Shri Shantadurga Higher Secondary School, Bicholim-Goa.

Final Examination March-2018

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

Date: 26/03/2018 **Chemistry** **Duration: 150 Minutes**

Instructions:-

1. All questions are compulsory; however question 21, 26, and 27 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 9 questions of 1 mark each.
Section-B consists of 10 questions of 2 marks each.
Section-C consists of 6 questions of 3 marks each.
Section-D consists of 2 questions of 4 marks each.

Section-A

Q.1. The solubility product expression for tin(II) hydroxide, $Sn(OH)_2$, is **$[Sn^{2+}][OH^-]^2$** (1)

$[Sn^{2+}][OH^-]$ # $[Sn^{2+}]^2[OH^-]$ # $[Sn^{2+}]^3[OH^-]$ # $[Sn^{2+}][OH^-]^2$

Q.2 The chemical formula of the compound formed when sodium reacts with oxygen is **Na_2O** (1)

NaO # Na_3O_2 # Na_2O_2 # Na_2O

Q.3. The oxidation state of manganese in $KMnO_4$ is **+7** (1)

+5 # +7 # +2 # +4

Q.4. Within isomers of alkanes, as the branching increases boiling point **Decreases** (1)

#Remains unchanged #Increases

#Decreases #First increases and then decreases

Q.5. The Enthalpy of a system is represented by **H** (1)

ΔH # E # ΔS # H

Q.6. Draw the pH Scale and label Acidic, Basic and Neutral. (1)

pH Scale

$[H_3O^+]$ Mol/L	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	10^{-10}	10^{-11}	10^{-12}	10^{-13}	10^{-14}
pH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
								Neutral							
	Acidic								Basic						

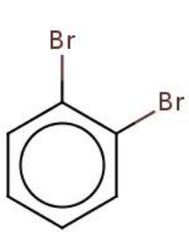
Q.7 Write a balanced chemical reaction illustrating a disproportionation redox reaction. (1)

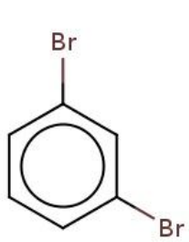
The decomposition of hydrogen peroxide is a familiar example of the reaction, where oxygen experiences disproportionation

$$\overset{+1\ -1}{2H_2O_2\ (aq)} \rightarrow \overset{+1\ -2}{2H_2O(l)} + \overset{0}{O_2(g)}$$

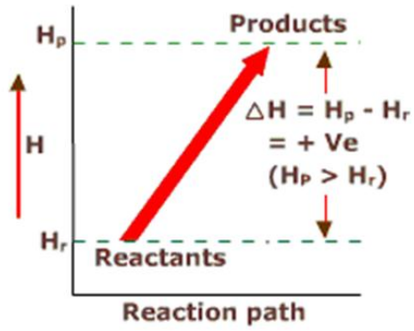
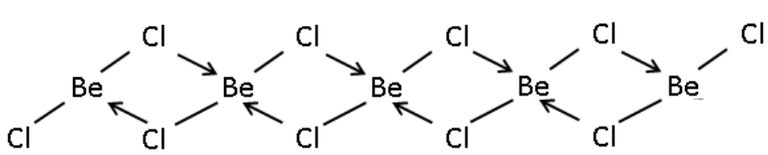
Here the oxygen of peroxide, which is present in –1 state, is converted to zero oxidation state in O_2 and decreases to –2 oxidation state in H_2O.

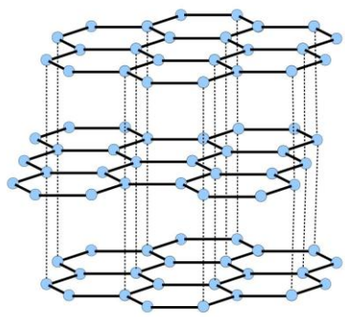
Q.8 Draw and name any two isomers of $C_6H_4Br_2$ (1)

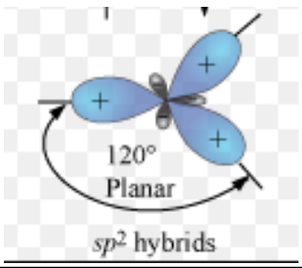




ANY TWO

	1,2-dibromobenzene 1,3-dibromobenzene 1,4-dibromobenzene OR o-dibromobenzene m-dibromobenzene p-dibromobenzene	
Q.9	Draw the Energy level diagram (Enthalpy change) for Endothermic reaction and write the expression for Enthalpy change.  	(1)
	Section-B	(2)
Q.10	Write the conjugate bases for the following Brönsted acids: **H_2O, NH_3 , HCO_3^{-1} and HNO_3** **Ans: OH^- , NH_2^- , CO_3^{-2} and NO_3^-**	(2)
Q.11	State the first law of thermodynamics and name the instrument used to measure the internal energy change that occurs in a system. The energy of an isolated system is constant. **OR** Energy can neither be created nor be destroyed but it can be transferred from one form in to another **Bomb Calorimeter/Calorimeter**	(2)
Q.12	A flask having a volume of 250.0mL and containing air is heated at 100 ˚C and sealed. Then the flask is cooled to 25˚C, immersed in water and opened. What volume of water will be drawn back into the flask? (assuming the pressure constant) **Ans. Formula: V1/T1 =V2/T2** Given that V_1 = 250 ml V_2 = ? T_1 = (100 + 273) K = **373**K, T_2 = 25 ˚C =(25 + 273)=**298K** Applying Charles law **V1/T1 =V2** T2 250 x 298 373 =199.74 ml water will be drawn back into the flask.	(2)
Q.13	Answer the following with respect to Beryllium: (i) Write a polymeric chain structure of its compound.  (ii) Why does Be does not impart any characteristic colour to the flame? Ans: The electrons in beryllium are too strongly bound to get excited by flame. Hence, this element do not impart any colour to the flame.	(2)

Q.14	Write **any four** points of similarities between Lithium and 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.15	The standard electrode potential of redox couples is given below: **Fe^{3+}/Fe^{2+} = +0.77V ; $I_{2(s)}/I^-$ = +0.54V ; Cu^{2+}/ Cu = +0.34V; Ag^+/Ag= +0.80V** With the reference to the above values, answer the following: (i) Name the strongest reducing agent. Ans: Copper (ii) Calculate the standard EMF of the cell having the following cell representation Cu / Cu^{2+} (0.1M) // Ag^+ (0.1M) / Ag E^o Cell = E^o Cathode-E^o Anode E^o Cell =**+0.80V-(+0.34V)** E^o Cell = **+0.46 V**	(2)
Q.16.	Answer the following questions with reference to the given structure showing allotropic form of Carbon  (i) Name the compound having the above structure=**Graphite** (ii) What is the hybridisation of each carbon in this structure=**sp^2** (iii)Why this compound can be used as a dry lubricant in machineries. Graphite cleaves easily between the layers and, therefore, it is very soft and slippery. For this reason graphite is used as a dry lubricant in machines running at high temperature, where oil cannot be used as a lubricant. (iv)It is a good conductor of electricity. Give reason Each carbon atom in hexagonal ring undergoes sp^2 hybridisation and makes three sigma bonds with three neighbouring carbon atoms. Fourth electron forms a π bond. The electrons are delocalized over the whole sheet. Electrons are mobile and therefore, graphite conducts electricity along the sheet.	(2)

Q.17.	Name the type of hybridisation formed when one 2s and two 2p orbital overlap and Draw the geometry of this hybrid orbitals. ANS: **sp^2 hybridisation**  	(2)
Q.18	Write the **l** and **m** values for the following orbitals orbital / **l** value / **m** value **3d** / **2** / -2,-1,0,1,2 **4f** / **3** / ,-3-2,-1,0,1,2,-3	(2)
Q.19	Write the complete electronic configuration for Mn, Co and write the example which is isoelectronic to the given elements. Mn: (25) $1s^2,2s^22p^6,3s^2\ 3p^64s^2\ 3d^5$ or $[Ar]4s^2\ 3d^5$ — isoelectronic — Co^{2+} Co : (27) $1s^2,2s^22p^6,3s^2\ 3p^64s^2\ 3d^5$ or $[Ar]4s^2\ 3d^7$ — isoelectronic — Cu^{2+}	(2)
	Section-C	
Q.20	Write the IUPAC nomenclature for the following compounds: (i) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3$ — Butan-2-ol (ii) $CH_3-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-OH$ — Propanoic acid (iii) $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_3$ — Butan-2-one	(3)
Q.21	Write any two important features of **equilibrium constant** and for the equilibrium system described by $$2\ SO_{2\,(g)} + O_{2\,(g)} \rightleftharpoons 2\ SO_{3\,(g)}$$ 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:** 1. Equilibrium constant is applicable only when concentrations of the reactants and products have attained their equilibrium state. 2. The value of equilibrium constant is independent of initial concentrations of the reactants and products. 3. Equilibrium constant is temperature dependent having one unique value for a particular reaction represented by a balanced equation at a given temperature. 4. The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction. 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}	(3)

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

OR

Q.21 Write a point of difference between Homogenous and Heterogeneous equilibria and calculate Kc for the following reaction (3)

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$$

Given equilibrium concentrations of

N_2=3.0 × 10^{-3}M, **O_2** = 4.2 × 10^{-3}M and **NO**= 2.8 × 10^{-3}M in a sealed vessel at 800K

Solution:

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

For the reaction equilibrium constant, K_c can be written as.

$$K_c = \frac{[NO]^2}{[N_2][O_2]}$$

$$= \frac{(2.8\times10^{-3}M)^2}{(3.0\times10^{-3}M)(4.2\times10^{-3}M)}$$

$$= 0.622$$

Q.22 State the **Hess's Law** of Constant Heat Summation and Calculate **ΔH_1 for** the following reaction between sulphur and oxygen which is exothermic in nature. (3)

In the direct one step preparation, change in enthalpy ie **ΔH –94.45 Kcal/mol.**

$$S + 3/2\ O_2 \rightarrow SO_3$$

In this example formation of sulphur trioxide takes place in two steps:
In the first step sulphur reacts with oxygen to produce sulphur dioxide

$$S + O_2 \rightarrow SO_2 \qquad \Delta H_1 = \_?\_\_\_ Kcal/mol$$

In the second step SO_2 reacts with more oxygen to produce SO_3

$$SO_2 + 1/2\ O_2 \rightarrow SO_3 \qquad \Delta H_2 = -23.49 Kcal/mol$$

Hess's Law states that the change in enthalpy accompanying a chemical reaction is independent of the pathway between initial and final states. **OR**

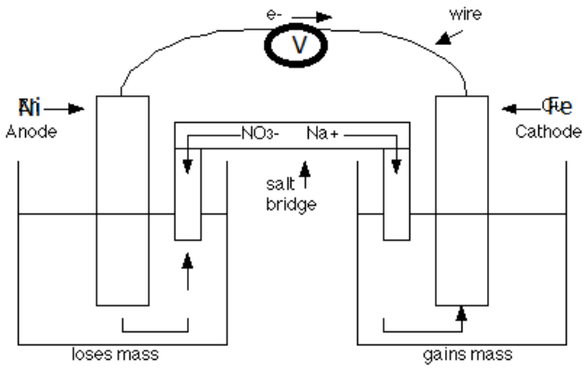
If a reaction takes place in several steps then its standard reaction enthalpy is the sum of the standard enthalpies of the intermediate reactions into which the overall reaction may be divided at the same temperature.

Formula: $\Delta H = \Delta H_1 + \Delta H_2$
-94.45 Kcal/mol = $\Delta H_1 + (-23.49$ Kcal/mol)
$\Delta H_1 = \Delta H - \Delta H_2$
$\Delta H_1 = -94.45$ Kcal/mol $- (-23.49$ Kcal/mol)
$\Delta H_1 = -94.45$ Kcal/mol $+ 23.49$ Kcal/mol
$\Delta H_1 = -70.96$ Kcal/mol

Q.23 The standard reduction electrode potential of Ni and Fe are given below (3)

Ni^{2+}/ Ni = -0.25V and Fe^{3+}/ Fe = -0.04V

(i) Draw a neat labelled diagram of an electrochemical cell with the reference to the given values.



(ii) Write the anodic and the cathodic reaction for the same.

Anodic reaction: $Ni(s) \rightarrow Ni^{2+}(aq) + 2\ e^-$

Cathodic reaction : $2\ Fe^{3+} + 2\ e^- \rightarrow 2\ Fe^{2+}$

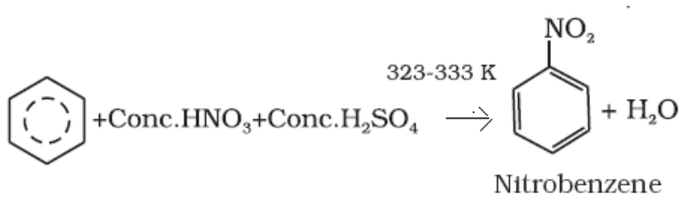
Q.24 Write the complete labelled chemical equation to carry out the following conversions (3)

(i) Bromoethane to Butane

$$C_2H_5Br + 2Na + BrC_2H_5 \xrightarrow{\text{dry ether}} C_2H_5-C_2H_5$$

Bromoethane n-Butane

(ii) Benzene to Nitrobenzene



Nitrobenzene

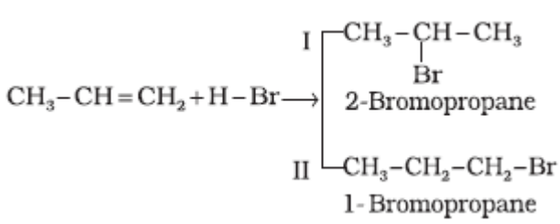
(iii)2-Methylpropane to 2-Methylpropan-2-ol

$$(CH_3)_3CH \xrightarrow[\text{Oxidation}]{KMnO_4} (CH_3)_3COH$$

2-Methylpropane 2-Methylpropan-2-ol

Q.25 Answer the following; (3)

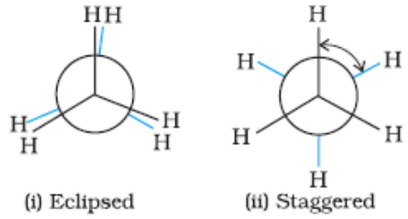
(i) Name the major and minor product obtained on reaction of hydrogen bromide with propene.



(Reaction not required)

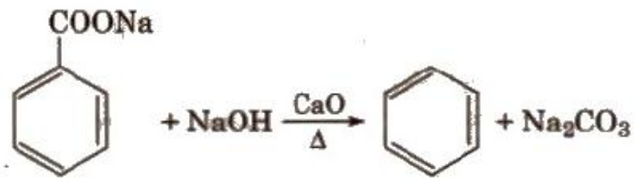
Major product: **2-bromopropane** **&** Minor product: **1-bromopropane**

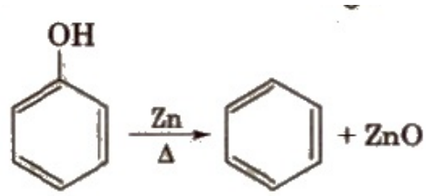
(ii) Draw and label Newmann Projections for the two conformations of Ethane.

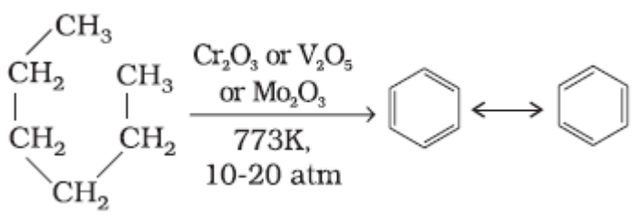


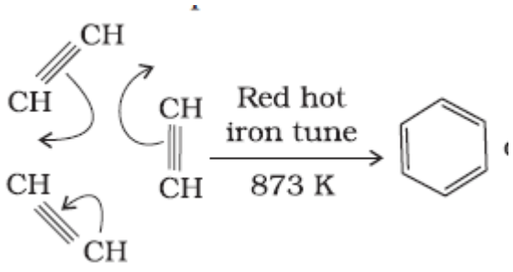
Newman's projections of ethane

(iii)Write a chemical reaction for the preparation of benzene by any one method.









Section-D

Q.26 With respect to group 13 elements answer the following questions; (4)

(i) Name any two important compounds of boron along with their chemical formula

1. **Borax** $Na_2B_4O_7.10H_2O$ 2. **Orthoboric acid**, H_3BO_3 3. **Diborane,** B_2H_6

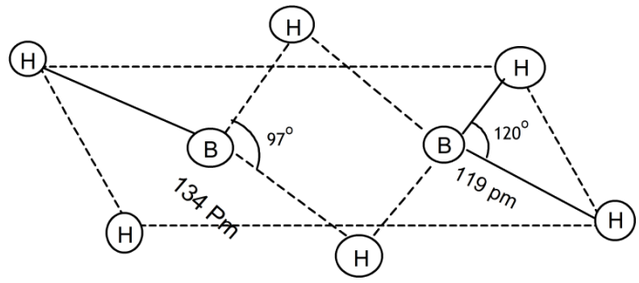
(ii) Concentrated HNO_3 can be transported in Aluminium Container. Give reason.

Ans: concentrated nitric acid renders aluminium passive by forming a protective oxide layer on the surface hence the reason.

(iii)Write a balanced chemical equation showing reaction of Aluminium with nitrogen at a high temperature.

$$2Al_{(S)} + N_{2(g)} \text{-------} \rightarrow 2AlN_{(S)}$$

(iv) Draw the structure of Diborane.



OR

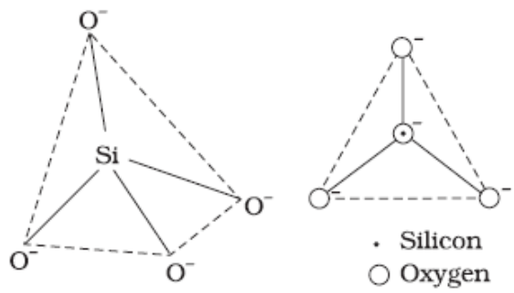
Q.26 With respect to group 14 elements answer the following questions; (4)

(i) Write a Balanced chemical equation showing production of water gas

$$C(s) + H_2O(g) \xrightarrow{473\text{–}1273K} CO(g) + H_2(g)$$

Water gas

(ii) Draw the structure of a silicate unit



(iii) Explain why Tetrachlorides of p- block are easily hydrolysed by water?

Ans: Tetrachlorides of p- block are easily hydrolysed by water because the central atom can accommodate the lone pair of electrons from oxygen atom of water molecule in *d* orbital

(iv) Write any two uses of Zeolites.

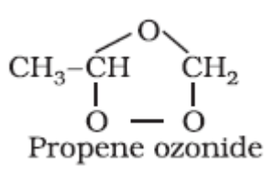
- Zeolites are widely used as a catalyst in petrochemical industries for cracking of hydrocarbons and isomerisation, *e.g., ZSM-5 (A type of zeolite) used to convert alcohols directly into gasoline*.
- Hydrated zeolites are used as ion exchangers in softening of "hard" water.

Q.27 Write complete reaction for the following: (4)

(i) $CH_4 + 2O_2 \longrightarrow A + B$

$CH_4 + 2O_2$ --→ $CO_2 + H_2O$

(ii) $CH_3 - CH = CH_2 + O_3 \longrightarrow A \xrightarrow{Zn + H_2O} B$

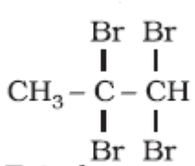
A= 

Propene ozonide

and **B** = CH_3CHO + HCHO

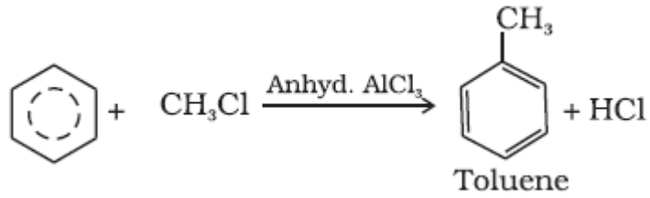
Ethanal Methanal

(iii) $H_3C - C \equiv CH + Br_2 \longrightarrow A \xrightarrow{Br_2} B$

Ans: **A**= $[CH_3CBr = CHBr]$ 1,2-Dibromopropene and **B** = 

1,1,2,2-Tetrabromopropane

(iv)  + CH_3Cl $\xrightarrow{\text{Anhy. } AlCl_3}$ A + B



OR

Q.27 Write complete reaction for the following: (4)

(i) $CH_3(CH_2)_4CH_3$ $\xrightarrow{\text{Anhy. } AlCl_3/HCl}$ A + B

Ans: **A**= $CH_3CH(CH_3)(CH_2)_2CH_3$ 2-Methylpentane and **B** = $CH_3CH_2CH(CH_3)CH_2CH_3$ 3-Methylpentane

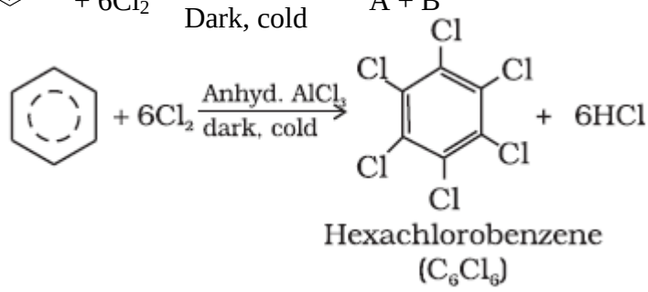
(ii) $CH_3-CH=CH_2 + H_2O + [O]$ $\xrightarrow{\text{dil } KMnO_4}$ A + B

Ans: **A**= $CH_3CH(OH)CH_2OH$ Propane-1, 2-diol and **B** = $CH_3-\overset{\overset{O}{\|}}{C}-H$ Ethanal

(iii) $HC\equiv CH + H_2O \xrightarrow[333K]{Hg^{2+}/H^+}$ A $\xrightarrow{\text{isomerisation}}$ B

Ans: **A**= Ethenol $CH_2=\underset{OH}{\underset{|}{C}}-H$ and **B** = $CH_3-\overset{\overset{O}{\|}}{C}-H$ Ethanal

(iv)  + $6Cl_2$ $\xrightarrow[\text{Dark, cold}]{\text{Anhy. } AlCl_3}$ A + B



*----------**THE END**----------*