Shri Shantadurga Higher Secondary School, Bicholim-Goa.
First Terminal Examination October-2019

Std: XI Science **Answer key** **Max Marks: 55**

Date: 21/10/2019 **Chemistry** **Duration: 150 Minutes**

Instructions:-

*1. All questions are compulsory; however question **8, 24,** and **25** has internal choice.*

*2. Use of calculator is **not permitted**, however logarithmic table will be provided on request.*

3. Every Question should be attempted only once.

Section-A consists of 7 questions of 1 mark each.
Section-B consists of 8 questions of 2 marks each.
Section-C consists of 8 questions of 3 marks each.
Section-D consists of 2 questions of 4 marks each.

$N_A = 6.022 \times 10^{23}$;

At mass (u): H=1, C=12, O=16, S=32; K=39

Section-A

Q.1. Shape of Boron Trifluoride molecule is------- **Trigonal planar** ------ **(1)**

Octahedral # Tetrahedral # Trigonal planar # Pyramidal

Q.2 A graph plotted at a constant volume is called __ **isochore** _ . **(1)**

isobar # isochore # isotherm # isomer

Q.3. In the chemical reaction **$2Na + 2D_2O \rightarrow 2A+B$**, **(1)**

A & **B** are **$NaOD$ & D_2**

NaOH & H_2O # NaOH & D_2O # NaOD & D_2 # Na_2D & D_2

Q.4. An example of a nucleophile is __ **H_2O** ___ . **(1)**

$AlCl_3$ # H^+ # BF_3 # H_2O

Q.5. Name the spectral series of hydrogen atom **spectrum** that lies in **UV** region? **(1)**

Ans: Lyman series

Q.6. Write **any two** properties of the **transition** metals. **(1)**

- Most of them exhibit variable oxidation states because of the presence of partly filled d- orbitals. *(Except Sc, Zn, Cd etc.)*
- Many of their compounds are coloured.
- They readily form complexes by acting as Lewis acids.
- They easily form coloured complexes
- Most of them and their compounds show ferromagnetic & paramagnetic behaviour.
- They act as good catalysts.

Q.7. Write the chain isomers for the compound having the molecular formula **C_4H_{10}** **(1)**

a) CH_3-CH_2-CH_2-CH_3

b) CH_3-CH-CH_3
|
CH_3

Section-B

Q.8 23g of **Ethyl alcohol** (Molar mass = 45g mol^{-1}) is dissolved in 54g of **water** (Molar mass=18g mol^{-1}). **(2)**

Calculate the **mole fraction** of ethyl alcohol and water in solution.

Ans: $n_{ethylalcohol} = \frac{23}{45} = 0.5111$

$n_{water} = \frac{54}{18} = 3.0$

$n_{ethylalcohol} + n_{water} = 0.5111 + 3.0 = 3.511$

$X_{ethylalcohol} = \frac{0.5111}{3.511} = 0.1455$

$X_{Water} = \frac{3.0}{3.511} = 0.8544$

OR

Q.8 Calculate the following **(2)**

1. Mass of **One atom of Iodine** *(Given atomic mass of Iodine=129 u)*

1) mass of 1 atom of Iodine= 129u

1 mole = 6.022×10^{23}

129 u = 6.022×10^{23} atoms of Iodine

X u = 1 atom of Iodine

$X = 129/6.022 \times 10^{23}$

= 21.42×10^{-23} u of Iodine **or** 2.142×10^{-24} u of Iodine

2. Number of atoms in **0.5 moles of Calcium** atoms. *(Given atomic mass of Calcium=40 u)*

2) 1 mole of Ca atom = 6.022×10^{23}atoms

0.5 mole of Ca atom = X atoms

$X = 6.022 \times 10^{23} \times 0.5$

$X = 3.011 \times 10^{23}$ atoms of Ca

Q.9 Define **Electronegativity**. Write its trends across the period and down the group. **(2)**

Ans. **Electronegativity** of an element is the tendency of its atom to attract the shared pair of electrons towards itself in a covalent bond.

or

It is a qualitative measure of the ability of an atom in a chemical compound to attract the shared electrons to itself.

Across the period it increases (except for noble gases)

Down the group it decreases

Q.10 Answer the following: **(2)**

i. Name two ions which are **isoelectronic** with Ne.

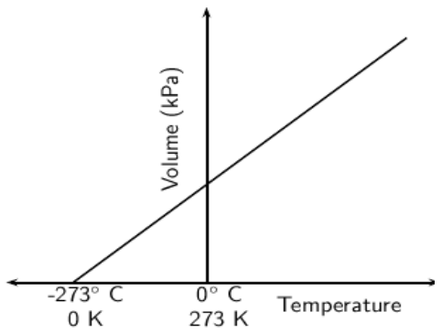
Ans. $\mathbf{O^{-2}}$ / $\mathbf{F^{-1}}$ / $\mathbf{Mg^{2+}}$ / $\mathbf{Na^{+1}}$

ii. Explain the trend observed for **atomic radius** across the period and down the group.

Ans. **Across the period it decreases.**

Down the group it increases

Q.11 Answer the following questions w.r.t. graph shown below.. **(2)**



1. Name the law depicted in above graph.
   Ans: **Charles law**.
2. What is **absolute zero**.
   The lowest hypothetical or imaginary temperature at which gases are supposed to occupy zero volume is called **Absolute zero.**

Q.12 Write a point of **similarity** and a point of **difference** between **hydrogen** and **halogen**. **(2)**

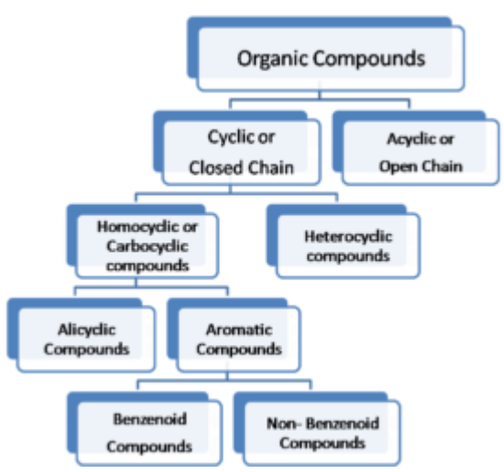
Hydrogen has one electron in its electron shell, needing one additional electron to fill that shell. The halogens all have seven electrons in their outer electron shells. These electron shells all need eight electrons for completion, so the halogens are also missing a single electron. The effect of this is that both hydrogen and the halogen elements can form negative ions by the addition of one electron to the outer energy shell. Hydrogen, however, also forms a positive ion by losing its one electron; no halogen does this.

Q.13 Wrie two points of difference between **ionic** hydrides and **covalent** hydrides. **(2)**

Ans.

ionic hydrides	**covalent hydrides**
⦿ Forms with s-block elements . ⦿ Form covalent(Li ,Be,Mg) and ionic hydride . ⦿ Ionic hydrides non-volatile	⦿ Forms with p-block elements . ⦿ Form covalent hydrides, form molecular compound ⦿ Volatile

Q.14 Write a complete classification of **carbocyclic** compounds. **(2)**



Q.15 Answer the following. **(2)**

1 .What is **acid rain**?

Ans. Pollutants like sulphur dioxide and nitrogen dioxide liberated into the air by industries reacts with water vapour in air to form sulphuric **acid** and nitric **acid**.Due to harmful chemicals in air, pH of rain water drops below 5.6 making it acidic. This is called acid rain.

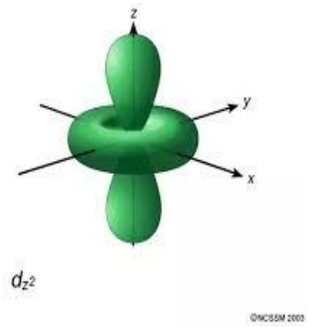
2. State any two gases responsible for the **green house** effect.

Ans. CO_2, Methane, water vapour, ozone , CFC , Nitrous Oxide.

Section-C

Q.16. Answer the following. **(3)**

1. Draw the shape of dz^2 orbital.



2. What is **black body** radiation?

Ans: The ideal body, which emits and absorbs all frequencies, is called a black body and all radiation emitted by such a body is called black body radiation.

3. Write the electronic configuration of **Sc**(Z=21)

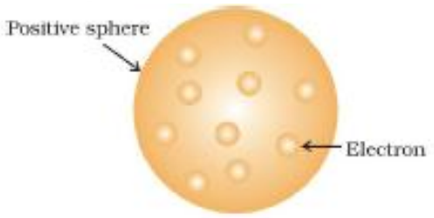
$$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$$

Q.17. Answer the following. **(3)**

1. State **Aufbau** Principle.

In the ground state of the atoms, the orbitals are filled in order of their increasing energies.

2. Draw a neat label diagram of **Thomson** model of atom.



3. Write any two limitations of **Bohr's** model of atom.

Ans: i) Bohr's model could not explain the spectrum other than hydrogen.

ii) Bohr's theory was unable to explain the splitting of spectral lines in the presence of magnetic field (Zeeman effect) or an electric field (Stark effect).

iii) It could not explain the ability of atoms to form molecules by chemical bonds.

Q.18 Answer the following. **(3)**

1. State **Avogadro**'s law.

It states that equal volumes of gases at the same temperature and pressure should contain equal number of molecules.

2. Write a point of difference between **molarity** and **molality**.

Molarity	Molality
It is defined as the number of moles of the solute in 1 litre of the solution. Unit = M Depends on Temperature	It is defined as the number of moles of solute present in 1 kg of solvent. Unit = m Does not depend on Temperature

3. Name the following:
   a) The mass of **one mole** of a substance in grams

   molar mass

   b) Property of a substance which can be measured or observed without changing the **identity** or **composition** of a substance

   physical property

Q.19 Write the full form of **VSEPR** Theory and write its **Four** Postulates **(3)**

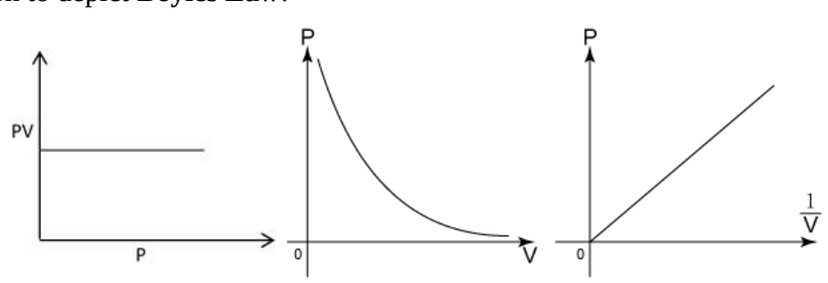
THE VALENCE SHELL ELECTRON PAIR REPULSION THEORY

- The shape of a molecule depends upon the number of valence shell electron pairs (bonded or nonbonded) around the central atom.
- Pairs of electrons in the valence shell repel one another since their electron clouds are negatively charged.
- These pairs of electrons tend to occupy such positions in space that minimise repulsion and thus maximise distance between them.
- The valence shell is taken as a sphere with the electron pairs localising on the spherical surface at maximum distance from one another.
- A multiple bond is treated as if it is a single electron pair and the two or three electron pairs of a multiple bond are treated as a single super pair.
- Where two or more resonance structures can represent a molecule, the VSEPR model is applicable to any such structure.

Q.20 **Answer the following.** **(3)**

1. Liquids at high altitudes boil at **lower temperatures** in comparison to that at sea level. Give reason.
   Ans: At high altitudes atmospheric pressure is low. Therefore liquids at high altitudes boil at lower temperatures in comparison to that at sea level.
2. State '**Dalton's Law** of Partial Pressure.
   Ans: 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**
3. What is **surface tension**?
   Ans: **Liquids tends to minimize their surface area because molecules of the liquid on the surface experience net attractive force towards the interior of the liquid, this characteristic property of the liquid is known as Surface Tension**

Q.21 Draw a graph to depict **Boyles Law**. **(3)**



Any one

A balloon with a volume of 2.0 L is filled with a gas at 3 atmospheres. If the pressure is reduced to 0.5 atmospheres without a change in temperature, calculate what would be the volume of the balloon?

Solution:

Since the temperature doesn't change, Boyle's law can be used. Boyle's gas law can be expressed as:

Formula : $P_1V_1 = P_2V_2$

where

- P_1 = initial pressure = 3 atm
- V_1 = initial volume = 2.0 L
- P_2 = final pressure =0.5 atm
- V_2 = final volume =?

To find the final volume, solve the equation for V_2:

- $V_2 = P_1V_1/P_2$
- V_2 = (2.0 L) (3 atm) / (0.5 atm)
- V_2 = 6 L / 0.5 atm
- V_2 = 12 L

Answer

The volume of the balloon will expand to 12 L.

Q.22 Answer the following questions: **(3)**

What is **syn** gas? Explain a method used to remove **temporary hardness** of water.

Ans. Syn gas or synthesis gas is a Mixture of CO and H_2

Ans . Temporary hardness of water can be removed by Boiling **OR** by Clarks method. (Any one)

- **Boiling :**

$$Mg(HCO_3)_2 \xrightarrow{\text{Heating}} Mg(OH)_2 \downarrow + 2CO_2 \uparrow$$

$$Ca(HCO_3)_2 \xrightarrow{\text{Heating}} CaCO_3 \downarrow + H_2O + CO_2 \uparrow$$

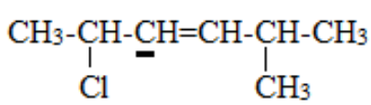
- **Clarks method :**

$$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 \downarrow + 2H_2O$$

1) Hydrogen peroxide is stored in **wax lined** glass bottle. Give reason.

Ans. Because metal surfaces or traces present in glass container ,H_2O_2 decomposes to give H_20 and O_2 .

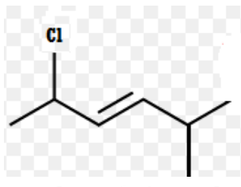
Q.23 Answer the following with respect to the given organic compound **(3)**



(i) Write the **hybridization** of the underlined species.

Ans: sp^2

(ii) Write the **bond line** structure.



(iii) Count and write the total number of **sigma** bond and **pi** bond

Ans: sigma = 20 and pi = 1

Section-D

Q.24 With respect to **Sigma bond**, answer the following questions. **(4)**

a) Name the different types of overlapping of atomic orbitals that leads to this bond formation.

Ans: **s-s, s-p and p-p overlap**

b) Why it is stronger than pi bond?

Ans: **because overlapping is axial (along the axis) and extent of overlap is maximum.**

c) Write its one point of difference with pi bond w.r.t free rotation of atoms.

Ans: **free rotation of atoms is not possible in pi bond whereas it is possible in sigma bond.**

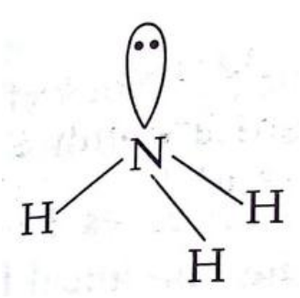
d) How many such bonds are present in C_2H_4 Molecule?

Ans: **five**

OR

Q.24 With respect to NH_3 **(Ammonia**) molecule answer the following. **(4)**

a) Draw the **shape** of the molecule.



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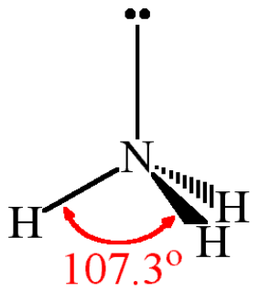

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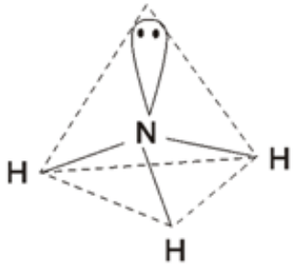
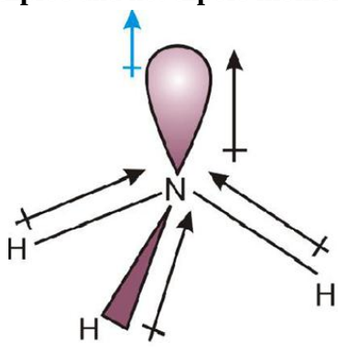


b) Show the **Bond diploe** and net **dipole moment** in this molecule.



c) Write the number of **lone pairs** and **bond pairs** on **Nitrogen** atom.

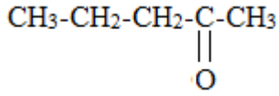
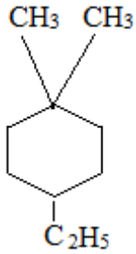
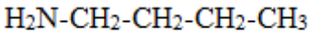
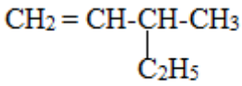
Ans: **lone pairs** = **One** and **bond pairs = Three**

d) Comment on its arrangement of bond pairs and lone pairs and also on its geometry.

Ans: Arrangement of bond pairs = **Tetrahedral**

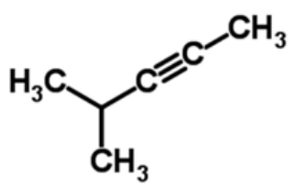
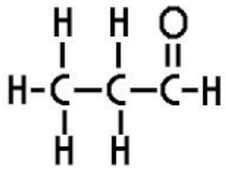
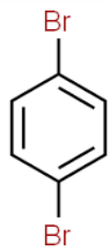
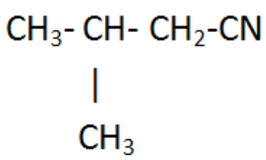
Geometry : **Pyramidal**

Q.25 Write the **IUPAC** name for the given compound: **(4)**

1. 	Pent-2-one
2. 	4-ethyl-1,1-dimethylcyclohexane
3. 	Butanamine
4. 	3-methylpentene

OR

Q.25 Write the structure for the following compounds: **(4)**

4-methylpent-2-yne	
Propanal	
p-dibromobenzene	
3-methylbutanenitrile	

**********THE END **********

Resemblance of hydrogen with halogens

1) Both hydrogen and halogens require one electron to complete their valence shell.

2) Both hydrogen and halogens are non-metals (Except iodine which has partial metallic character).

3) Both hydrogen and Halogens acts as negative ions when combined with metals.

4) Their molecules are diatomic.

5) Like Halogens, hydrogen can also form both ionic and covalent bond.

Explanation:

Hydrogen: NaH (ionic), CH_4 (Covalent)

Halogens: NaCl (ionic), HCl (Covalent)

6) Both Hydrogen and Halogens form compounds with metals and non-metals.

Explanation:

Hydrogen: H_2S [S = Non-metal] ; CaH_2 (Ca= Metal)

Halogens: HCl [H = Non-metal] ; $CaCl_2$ (Ca = Metal)