Shri Shantadurga Higher Secondary School, Bicholim-Goa.

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

Day: – Wednesday | **(Subject:-Chemistry)** | **Date:- 29-03-2017**

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

Total No of Questions: -5 | **Second Terminal Examination- March 2017** | **Total No of Printed pages: 4**

Q 1 A A mixture of acetic acid and sodium acetate acts as ___**Acidic buffer**____solution. **1**

Acidic buffer # Basic buffer # Neutral buffer # Ionic buffer

Q 1 B **3**

Answer the following

a) State the law of chemical equilibrium.

Ans

At a given temperature, the product of concentrations of the reaction products raised to the respective stoichiometric coefficient in the balanced chemical equation divided by the product of concentrations of the reactants raised to their individual stoichiometric coefficients has a constant value.

The equilibrium constant for a general reaction,

$$a\,A + b\,B \rightarrow c\,C + d\,D \text{ is expressed as,}$$

$$K_c = [C]^c[D]^d / [A]^a[B]^b$$

where [A], [B], [C] and [D] are the equilibrium concentrations of the reactants and products.

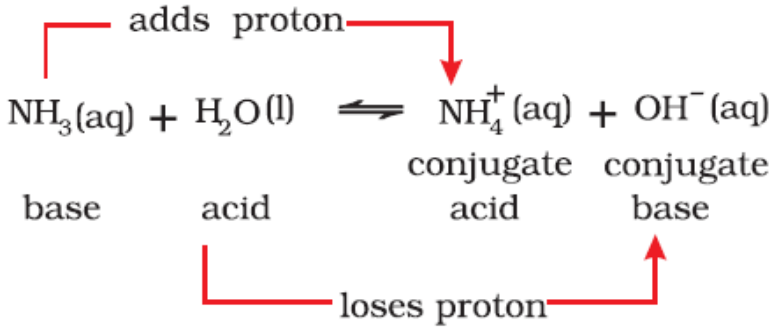
b) Write one point of difference between Homogenous and Heterogeneous equilibrium.

In a homogeneous system, all the reactants and products are in the same phase and Equilibrium in a system having more than one phase is called heterogeneous equilibrium

c) What is a conjugate acid-base pair?

The acid-base pair that differs only by one proton is called a **conjugate acid-base pair**.

OR



Therefore, OH^- is called the conjugate base of an acid H_2O and NH_4^+ is called conjugate acid of the base NH_3.

Q 1 C — **3**

Answer the following

1. Write the expression for the equilibrium constant, *Kc* for the following reaction:

$$2NOCl\ (g) \rightarrow 2NO\ (g) + Cl_2\ (g)$$

Ans:

$$K_c = \frac{\left[NO_{(g)}\right]^2\left[Cl_{2(g)}\right]}{\left[NOCl_{(g)}\right]^2}$$

2. For the equilibrium system described by

$$2\ SO_{2\ (g)} + O_{2\ (g)} \rightarrow 2\ SO_{3\ (g)}$$

at a particular temperature the equilibrium concentrations of SO_2, O_2 and SO_3 were 0.75 M, 0.30 M, and 0.15 M, respectively. Calculate the equilibrium constant, K_c, for the reaction.

Ans.

Equilibrium constant expression for the balanced equation:

$$K_{eq} = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$

substitute the known values, and solve for the Unknown K_{eq}

$$K_{eq} = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{(0.15)^2}{(0.75)^2(0.30)} = 0.13$$

3. Write the expression for solubility product for the following

$K_3\ PO_4$

$K_{sp} = [K^+]^3[PO_4{}^{3-}]$

Q 1 D — **2**

Answer the following questions.

1. Name the salts present in temporary hard water and permanent hard water.

Temporary	Permanent
$Ca(HCO_3)_2$ /$Mg(HCO_3)_2$	Chlorides and sulphates of Ca and Mg

2. Write a chemical equation showing laboratory method for preparation of Dihydrogen gas

$$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$$ or $$Zn + 2NaOH \rightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + H_2$$

Q 1 E — **2**

Write the formula and one use of the following

1. **Heavy water**

__ **D_2O** __It_is used as a moderator in nuclear reactors

2. **Hydrogen peroxide**

H_2O_2 It is used in pollution control treatment of domestic and industrial effluents. it is used as a hair bleach and as a mild disinfectant. As an antiseptic it is sold in the market as perhydrol . It is used to manufacture chemicals like sodium perborate and per-carbonate It is used in the synthesis of hydroquinone, tartaric acid and certain

	food products and pharmaceuticals (cephalosporin) etc It is employed in the industries as a bleaching agent for textiles, paper pulp, leather, oils, fats, etc	
Q 2 A	The saline Hydride from the following is ____ **$\underline{BeH_2}$** ____ # H_2O # $VH_{0.56}$ # BeH_2 # CH_4	**1**
Q 2 B	Answer the following. a) Determine the Oxidation number of the underlined element in following compounds 1. $K\underline{Mn}O_4$ 2. $\underline{S_2}O_3^{2-}$	**3**

$K\underline{Mn}O_4$	$\underline{S_2}O_3^{2-}$
Let the O.N of Mn be x O.N of K=1 and O.N of O= -2 Therefore 1+x+4 X -2=0 1+x -8=0 X=+7 Therefore O.N of Mn = +7	Let the O.N of S be x O.N of O= -2 Therefore 2x+3X -2= -2 2x -6 = -2 2x =-2 +6 ie 2x = +4 or x= +2 Therefore O.N of S = +2

b) Write a note on Green Chemistry.

Ans.

Green chemistry is a strategy for controlling environmental pollution. It utilizes the existing knowledge and practices so as to bring about reduction in the production of pollutants

c) What is Acid rain and how it is caused?

Normally rain water has a pH of 5.6. When the pH of the rain water drops below 5.6, it is called acid rain. Acid rain refers to the ways in which acid from the atmosphere is deposited on the earth's surface. Acid rain is a byproduct of a variety of human activities that emit the oxides of sulphur and nitrogen in the atmosphere.

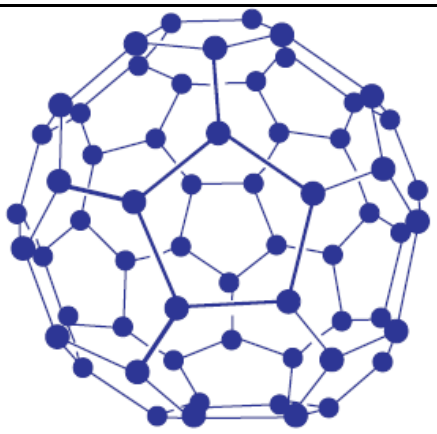
SO_2 and NO_2 after oxidation and reaction with water are the major contributors to acid rain, as polluted air contains particulate matter that catalyse the oxidation.

$2SO_2(g) + O_2(g) + 2H_2O(l) \longrightarrow 2H_2SO_4(aq)$

$2NO_2(g) + O_2(g) + 2H_2O(l) \longrightarrow 4HNO_3(aq)$

Q 2 C	Answer the following. 1) Using the standard electrode potentials given below, predict if the reaction between the following is feasible or not **$Fe + Cd^{2+} \rightarrow Cd + Fe^{2+}$** $E^0 (Cd^{2+}/ Cd) = -0.44$ V and $E^0 (Fe^{2+}/ Fe) = -0.74$ V 2) Identify the Oxidising and Reducing agent in the following reaction. $3CuO + 2NH_3 \rightarrow 3Cu + N_2 + 2H_2O$	**3**

	3) Write the Oxidation and Reduction half-cell reaction for the following cell $Al \mid Al^{3+}_{(1M)} \parallel Cu^{2+}_{(1M)} \mid Cu$	
Q 2 D	Define the following. 1) Oxidation 2) Reduction 3) Oxidising agent 4) Reducing agent ***Ans :*** ***Oxidation:*** Loss of electron(s) by any species. ***Reduction:*** Gain of electron(s) by any species. ***Oxidising agent :*** Acceptor of electron(s). ***Reducing agent :*** Donor of electron(s). **OR** ***Oxidation:*** An increase in the oxidation number of the element in the given substance. ***Reduction:*** A decrease in the oxidation number of the element in the given substance. ***Oxidising agent:*** A reagent which can increase the oxidation number of an element in a given substance. These reagents are called as **oxidants** also. ***Reducing agent:*** A reagent which lowers the oxidation number of an element in a given substance. These reagents are also called as **reductants**.	**2**
Q 2 E	Answer the following. I. Write two functions of **salt bridge** Ans: It connects the two half cells and maintains the electrical neutrality II. Write the IUPAC names for the following compounds. a. $CH_3CH(CH_3)CH_2OH$ 2-Methylpropan-1-ol b. $CH_3CH_2CH_2NH_2$ Propan-1-amine	**2**
Q 3 A	The general electronic configuration of the outermost orbit in the case of alkaline earth metal is:_____ **ns^2**_____ **# ns^2np^1 # ns^2 # ns^2np^2 # ns^1**	**1**
Q 3 B	Answer the following. 1. Look at the structure shown below and answer the questions	**3**



1.Name this structure

The structure of C60,

Buckminsterfullerene or *bucky balls*

2. Number of six membered rings present in it.

Twenty

3.Type of Hybridization that carbon atom has undergone

sp2 hybridisation

4. How it is prepared.

By **heating of graphite** in an electric arc in the presence of inert gases such as helium or argon.

2. Name some important compounds of silicon

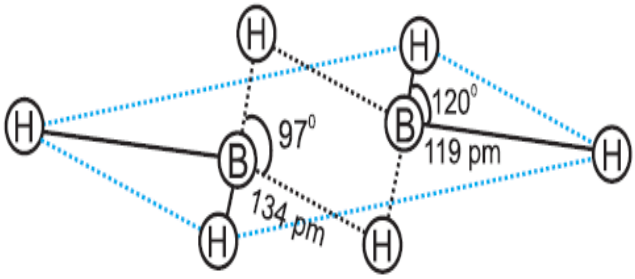
Silicon Dioxide, Silicones & Silicates

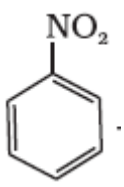
Q 3 C Answer the following. **3**

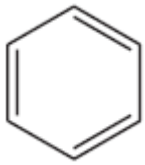
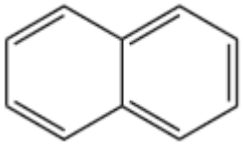
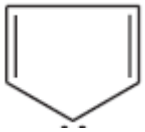
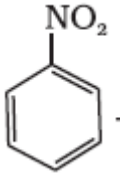
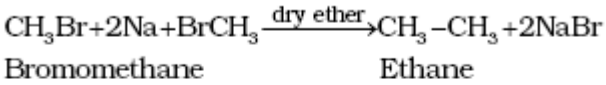
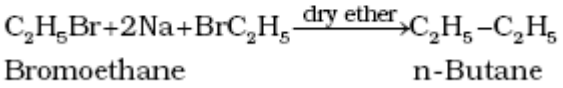
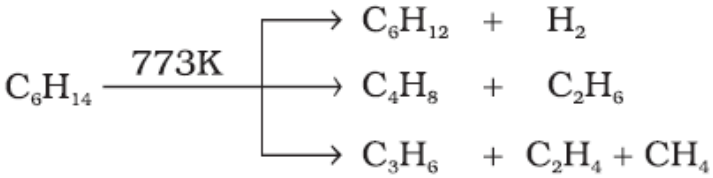
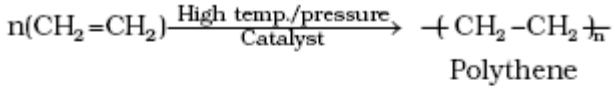
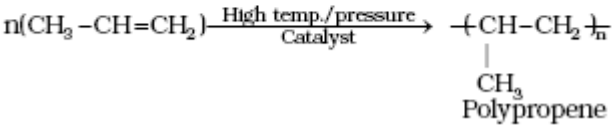
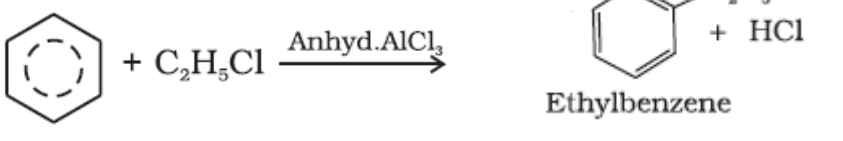
1. Write any four points of difference between Diamond & Graphite.

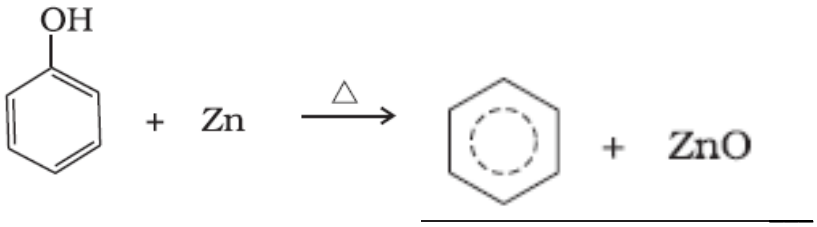
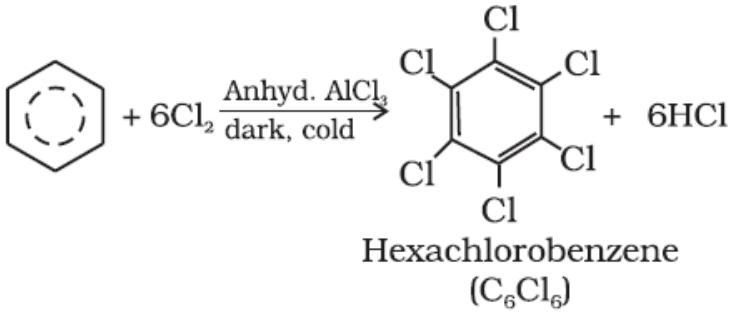
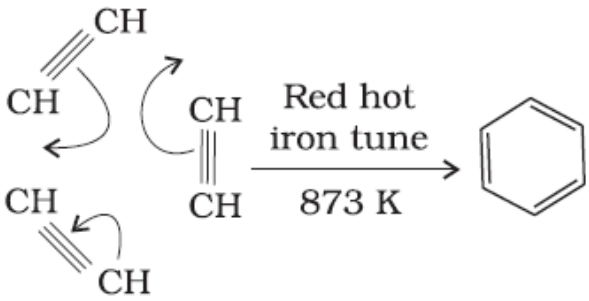
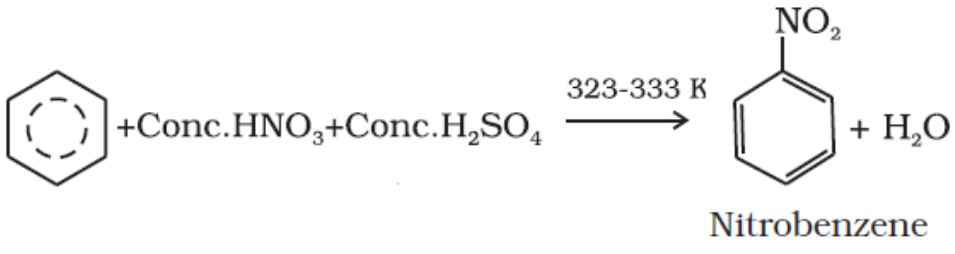
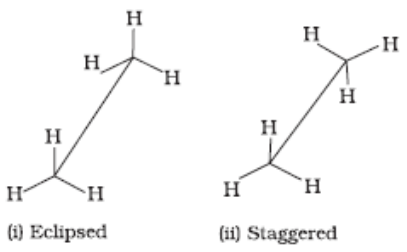
Graphite	Diamond
Graphite has layered structure. Layers are held by van der Waals forces and distance between two layers is 340 pm.	It has a crystalline lattice. The structure extends in space and produces a rigid three dimensional network of carbon atoms.
Each carbon atom undergoes sp^2 *hybridisation*	each carbon atom undergoes sp^3 *hybridisation*
C—C bond length within the layer is 141.5 pm.	The C–C bond length is 154 pm.
it is very soft and slippery	It is a hardest substance on the earth.
It is used as a dry lubricant in machines running at high temperature.	It is used as an abrasive for sharpening hard tools, in making dies and in the manufacture of tungsten filaments for electric light bulbs.
Good conductor of electricity	Bad conductor of electricity
Very cheap	Very costly
Graphite are malleable and are formed form layers of carbon atom joined together by 3 covalent bonds.	Diamond have a tetrahedral structure formed by 4 covalent bonds

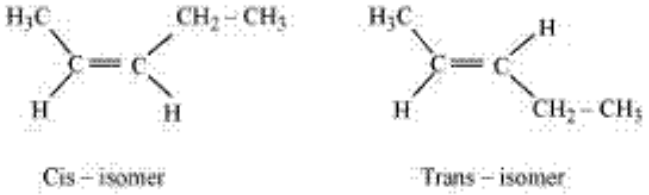
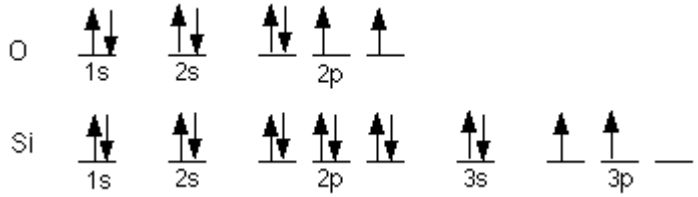
2. Draw the structure of Diborane



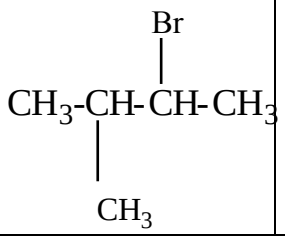
Q 3 D	Write **<u>any four</u>** points of similarities between lithium & Magnesium. (i) Both lithium and magnesium are harder and lighter than other elements in the respective groups. (ii) Lithium and magnesium react slowly with water. Their oxides and hydroxides are much less soluble and their hydroxides decompose on heating. Both form a nitride, Li_3N and Mg_3N_2, by direct combination with nitrogen. (iii) The oxides, Li_2O and MgO do not combine with excess oxygen to give any superoxide. (iv) The carbonates of lithium and magnesium decompose easily on heating to form the oxides and CO_2. Solid hydrogencarbonates are not formed by lithium and magnesium. (v) Both LiCl and $MgCl_2$ are soluble in ethanol. (vi) Both LiCl and $MgCl_2$ are deliquescent and crystallise from aqueous solution as hydrates, $LiCl \cdot 2H_2O$ and $MgCl_2 \cdot 8H_2O$.	**2**
Q 3 E **Q 3 E**	Comment on following properties with respect to Alkaline earth metals **1. <u>Ionization enthalpy</u>** ➢ The alkaline earth metals have low ionization enthalpies due to fairly large size of the atoms. ➢ Since the atomic size increases down the group, their ionization enthalpy decreases ➢ The first ionisation enthalpies of the alkaline earth metals are higher than those ➢ of the corresponding Group 1 metals.(This is due to their small size as compared to the corresponding alkali metals.) ➢ It is interesting to note that the second ionisation enthalpies of the alkaline earth metals are smaller than those of the corresponding alkali metals **2. <u>Atomic and ionic radii.</u>** ➢ The atomic and ionic radii of the alkaline earth metals are smaller than those of the corresponding alkali metals in the same periods.(This is due to the increased nuclear charge in these elements.) ➢ Within the group, the atomic and ionic radii increase with increase in atomic number **OR** Give reason for the following (i) The hydroxides of alkali metals are strong bases. **Due to high enthalpy of hydration** (ii) Be and Mg does not give colour to the flame whereas other alkaline earth metals do so. **The electrons in beryllium and magnesium are too strongly bound to get excited by flame. Hence, these elements do not impart any colour to the flame.**	**2**
Q 4 A	 The compound which does not obey Huckel rule is _____	**1**

	#  #  #  # 	
Q 4 B	Explain the following name reactions with equation **a) Wurtz Reaction** Alkyl halides on treatment with sodium metal in dry ethereal (free from moisture) solution give higher alkanes. This reaction is known as **Wurtz reaction** and is used for the preparation of higher alkanes containing even number of carbon atoms.  Bromomethane Ethane  Bromoethane n-Butane **b) Pyrolysis** Higher alkanes on heating to higher temperature decompose into lower alkanes, alkenes etc. Such a decomposition reaction into smaller fragments by the application of heat is called pyrolysis or cracking.  **c) Polymerisation Reaction** Polythene is obtained by the combination of large number of ethene molecules at high temperature, high pressure and in the presence of a catalyst. The large molecules thus obtained are called polymers. This reaction is known as **polymerisation.** The simple compounds from which polymers are made are called **monomers.**  Polythene  Polypropene Polymers are used for the manufacture of plastic bags, squeeze bottles, refrigerator dishes, toys, pipes, radio and T.V. cabinets etc.	**3**
Q 4 C	Complete the following chemical equations by replacing A,B,C,D,X and Y (i)  Ethylbenzene	**3**

	(ii)  (iii)  	
Q 4 D	Write chemical equations showing how you will carry out following conversions. 1) Ethyne to Benzene  2) Benzene to Nitrobenzene  	**2**
Q 4 E	Draw the following 1) Draw the Sawhorse projection formulae of ethane in staggered and eclipsed forms.  *Sawhorse projections of ethane*	**2**

	2) Geometrical isomers of Hex-2-ene Geometrical isomers of hex-2-ene are:  Cis – isomer Trans – isomer	
Q 5 A	____**3f** ____orbital of the following is an incorrect orbital notation. **# 2s # 2p # 3f # 3d**	**1**
Q 5 B	Answer the following **(i)** Draw the orbital diagrams for O and Si. How many unpaired electrons are in each of these? **Ans.**  There are 2 unpaired electrons in each. (ii) For the principle quantum no**. n = 4**; How many types of orbitals are there? How many electrons can be accommodated in the complete principle shell? **Ans.** For n = 4, there are four possible values for l. They are; 0 .... s orbitals 1 .... p orbitals 2 .... d orbitals 3 .... f 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 l = 3, ml = -3,-2, -1, 0, 1, 2,3 = 14 electrons **Each orbital can accommodate 2 electrons hence total no. of electrons = 32**	**3**

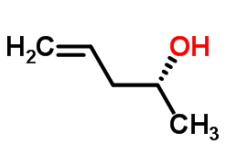
Q 5 C — Write the IUPAC names for the following compounds — **3**

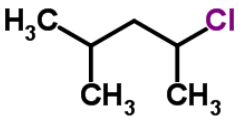
1. CH_3-CHO	Ethanal
2. CH_3COCH_3	Propanone
3. 	2-Bromo-3-methylbutane

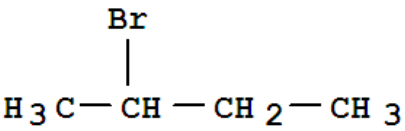
OR

Q 5 C — Write the structures for the following compounds by rewriting their IUPAC names — **3**

I. Pent-4-en-2-ol
II. 2-Chloro-4-methylpentane
III. 2-Bromobutane

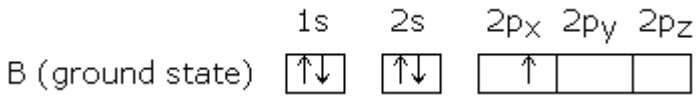


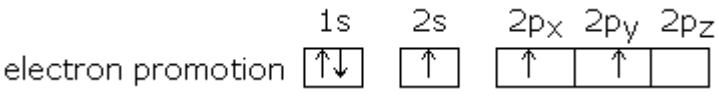




Q 5 D — **Deduce the Hybridization of Boron in BF_3** — **2**

The ground state electronic configuration of B is $1s^2\ 2s^2\ 2p^1$. The promotion of one '2s' electron to one of the empty '2p' orbital permits the possibility of 'sp^2' hybridisation. The three 'sp^2' hybrid orbitals are oriented at 120^o in a plane giving a trigonal geometry around the boron atom.





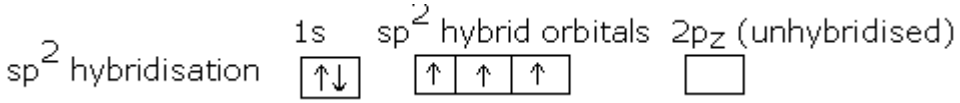


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Illustration: Boron fluoride - BF_3

Fluorine has one half filled p orbital and boron has three half filled 'sp^2' filled orbitals at 120°angle. The half-filled p orbital of fluorine overlaps with each of the sp^2 hybrid orbitals of B to form sigma bond between B and F giving it a trigonal planar or triangular planar geometry.

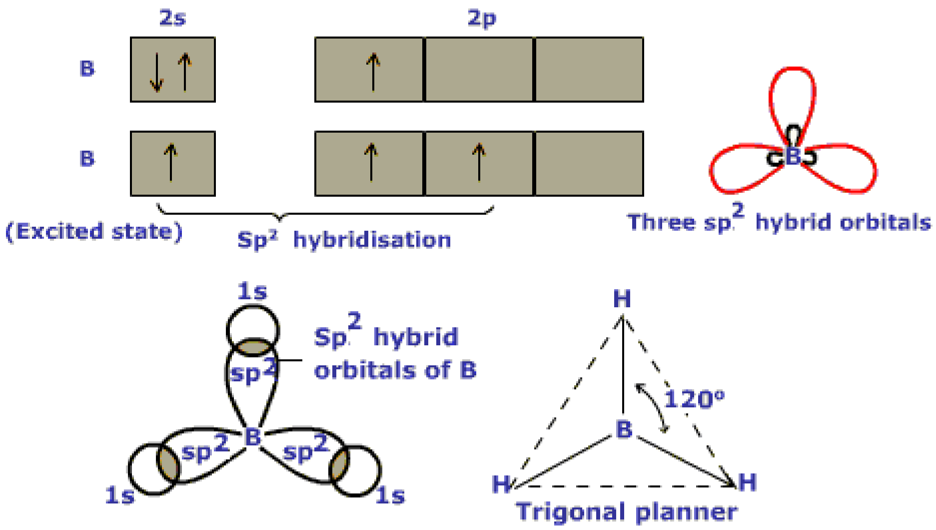

Fig: - Formation of BF_3molecule

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Q 5 E

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A gas tanker carries helium gas at a pressure of 2.5 atmospheres at 25°C.The tanker can withstand a maximum pressure of 10 atmospheres. It collides with a truck and catches fire. According to the above information the tanker will blow up after the collision or it will catch fire. Explain. (**Melting point of iron = 1535°C**)

Ans.

The pressure built up in the tanker at melting point of iron is:

P_1 = 2.5 atm, P_2 = ? , T_1 = 25°C, T_2 = 1535°C = 1808K

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \text{ or } P_2 = \frac{P_1 T_2}{T_1} = \frac{2.5 \times 1808}{298} = 15.16 \text{ atm}$$

Since, the pressure of the gas in the tank is much more than 10 atm at the melting point. Thus, the tank will blow up before reaching the melting point.

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