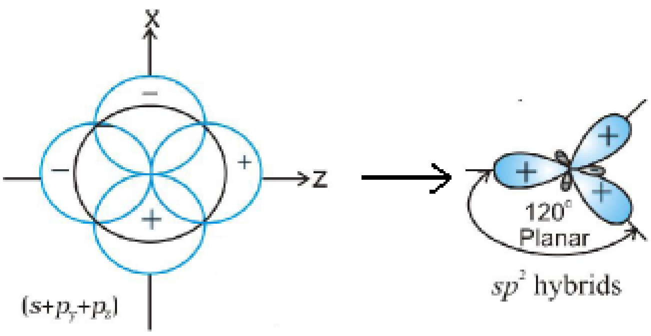
One molecule of Ammonia will weigh=x gram

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

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

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

Q 1 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: __40_____number of moles water are present in 720 grams of water. # 4 # 20 # 40 # 2	1
Q 2 A	State the following. **a) Heisenberg's Uncertainty Principle** Heisenberg's uncertainty principle states that both the position and momentum of an electron cannot be known precisely at the same time. **b) Aufbau Principle** In the ground state of the atoms, the orbitals are filled in order of their increasing energies. In other words, electrons first occupy the lowest energy orbital available to them and enter into higher energy orbitals only after the lower energy orbitals are filled. **c) Paulis 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."	3
Q 2 B	Explain why Copper and Chromium shows exceptional electronic configuration Chromium (Cr): Atomic number = 24 The electronic configuration of Cr should have been: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2 3d^4$ But it actually shows $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$ same way Chromium (Cu): Atomic number = 29 The electronic configuration of Cu should have been: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2 3d^9$ But it actually shows $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ In certain elements such as Cu, or Cr, where the two subshells (4s and 3d) differ slightly in their energies, an electron shifts from a subshell of lower energy (4s) to a subshell of higher energy (3d), provided such a shift results in all orbitals of the subshell of higher energy getting either completely filled or half filled. The valence electronic configurations of Cr and Cu, therefore, are $4s^1\ 3d^5$ and $4s^1\ 3d^{10}$ respectively and not $4s^2 3d^4$ and $4s^2 3d^9$. It has been found that there is extra stability associated with these electronic configurations.	2
Q 2 C	Explain the (n+l) rule to determine the energies of 4s and 3d orbitals **ANS**;The lower the value of (n + l) for an orbital, the lower is its energy. If two orbitals have the same value of (n + l), the orbital with lower value of n will have the lower energy. For 4s orbital (n+l)=(4+0)=4 And for 3d orbital (n+l)=(3+2)=5 And since (n+l) value for 4s orbital is 4 which is less than (n+l) value for 3d orbital which is 5 hence 4s orbital is filled first before 3d orbital.	2

Q 2 D	Determine the possible values of quantum numbers **n, l, m_l** for the M shell of an atom. For M shell ,**n** = 3, l=(0….up to 3-1) For **n** = 3, there are three possible values for l. They are; 0 …. s orbitals 1 …. p orbitals 2 …. d orbitals For each of these there are values for ml l=0, ml = 0 = 2 electrons l = 1, ml = -1, 0, +1 = 6 electrons l = 2, ml = -2, -1, 0, 1, 2 = 10 electros Each orbital can accommodate 2 electrons hence total no. of electrons = 18	2
Q 2 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: The number of electrons & neutrons present in $^{80}_{35}Br$ is_35& 45_respectively # 45&35 # 35&80 # 35& 45 # 35&40	1
Q 3 A	Define Hybridisation. Explain formation of sp^2 hybrid orbitals with diagram **Ans:**The phenomena of intermixing of atomic orbitals of slightly different energies of the atom (by redistributing their energies) to form new set of orbitals of equivalent energies and identical shape is known as hybridization. ***sp^2 hybridisation :*** In this hybridization there is involvement of one *s* and two *p*-orbitals in order to form three equivalent sp^2 hybridised orbitals. For example, in BCl_3 molecule, the ground state electronic configuration of central boron atom is $1s^22s^22p^1$. In the excited state, one of the 2*s* electrons is promoted to vacant 2*p* orbital *molecule* 	3

Q 3 B Write any two points of difference between sigma & pi bonds **2**

Sigma (σ) Bond	Pi (π) Bond
(a) It is formed by the end to end overlap of orbitals.	It is formed by the lateral overlap of orbitals.
(b) The orbitals involved in the overlapping ares–s, s–p, or p–p.	These bonds are formed by the overlap of p–porbitals only.
(c) It is a strong bond.	It is weak bond.
(d) The electron cloud is symmetrical about the line joining the two nuclei.	The electron cloud is not symmetrical.
(e) It consists of one electron cloud, which is symmetrical about the internuclear axis.	There are two electron clouds lying above and below the plane of the atomic nuclei.
(f) Free rotation about σ bonds is possible.	Rotation is restricted in case of pi-bonds.

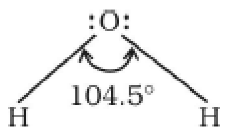
Q 3 C Define the following **2**

i. **Bond Enthalpy**

It is defined as the amount of energy required to break one mole of bonds of a particular type between two atoms in a gaseous state.
The unit of bond enthalpy is **kJ mol^{-1}**.
For example, the H – H bond enthalpy in hydrogen molecule is 435.8 kJ mol^{-1}.
$H_2(g) \rightarrow H(g) + H(g)$; $\Delta_a H^V = 435.8$ kJ mol^{-1}

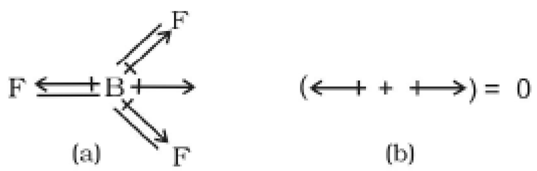
ii. **Bond angle**

It is defined as the angle between the orbitals containing bonding electron pairs around the central atom in a molecule/complex ion.
Bond angle is expressed in degree .For example H–O–H bond angle in water can be represented as under :

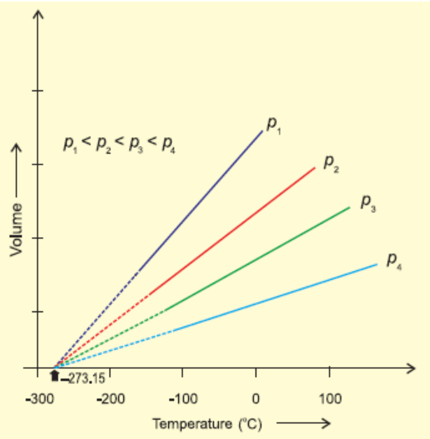


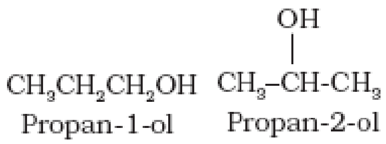
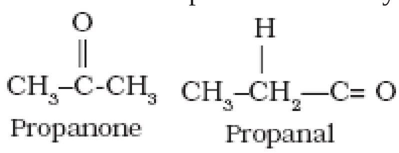
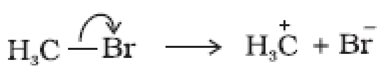
Q 3 D Explain with structure why in BF_3 molecule Total Dipole moment is Zero **2**

Ans: In BF_3, the dipole moment is zero although the B – F bonds are oriented at an angle of 120° to one another, the three bond moments give a net sum of zero as the resultant of any two is equal and opposite to the third.

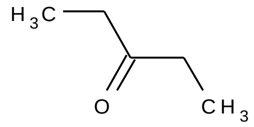
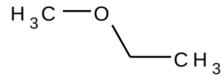
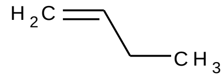
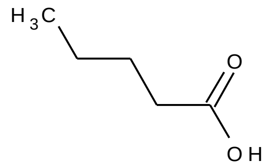


BF_3 molecule; representation of (a) bond dipoles and (b) total dipole moment

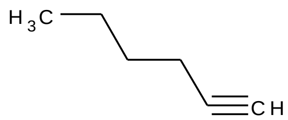
Q 3 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: The percentage of s character in sp^3 hybridized orbital is_____ <u>25%</u>_____ # 25% # 30% # 50% # 35%	1
Q 4 A	Name the different types of van-dar-waals 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 4 B	It is hard to begin inflating a balloon. A pressure of 800.0 Kpa is required to initially inflate the balloon 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
Q 4 C	Answer the following questions with respect to following graph.  1. What does each line of the volume *vs* temperature graph is called as? Ans: **Isobar** 2. Which Gas law does this Graph depicts?	2

	Ans: **Charles law** 3. What do you understand by Absolute Zero? Ans: The lowest hypothetical or imaginary temperature at which gases are supposed to occupy zero volume is called **Absolute zero**.	
Q 4 D	State the following **i. Dalton's Law of partial pressures.** It states that the total pressure exerted by the mixture of non-reactive gases is equal to the sum of the partial pressures of individual gases **ii. Gay Lussac's Law (Pressure- Temperature Relationship)** It states that at constant volume, pressure of a fixed amount of a gas varies directly with the temperature.	**2**
Q 4 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: Use of hot air balloons is an application __ **Charles**' _law # Charles' # Gay Lussac's # Avogadro's # Boyle's	**1**
Q 5 A	Explain the following with suitable examples. **a) Position Isomerism** When two or more compounds differ in the position of substituent atom or functional group on the carbon skeleton, they are called position Isomers and this phenomenon is termed as position isomerism. For example, the molecular formula **C_3H_8O** represents two alcohols:  propan-1-ol and propan-2-ol are position Isomers of molecular formula **C_3H_8O** **b) Functional group isomerism.** Two or more compounds having the same molecular formula but different functional groups are called functional isomers. and this phenomenon is termed as functional group isomerism For example, the molecular formula **C_3H_6O** represents an aldehyde and a ketone:  Propanone and propanal are functional group isomers of molecular formula **C_3H_6O** **c) Heterolytic cleavage.** In heterolytic cleavage, the bond breaks in such a fashion that the shared pair of electrons remains with one of the fragments. After heterolysis, one atom has a sextet electronic structure and a positive charge and the other, a valence octet with at least one lone pair and a negative charge. Thus, heterolytic cleavage of bromomethane will give $^{+}CH_3$ and Br^{-} as shown below. 	**3**

Q 5 B Write the structural formulae of the following compounds. **2**

a) Pentan-3-one	
b) Methoxyethane	
c) But-1-ene	
d) Propanoic acid	

Q 5 C Write the IUPAC names of the following compounds. **2**

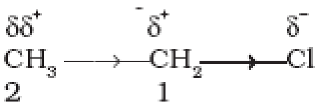
Br CH_3-CH- CH- CH_3 CH_3	2-bromo-3-methylbutane
CH_3-C H_2-C OO-CH_3	methyl propionate
CH_3-CH- CH_2-CH_3 NH_2	butan-2-amine
	hex-1-yne

Q 5 D **2**

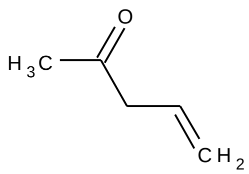
Answer the following.

I. Explain the **inductive effect** with an example.

Let us consider cholorethane (CH_3CH_2Cl) in which the C–Cl bond is a polar covalent bond. It is polarised in such a way that the carbon-1 gains some positive charge (δ+) and the chlorine some negative charge (δ–). The fractional electronic charges on the two atoms in a polar covalent bond are denoted by symbol δ (delta) and the shift of electron density is shown by an arrow that points from δ+ to δ– end of the polar bond.



In turn carbon-1, which has developed partial positive charge (δ+) draws some electron density towards it from the adjacent C-C bond. Consequently, some positive charge (δδ+) develops on carbon-2 also, where δδ+ symbolises relatively

	smaller positive charge as compared to that on carbon – 1. In other words, the polar C – Cl bond induces polarity in the adjacent bonds. Such polarisation of σ-bond caused by the polarisation of adjacent σ-bond is referred to as the **inductive effect**. II. Write the formulas of the first three members of each homologous series beginning with following a) HCHO b) CH_3OH Ans:- a) HCHO , CH_3-CHO , CH_3 –CH_2-CHO b) CH_3OH, CH_3–CH_2-OH, CH_3–CH_2–CH_2-OH	
Q 5 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: The correct IUPAC name of the following compound is____ **<u>Pent-4-en-2-one</u>** .  # 3-Buten-1-al # Pent-4-en-2-one # 2-pentanone # Pent-1-ene	**1**
Q 6 A	Define the following. 1) **Electronegativity** A qualitative measure of the ability of an atom in a **chemical compound** to attract shared electrons to itself is called **electronegativity**. 2) **Atomic radii** Distance from the centre of the nucleus to outermost shell of electrons. Covalent Radii :The distance of closest approach of one atom to another atom in a bonded situation . It is half of the internuclear distance of two atoms 3) **Modern periodic law** The physical and chemical properties of the elements are periodic functions of their atomic numbers.	**3**
Q 6 B	Explain the variation of Ionisation Enthalpy across the period and down the group **Ans**:When we move from lithium to fluorine **across the second period**, successive electrons are added to orbitals in the same principal quantum level and the shielding of the nuclear charge by the inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus. Thus, across a period, increasing nuclear charge outweighs the shielding. Consequently, the outermost electrons are held more and more tightly and the **ionization enthalpy increases across a period.** **Ionisation Enthalpy decreases down the grou**p. The factors responsible for the ionization enthalpy of the main group elements to decrease down a group are	**2**

	listed below: **(i) Increase in the atomic size of elements**: As we move down a group, the number of shells increases. As a result, the atomic size also increases gradually on moving down a group. As the distance of the valence electrons from the nucleus increases, the electrons are not held very strongly. Thus, they can be removed easily. Hence, on moving down a group, ionization energy decreases. **(ii) Increase in the shielding effect**: The number of inner shells of electrons increases on moving down a group. Therefore, the shielding of the valence electrons from the nucleus by the inner core electrons increases down a group. As a result, the valence electrons are not held very tightly by the nucleus. Hence, the energy required to remove a valence electron decreases down a group.	
Q 6 C	Cations are smaller than Anions in radii than their parent atoms. Give reason. A cation has a fewer number of electrons than its parent atom, while its nuclear charge remains the same. As a result, the attraction of electrons to the nucleus is more in a cation than in its parent atom. Therefore, a cation is smaller in size than its parent atom. On the other hand, an 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. The atomic radius of Na is 186 pm compared to the ionic radius of 95 pm for Na^+	**2**
Q 6 D	Identify and group the following properties into intensive and extensive properties (temperature , pressure ,Mass , volume , enthalpy, viscosity) Ans:- **intensive properties**= temperature , pressure and viscosity **extensive properties**= Mass , volume , enthalpy	**2**
Q 6 E	Complete the following statement by choosing the *correct* alternative from those given below the statement and rewrite the completed statement: The system in which exchange of mass and energy takes place with surrounding is called as____ Open ___system. # Open # Closed # Isolated # Adiabatic	**1**

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