Shri Shantadurga Higher Secondary School, Bicholim-Goa.
Final Examination March-2019

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

Date: 25/03/2019 **Chemistry** **Duration: 150 Minutes**

Instructions:-

*1. All questions are compulsory; however question **23, 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. Amongst the following properties, **Temperature** is not an extensive property. (1)

Mass # Volume # Temperature # Enthalpy

Q.2 The solutions which resist change in pH on dilution or with the addition of small amounts of acid or alkali are called **Buffer** Solutions. (1)

Neutral # Alkaline # Buffer # Acidic

Q.3. The standard EMF (E^0Cell) for the electrochemical cell set up, using following electrodes with electrodes potential: E^0 Ag^+/Ag = **0.80v** E^0 Zn^{2+}/Zn = **-0.76v** is **1.56V** (1)

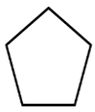
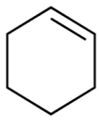
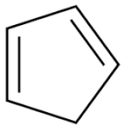
0.04V # 1.56V # -1.56V # -0.04V

Q.4. Among the alkali metal ions, the metal ion with the highest hydration enthalpy is **Li^+** (1)

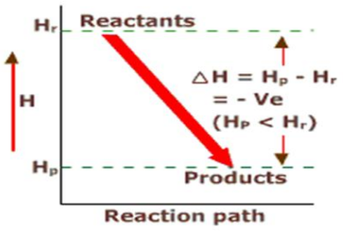
Na^+ # Li^+ # Rb^+ # Cs^+

Q.5. (1)

The compound that exhibits huckel rule among the following is 

 #  #  # 

Q.6. Draw the Energy level diagram (Enthalpy change) for Exothermic reaction and write the expression for Enthalpy change. (1)



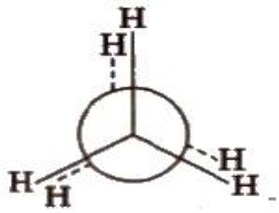
(a) Enthalpy change during an Exothermic reaction

Q.7 Draw the pH Scale and label Acidic, Basic and Neutral. (1)

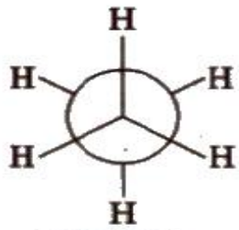
pH Scale

$[H_3O^+]$ 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.8 Draw and name any two conformations of Ethane using Newmann projection. (1)



eclipsed



staggered

Q.9 Write electronic configuration of **Cr (Z= 24)** (1)

$[Ar]3d^5 4s^1$ or $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

Section-B

(2)

Q.10 Answer the following questions based on the reaction given below: (2)

$CuSO_4 + Zn \longrightarrow ZnS0_4 + Cu$

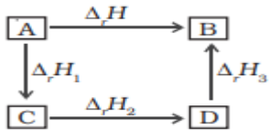
1) Write the cathode and anode reactions.
   ANODE: Oxidation: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$
   CATHODE: Reduction: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
2) Identify and write reducing agent and oxidising agent.
   Reducing agent: **Zn**
   Oxidising agent: **Cu**

Q.11 With respect to the **group I** elements, write the following: (2)

1) General electronic configuration: **ns^1**

2) Trend in Atomic radii : **It increases down the group.**

Q.12 Name and state the law represented by following equation. (2)



Also write the mathematical expression for the same law.

Ans: **Hess's Law of constant heat summation.**

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.

Mathematical expression : $\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3$

Q.13 Write any four points on important features of equilibrium constants. (2)

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.

Q.14 Calculate the oxidation numbers of underlined elements in the following compounds and ions : (2)

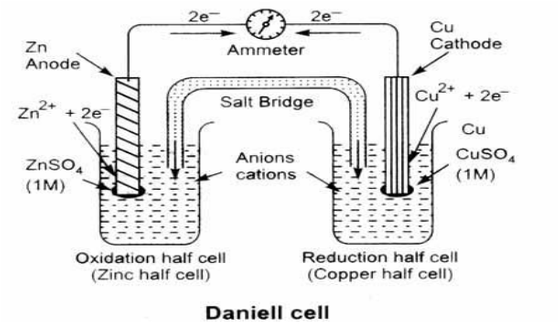
i) $H_2\underline{S}O_4$ **: (+6)**

ii) $K\underline{Mn}O_4$ **: (+7)**

iii) $(\underline{P}O_4)^{3-}$ **: (+5)**

iv) $(H\underline{S}O_4)^-$ **: (+6)**

Q.15 Draw a neat labelled diagram of Daniel cell and state one use of salt bridge. (2)



Daniell cell

use of salt bridge(ANY ONE)

- **Salt bridge connects two half cells and doesn't allow electrolytes to mix.**
- **It prevents electrical neutrality by passing required ions, and minimizes liquid junction potential.**
- **Does not allow voltage to drop.**

Q.16. Write the commercial method of preparation of quicklime and state its **TWO** uses. (2)

It is prepared on a commercial scale by heating limestone ($CaCO_3$) in a rotary kiln at 1070-1270 K. heat $CaCO_3 \rightarrow CaO + CO_2$

Uses(ANY TWO):

1. It is extensively used for medicinal purpose and insecticides.
2. It finds its application in manufacturing of cement, paper, and high-grade steel.
3. Lime is used as a reagent in laboratories for dehydration, precipitation, etc.
4. It is the cheapest alkali available which is an important ingredient in the manufacturing of caustic soda.
5. It is employed in the purification of sugar and in the manufacture of dye stuffs.

Q.17. Complete the following equations: (2)

i) $2Al_{(s)} + 2\,NaOH_{(aq)} + 6\,H_2O_{(l)} \rightarrow \mathbf{2N_a^+\,[Al(OH)_4]^-_{(aq)} + 3H_{2(g)}}$

ii) $Sn + 2H_2O \xrightarrow{\Delta} \mathbf{SnO_2 + 2H_2}$

Q.18 At 30°C and 780mm of Hg pressure, a gas occupies 500ml volume. What will be its pressure at a height where temperature is 20°C and volume of a gas is 660ml? (2)

$P_1 = 780$ mm of Hg $\qquad P_2 = ?$

$V_1 = 500$ ml $\qquad V_2 = 660$ ml

$T_1 = 273+30 = 303$ k $\qquad T_2 = 273+20 = 293$ k

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$P_2 = \frac{P_1V_1T_2}{V_2T_1}$$

$$P_2 = \frac{780x500x293}{660x303}$$

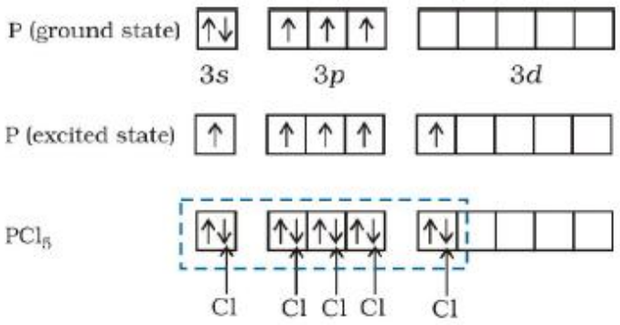
$$= 571.40 \text{ mm of Hg}$$

Q.19 Explain the **sp^3d hybridisation** with respect to formation of Phosphorus pentachloride and comment on its **geometry**. (2)

In PCl_5 molecule the central atom is P.

$_{15}P - 1s^2,2s^2,2p^6,3s^2,3p^3$

$_{17}Cl - 1s^2,2s^2,2p^6, 3s^2, 3p^5$



sp^3d hybrid orbitals filled by electron pairs donated by five Cl atoms.

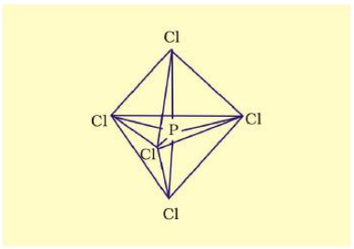


Fig. 4.17 Trigonal bipyramidal geometry of PCl_5 molecule

In PCl_5 the five *sp*3*d* orbitals of phosphorus overlap with the singly occupied *p* orbitals of chlorine atoms to form five P–Cl sigma bonds.

Geometry: **Trigonal bipyramidal**

Section-C

Q.20 Write the IUPAC nomenclature for the following compounds: (3)

(i) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-Br$

1-Bromo-propan-2-ol

(ii) $CH_3-CH_2-\underset{\displaystyle O}{\underset{\|}{C}}-CH_3$

Butanone

(iii) $CH_3-\underset{\displaystyle O}{\underset{\|}{C}}-H$

Ethanal

Q.21 Answer the following : (3)

(i) Arrange the following organic compounds in increasing order of their boiling point ;
2-methyl pentane, Hexane, 2,3-dimethyl butane

2,3-dimethyl butane, 2-methyl pentane, Hexane,

(ii) Write the complete chemical equation , name and label major and minor products in hydro halogenation of propene.

$$\underset{\text{propene}}{CH_3CH=CH_2} + \underset{\text{hydrogen bromide}}{HBr} \longrightarrow \underset{\text{1-bromopropane (minor product)}}{CH_3CH_2CH_2Br} + \underset{\text{2-bromopropane (major product)}}{\underset{\displaystyle Br}{\underset{|}{CH_3CHCH_3}}}$$

(iii) Illustrate Wurtz reaction with complete chemical reaction.

$$C_2H_5Br + 2Na + BrC_2H_5 \xrightarrow{\text{Dry ether}} \underset{\text{Butane}}{C_4H_{10}} + 2NaBr$$

Q.22 State the following. (3)

1. **Closed system**.

A system in which there is no exchange of **matter,** but **exchange** of **energy** is possible between system and the surroundings

2. **Standard enthalpy of formation**

The standard enthalpy change for the formation of one mole of a compound from its elements in their most stable states of aggregation *(also known as reference states)* is called Standard Molar Enthalpy of Formation**.**

3. **Standard enthalpy of Vaporization.**

Amount of heat required to vaporize one mole of a liquid at constant temperature and under standard pressure (1bar) is called its standard enthalpy of vaporization or molar enthalpy of vaporization, $\Delta_{vap}H^0$

Q.23 Write a point of difference between Homogenous and Heterogeneous equilibria and calculate Molar Concentration of NO (given Kc for the following reaction= 0.622) (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 in a sealed vessel at 800K

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

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

$$0.622 = \frac{[NO]^2}{3.0 \times 10^{-3} \text{ X } 4.2 \times 10^{-3}}$$

Therefore $\frac{[NO]^2}{} = 0.622 \text{ X } 3.0 \times 10^{-3} \text{ X } 4.2 \times 10^{-3}$ **$= 7.8372 \text{ X } 10^{-6}$**

$[NO] = \sqrt{\mathbf{7.8372 \text{ X } 10^{-6}}}$

$[NO] = 2.799 \textbf{ X } 10^{-3}$

OR

Q.23 For the equilibrium system described by: $PCl_{5\,(g)} \rightleftharpoons PCl_{3\,(g)} + Cl_{2\,(g)}$
K_{eq} equals 35 at 487°C.
If the concentrations of the PCl_5 and PCl_3 are 0.015 M and 0.78 M, respectively, what is the concentration of the Cl_2?
Ans:

$$K_{eq} = \frac{[PCl_3]\,[Cl_2]}{[PCl_5]}$$

Let x = the unknown, $[Cl_2]$. Substitute in known values and solve for □:

$$35 = \frac{(0.78)\ (x)}{(0.015)}$$

$$35 \times 0.015 = 0.78 \times (x)$$

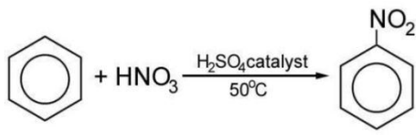
$$x = [Cl_2] = 0.67M$$

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

(i) But-2-yne to trans-But-2-ene

$HC \equiv CH + H_2 \longrightarrow H_2C=CH_2$

(i) Benzene to Nitrobenzene

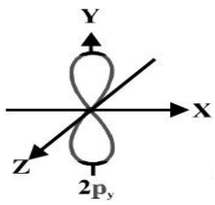


(ii) Propyne to Propene

$CH_3\text{-}C \equiv CH + H_2 \longrightarrow CH_3\text{-}CH=CH_2$

Q.25 Answer the following; (3)

(i) Draw the shape of Py orbital.



(ii) State Hund's rule of maximum multiplicity.

It states that pairing of electrons in the orbitals belonging to the same subshell (p,d or f) does not take place until each orbital belonging to that subshell has got one electron each i.e. it is singly occupied.

iii) What are the values of Azimuthal quantum numbers (l) for 3p orbitals?

0 ,1 ,2

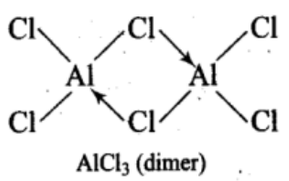
Section-D

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

(i) Why is boric acid considered as a weak acid?

Because it is not able to release H^+ ions on its own. It receives OH^- ions from water molecule to complete its octet and in turn releases H^+ ions.

(ii) Draw the dimeric structure of $AlCl_3$



$AlCl_3$ (dimer)

(iii) Write a balanced chemical equation for the reaction of elemental boron with chlorine at high temperature.

$2B(s) + 3X_2(g) \rightarrow 2BCl_3$

(iv) Write a chemical formula of Borax and Orthoboric acid.

Borax - $Na_2B_4O_7.10H_2O$ Orthoboric acid – H_3BO_3

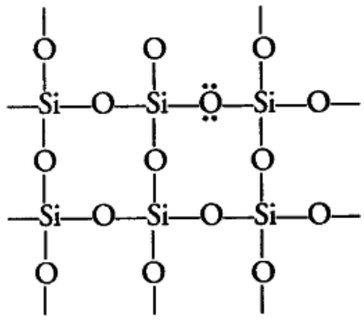
OR

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

(i) Why does carbon shows anomalous behaviour?

High ionisation enthalpy, high electronegativity, small size, unavailability of d orbitals, ability to form pπ-pπ multiple bonding.

(ii) Draw the structure of a SiO_2



(iii) Name the zeolite that is used for direct conversion of alcohol to gasoline.

ZSM-5

(iv) How fullerenes are prepared?

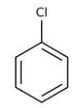
Fullerenes are prepared by heating of graphite in an electric arc in the presence of inert gases such as helium or argon.

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

(i) $CH_4 + H_2O \longrightarrow CO + 3H_2$

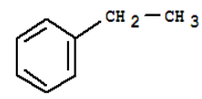
(ii)  + H_2SO_4 $\xrightarrow{SO_3 \text{ fumes}}$  + H_2O

(iii) $HC \equiv CH + Na \longrightarrow HC \equiv C^- Na^+ + \frac{1}{2} H_2$

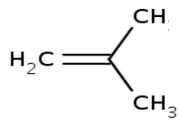
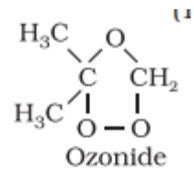
(iv)  + Cl_2 $\xrightarrow{\text{Anhydrous. } AlCl_3}$  + HCl

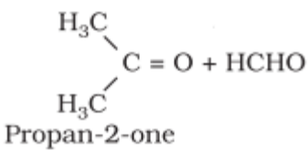
OR

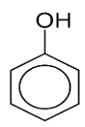
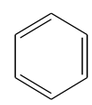
Q.27 Write complete reaction for the following: (4)

(i)  + $CH_3 - CH_2 - Cl$ $\xrightarrow{\text{Anhydrous. } AlCl_3}$  + HCl

(ii) $Br - CH_2 - CH_2 - Br \xrightarrow{Zn} CH_2{=}CH_2 + ZnBr_2$

(iii)  + O_3  Ozonide $\xrightarrow{Zn/H_2O}$


Propan-2-one

(iv)  + Zn $\longrightarrow$  + ZnO

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