SUCCESS KEY TEST SERIES

First Term Examination[MODEL ANSWER]

Std: 11th Science | **Subject: Chemistry** | **Time: 3Hrs**

Date : | **Chapter 1 To 8** | **Max Marks: 70**

Section A (MCQ & VSA 1 MARKS Questions)

Q.1 Select and write the correct answer: **10**

(i) Ans. (c)

(ii) Ans. (d)

(iii) Ans. (c)

(iv) Ans. (b)

(v) Ans. ©

(vi) Ans. ©

(vii) Ans. (d)

(viii) Ans. (b)

(ix) Ans. (b)

(x) Ans. (a)

Q.2 Answer the following: **8**

(i) Ans. The metallic radius is greater than covalent radius because metallic bond has no overlapping but covalent bond has.

(ii) Ans. The equilibrium distance between the nuclei of two bonded atoms in a molecule is called bond length.

(iii) Ans. Hydrogen does not have any neutron in it.

(iv) Ans. Francium (Fr)

(v) Ans. Molarity = Number of moles / Amount of solution (In litres)
Molar mass of NaOH = 23 + 16 + 1 = 40 g
Number of moles in 4 g = 4 g / 40 g = 0.1 mole
Amount of solution = 500 mL/1000 = 0.5 L
Therefore, Molarity = 0.1 Mole / 0.5 Litres = 0.2 M

(vi) Ans. i. Alumina ii. Silica gel

(vii) Ans. The reaction which involves the removal of oxygen/electronegative element from a substance or addition of hydrogen/electropositive element to a substance is known as reduction reaction.

(viii) Ans. The basic unit of mass in the SI system is kilogram.

Section B (SA I - 2 MARKS EACH)

Attempt any Eight: **16**

Q.3 Ans. By Hund's rule,

$^{16}_{8}O$ $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$

The electronic configuration,

$1s^2 2s^2 2p_x^2 2p_y^2 2p_z^0$ violates Hund's rule

Q.4 Ans. i. Electro negativity is defined as the tendency of an atom to attract a shared pair of electrons towards itself in a covalent bond.
ii. Smaller is the size of atom, more is its nuclear charge, hence more is the electro negativity.
iii. Alkaline earth metals have low value of electro negativity as they have fewer tendencies to attract a shared pair of electrons because of their big size and less nuclear charge due to this value of electro negativity decreases down the group

Q.5 Ans. It is given that:

Atomic mass of M=56

% Percentage of M=70.0%

The empirical formula of the compound

% M=70.0%

Hence, % O=30.0%, Atomic mass of O= 16u

So,

$$\text{Moles of M} = \frac{\text{\% of M}}{\text{Atomic mass of M}} = \frac{70.0}{56} = 1.25\,\text{mol}$$

$$\text{Moles of O} = \frac{\text{\% of O}}{\text{Atomic mass of O}} = \frac{30.0}{16} = 1.875\,\text{mol}$$

Hence the ratio of number of moles of M:O can be calculated as :

$$\frac{1.25}{1.25} = 1, \quad \frac{1.875}{1.25} = 1.5$$

Convert the ratio into whole number by multiplying by the suitable coefficient, i.e., 2.

Therefore, the ratio of number of moles of M:O is 2:3.

Hence, the empirical formula is M_2O_2.

Empirical formula of the compound = M_2O_3

Q.6 Ans. (a) Residue: The solid (insoluble part) that remains behind on the filter paper is called the residue.

(b) Filtrate: The liquid which passes through the filter paper and gets collected in the beaker is called the filtrate.

Q.7 Ans. We have:

Percentage of C	20%
Percentage of Hydrogen	6.7%
Percentage of Nitrogen	46.67%

And the Molar mass of the compound = 60 g mol^{-1}

The molecular formula of the compound=?

% carbon + % hydrogen + % nitrogen = 20 + 6.7 + 46.67 = 73.37%

This is less than 100%.

So, the compound contains adequate oxygen so that the total percentage of elements is 100%.

Hence, % of oxygen = 100 - 73.37 = 26.63%

$$\text{Moles of C} = \frac{\text{\% of C}}{\text{Atomic mass of C}} = \frac{20}{12} = 1.667\,\text{mol}$$

$$\text{Moles of H} = \frac{\text{\% of H}}{\text{Atomic mass of H}} = \frac{6.7}{1.0} = 6.700\,\text{mol}$$

$$\text{Moles of N} = \frac{\text{\% of N}}{\text{Atomic mass of N}} = \frac{46.67}{14} = 3.334\,\text{mol}$$

$$\text{Moles of O} = \frac{\text{\% of O}}{\text{Atomic mass of O}} = \frac{26.63}{16} = 1.664\,\text{mol}$$

Therefore, the ratio of number of moles of C: H: N: O is

$$\frac{1.667}{1.664} = 1, \quad \frac{6.700}{1.664} = 2, \text{ and } \frac{1.664}{1.664} = 1$$

Hence, empirical formula is CH_4N_2O

Empirical formula mass = 12 + 4 + 28 + 16 = 60g mol^{-1}
We know,
Molar mass = Empirical formula mass
Molecular formula = Empirical formula = CH_4N_2O
Molecular formula of the compound = CH_4N_2O

Q.8 Ans. Molar Mass: The mass of one mole of a substance (element/compound) in grams is called its molar mass. The molar mass of any element in grams is numerically equal to atomic mass of that element in u.

Explanation:

Element	Atomic mass(u)	Molar mass ($g\,mol^{-1}$)
H	1.0 u	1.0 $g\,mol^{-1}$
C	12.0 u	12.0 $g\,mol^{-1}$
O	16.0 u	16.0 $g\,mol^{-1}$

Similarly molar mass of any substance, existing as polyatomic molecule, in grams is numerically equal to its molecular mass or formula mass in u.

Polyatomic substance	Molecular formula mass (u)	Molar mass ($g\,mol^{-1}$)
O_2	32.0 u	32.0 $g\,mol^{-1}$
H_2O	18.0 u	18.0 $g\,mol^{-1}$
NaCl	58.5 u	58.5 $g\,mol^{-1}$

Q.9 Ans. Po: [Xe] $6s^2 6p^4$

Q.10 Ans. **The following information is given that is:**

- Number of moles of Carbon-dioxide = 5 mol
- Number of moles of CO_2 = 0.5 mol
- Volume of STP = ?(to be solved)

We know,

$$\text{Number of moles (n)} = \frac{\text{Volume of a gas at STP}}{\text{Molar volume of gas}}$$

Molar volume of gas = 22.4 $dm^3\ mol^{-1}$ atSTP

$$\text{Number of moles of gas (n)} = \frac{\text{Volume of a gas at STP}}{\text{Molar volume of gas}}$$

i. Volume of the gas at STP = Number of moles of a gas (n) x Molar volume of a gas
= 5 mol x $dm^3\ mol^{-1}$ = 112 dm^3

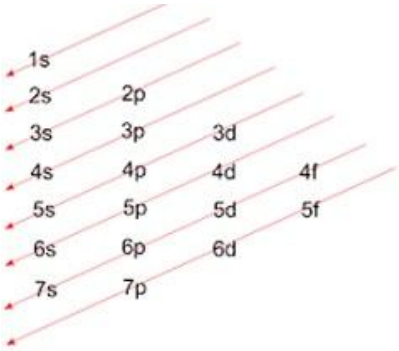
ii. Volume of the gas at STP = Number of moles of a gas (n) x Molar volume of a gas
= 5 mol x $dm^3\ mol^{-1}$ = 11.2 dm^3

Volume occupied by 5 mol of CO_2 = 112 dm^3

Volume occupied by 0.5 mol of CO_2 = 11.2 dm^3

Q.11 Ans. Aufbau principle

1. It states that in ground state of atom, the orbitals are filled in order of their increasing energies.
2. That is electrons first occupy the lower energy orbital then higher energy orbitals are filled.
3. The orbitals are filled in order:



1s,2s,2p,3s,3p,4s,3d,4p,5s,4d,5p,6s,4f,5d,6p,7s,5f,6d,7p…

Q.12 Ans. $Li^{\oplus}$ ion has very small size, therefore the charge density on $Li^{\oplus}$ is high. Therefore it has high tendency to distort the electron cloud around the negatively charged large chloride ion. This results in partial covalent character of the LiCl bond. $Na^{\oplus}$ ion cannot distort the electron cloud of $Cl^{\ominus}$ due to the bigger size of $Na^{\oplus}$ compared to $Li^{\oplus}$.

Q.13 Ans. a. 0.0000000000349
b. 0.375
c. 51,600
d. 0.004371
e. 0.000011
f. 0.143
g. 477
h. 5.00858585

Q.14 Ans. The properties of substance that makes it suitable for crystallization are :
1. The compound to be crystallized should be least or sparingly soluble in the solvent at room temperature but highly soluble at high temperature.
2. Solvent should not react chemically with the compound to be purified.
3. Solvent should be volatile so that it can be removed easily.
4. Water, ethyl alcohol, methyl alcohol, acetone, ether or their combinations are generally used as solvent for crystallization.

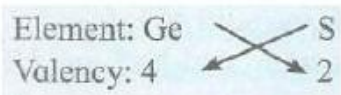
Section C (SA II - 3 MARKS EACH)

Attempt any Eight: **24**

Q.15 Ans. From the group number we understand that the general outer electronic configuration and number of valence electrons and valencies of the three elements are:

Element	Group	Outer electronic configuration	Number of Valence electron	Valency
Ge	14	ns^2np^2	4	4
S	16	ns^2np^4	6	8-6=2
Br	17	ns^2np^5	7	8-7=1

(i) S is more electronegative than Ge. Therefore, the empirical formula of the compound formed by these two elements is predicted by the method of across multiplication of the valacies:



Formula: Ge_2S_4

Empirical formula: GeS_2

(ii) Br is more electronegative than Ge. The empirical formula of the compound formed by these two elements in predicted by the method of cross multiplication of valencies:

Element: Ge		Br
Valency: 4		1

Formula: $GeBr_4$

Empirical formula: $GeBr_4$

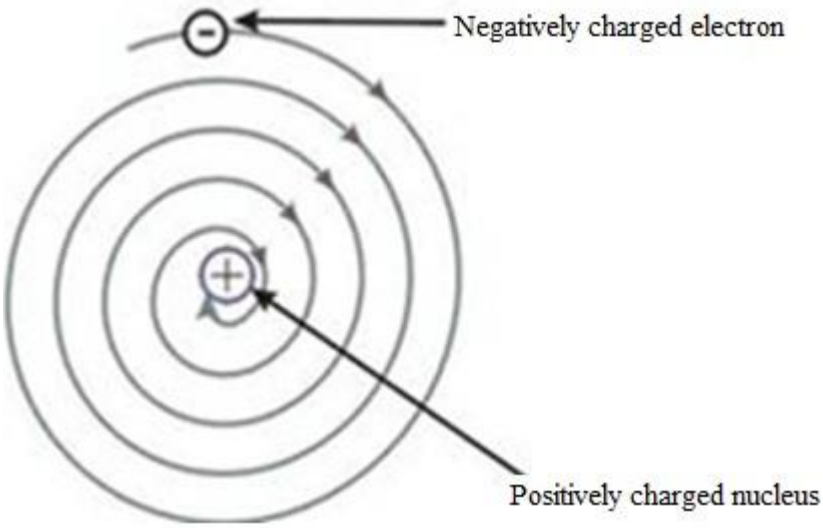
Q.16 Ans. i. Sigma bond is stronger than pi bond as in sigma overlapping region is more.

ii. HF is polar because there is a major difference of electro negativity between H and F.

Iii. Carbon is tetravalent because it has four electrons in its outer shell that it can use to pair with other atoms in order to form chemical bond.

Q.17 Ans. He failed to explain the stability of an atom" that can be explained as :

1. According To Electromagnetic theory, a charged particle revolving in circular path continuously emits energy and shortens its path.



2. As we know, Electrons are also a charged particle revolving in circular path. So, they should also emit energy and shorten its path.

3. As a result, they should finally fall into nucleus. But this doesn't happen.

The second serious drawback of the Rutherford model is that:

1. It does not describe the distribution of electrons around the nucleus and their energies.

Q.18 Ans. Group 1

(i) All the elements of group-1 rapidly lose their luster in air due to formation of a layer of oxide, peroxide and in some cases superoxide by reaction with oxygen in air.

The reactions involved are :

$2Li + O_2 \rightarrow 2LiO$

(Lithium oxide)

$2Na + O_2 \rightarrow Na_2O_2$

(Sodium peroxide)

$K + O_2 \rightarrow KO_2$

(Potassium superoxide)

(ii) The oxides of group-1 metals are strongly basic in nature. They dissolve in water forming aqueous solutions of strong alkali.

For example;

$2LiO\ (s) + H_2O\ (l) \rightarrow 2LiOH\ (aq)$

Group 2

These metals are protected from air oxidation by an oxide film formed on their surface. All the elements of group-2 burn when ignited in air forming MO type oxides. The product is a mixture of oxide and nitride as given below :

$2Mg + O_2 \rightarrow 2MgO$

$3Mg + N_2 \rightarrow Mg_3N_2$

Q.19 Ans. (i) Mole fraction: It is the ratio of number of moles of a particular component of a solution to the total number of moles of the solution. It is denoted by xm.
(ii) Molarity: The number of moles of the solute present in 1 litre of the solution. It is denoted by M.

Q.20 Ans. $He^{\oplus}$ is a hydrogen- like species having the nuclear charge Z = 2 and and for the first orbit n = 1

Radius of first orbit of $He^{\oplus}$

$$r_1 = \frac{52.9(n^2)}{Z} = \frac{52.9 \times 1^2}{2}$$

Energy of first orbit of He^{A}

$$E_n = -2.18 \times 10^{-18}\left(\frac{Z^2}{n^2}\right) J$$

$$= -2.18 \times 10^{-18}\left(\frac{2^2}{1^2}\right)$$

$$= -8.72 \times 10^{-18} J$$

Q.21 Ans. $Bi(OH)_3(s) + SnO_2^{2-}(aq) \rightarrow SnO_3^{2-}(aq) + Bi(s)$ (basic)

Step 1 : write skeletal equation

$Bi(OH)_3(s) + SnO_2^{2-}(aq) \rightarrow SnO_3^{2-}(aq) + Bi(s)$ (basic)

Step 2 : write their oxidation numbers

+3 +2

$Bi(OH)_3(s) + SnO_2^{2-}(aq)$

+4 0

$\rightarrow SnO_3^{2-}(aq) + Bi(s)$ (basic)

Step 3 : identify the species getting oxidized and reduced

3 +2

$Bi(OH)_3(s) + SnO_2^{2-}(aq)$

+4 0

$\rightarrow SnO_3^{2-}(aq) + Bi(s)$ (basic)

Species getting oxidized =Sn

(increase per atom =2)

Species getting reduced =Bi

(decrease per atom =2)

Step 4 : equalize the increase and decrease

$Bi(OH)_3(s) + SnO_2^{2-}(aq)$

$\rightarrow SnO_3^{2-}(aq) + Bi(s)$ (basic)

Step 5 : Balance all except H and O

$Bi(OH)_3(s) + SnO_2^{2-}(aq) + H+$

$\rightarrow SnO_3^{2-}(aq) + Bi(s)$

+ 2 OH-

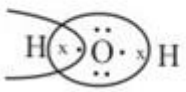
Hence balanced

Q.22 Ans. (a) In this Cu is getting reduced(oxidant) and S is getting oxidized (reductant).
(b) In this F is getting reduced and
© In this Iodine is getting reduced and Sulphur is getting oxidized .

Q.23 Ans. (i) CI and Br belong to the same group of halogens with Br having higher atomic number than CI. As the atomic number increases down the group the effective nuclear charge decreases. The increased shielding effect of core electrons can be notice. The electron has to be added to a father shell, which releases less energy and thus electron gain enthalpy becomes less negative down the group. Therefore, CI has more negative down the group. Therefore, CI has more negative electron gain enthalpy than Br.

(ii) F and O belong to the same second period, with F having higher atomic number than O. As the atomic number increases across a period, atomic radios decreases and electron can be added more easily. Therefore more energy is released with gain of an electron as we move to right in a period. Therefore, F has more negative electron gain enthalpy.

Q.24 Ans.

Electron Distribution in H_2O molecule	Shape of H_2O molecule	H-O-H bond angle
	'V' shape	104° 35'

Q.25 Ans.

$C = v\lambda \qquad \therefore v = \frac{C}{\lambda}$

$\therefore$ frequency of violet light =

$\frac{3 \times 10^{8}\ m\ s^{-1}}{400 \times 10^{-9}\ m} = 4.00 \times 10^{14}\ Hz$

and frequency of red light

$= \frac{3 \times 10^{8}\ m\ s^{-1}}{750 \times 10^{-9} m} = 4.00 \times 10^{14} Hz$

Q.26 Ans. i. The position of hydrogen is unique because it not only resembles alkali metals and halogens in certain properties but also differs from both of them in certain other properties.

ii. Resemblance with alkali metals:

iii. Like alkali metals, it also contains one electron in its valence shell.

iv. It has electropositive character. And it has strong tendency to lose one electron to form hydrogen ion.

v. Like alkali metals, it also combines with non-metal to form their oxides, halides and sulphides.

vi. It liberated at cathode in the same way alkali metals are liberated at the cathode.

vii. Hydrogen is a strong reducing agent.

Resemblance with Halogens:

i. Like halogens, they also require only one electron for the stable configuration nearest inert gas.

ii. They have a strong tendency to gain one electron to form hydride ion.

iii. It has almost similar ionization enthalpy with those of halogens.

iv. Like halogens, it shows an oxidation state of -1.

v. Just like halogens, hydrogen also exists as diatomic molecule.

Section D (SA II - 4 MARKS EACH)

Attempt any Three: **12**

Q.27 Ans. The rules to assign oxidation number are:

(i) The oxidation number of each atom of an element in Free State is zero. Thus each atom in H_2, Cl_2, O_3, S_8, O_2, Ca, etc. has oxidation number of zero.

(ii) The oxidation number of an atom in a monatomic ion is equal to its charge. Thus alkali metals have oxidation number +1 in all their compounds. Alkaline earth metals have oxidation number +2 in all their compounds. Al is considered to have +3 as its oxidation number in all its compounds.

(iii) The oxidation number of O is usually -2 in all of its compounds except in peroxide or peroxide ion where it has oxidation number of -1 and in superoxide each oxygen has oxidation number -1/2.

(iv) The oxidation number of H atom is either +1 or -1. When the H atom is bonded to non-metals, its oxidation number is +1. When it is bonded to metals, it possesses oxidation number of -1.s

(v) The oxidation number of F is -1 in all of its compounds. The other halogens Cl, Br and I usually exhibit oxidation number of -1 in their halide compounds. However in compounds in which halogens Cl, Br and I are bonded to oxygen, oxidation number of halogens is +1.

(vi) The algebraic sum of oxidation number of all the atoms in a neutral molecule is zero.

vii) The algebraic sum of oxidation numbers of all the atoms in a polyatomic ion is equal to net charge of the ion.

(viii) When two or more atoms of an element are present in molecule or ion, oxidation number of the atom of that element will be average oxidation number of all the atoms of that element in that molecule.

(ix) By applying rules 1 to 5, it is possible to determine oxidation numbers of atoms of various elements in molecules or ions. For doing this the rules 6, 7 and 8 are useful.

Q.28 Ans. (i) This theory was proposed by Dalton.

(ii) This theory came into existence in 1808.

(iii) Dalton published the theory as "A New system of chemical philosophy".

(iv) Matter consists of tiny, indivisible particles called atoms.

(v) All atoms of a given element have identical properties like mass , shape , size etc

(vi) Atoms of different elements are different.

(vii) Compounds are formed when atoms of different elements combine together in a fixed simple whole number ratio.

(viii) Chemical reactions involve only reorganization of atoms.

(ix) Atoms are neither created nor destroyed during a chemical reaction.

Q.29 Ans. (i) The elements in which the last electron enters (n- 2) f orbitals are called f- block elements. These elements are also called as inner transition elements because they form a transition series within the transition elements.

(ii) The f-block is placed separately at the bottom of the Periodic Table.

(iii) As there are seven orbitals in a F-subshell, the general outer electronic configuration of the f-block is ns^2 $(n-1)d^{0-1}$ $(n-2)$ f^{1-14}.

(iv) These are divided into two series that are lanthanide series and actinide series.

(v) The first series of elements are called lanthanides and include elements with atomic numbers beginning from 57 and ending at 71. Except for promethium which is radioactive.

(vi) The second series of elements are called actinides and include elements with atomic numbers beginning from 89 and ending at 103. These elements generally have a radioactive nature.

(vii) These elements are non-radioactive The Lanthanide and Actinide series are named after their preceding elements lanthanum and actinium in the third group of the d-block of the 6th and 7th period respectively.

(viii) The Lanthanides are also known as rare earth elements. The last electron of the elements of these series is filled in the (n-2) f subshell, and therefore, these are called inner-transition elements. These elements have very similar properties within each series.

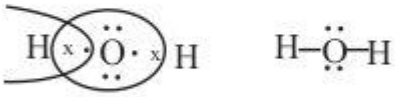
(ix) The actinide elements beyond Uranium are called transuranium elements. All the transuranium elements are manmade and radioactive.

Q.30 Ans.

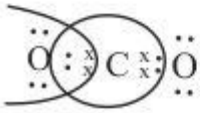
(a) Hydrogen (H_2)

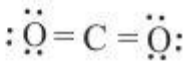
H–H

(b) Water (H_2O)

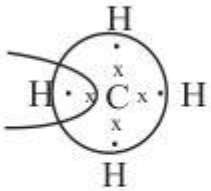


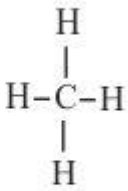
(c) Carbon dioxide (CO_2)





(d) Methane (CH_4)





(e) Lithium fluoride (LiF)

Q.31 Ans. The anomalous behaviour is :

EXCEPTIONAL ELECTRONIC CONFIGURATION OF CHROMIUM AND COPPER

For Copper (Cu)= [Ar] ^{18},$4s^2 3d^9$

But actually, it has : [Ar] ^{18},$4s^1 3d^{10}$

Similarly, for Chromium it should be: [Ar] ^{18},$4s^2 3d^4$

But in actual it is:=[Ar] ^{18},$4s^1 3d^5$

The reason behind is:

1. All half-filled and fully filled orbital are more stable

If configuration is $4s^2\ 3d^9$, then the d orbital is not fully filled. If configuration is $4s^1\ 3d^{10}$, then the d orbital is completely filled. That means it becomes more stable.

2. The more is the exchange energy more stable is the orbital as shown below:

If configuration was $4s^2 3d^4$ the exchange energy is:

Total number of exchanges = 3 + 2 + 1 = 6

If configuration is $4s^1 3d^5$the exchange energy is:

Total number of exchanges = 4 + 3 + 2 + 1 = 10

So, more is the exchange energy -more is the stability.