# West Bengal - 2018

# Grade 12

# Chemistry

# Total time: 3 hours

# Total marks: 70

## Instructions to the candidates:

- i. You are required to comply with the directions given by the head invigilator at the examination venue.
- ii. Your student id card must be visible on your desk during the entire examination.
- iii. Marks will be deducted for bad hand writing.

# PART-A

1. Answer the following questions (Alternatives are to be noted)

(2 x 5=10)

(a) At a constant pressure, the solubility of a gas in a liquid solvent changes when temperature is increased. State what changes occur and explain why it happens. (2)

**Answer:** At a constant pressure, the solubility of a gas in a liquid solvent changes when temperature is increased. Increased temperature causes an increase in kinetic energy. The higher kinetic energy causes more motion in molecules which break intermolecular bonds and escape from solution.

Why the vapour pressure is lowered when urea is dissolved in water under ordinary condition? (2)

**Answer:** When urea is added its molecule also occupy the topmost surface of solution so the equilibrium of vapour decreases which makes water vapour less

(b) The particles of a true solution can pass through a semi permeable membrane, but those of a colloidal solution cannot. Explain why.

**Answer:** True Solution is a homogeneous mixture of two or more substances in which substance dissolved (solute) in solvent has the particle size of less than 10-9 m or 1 nm. Particles of true solution cannot be filtered through filter paper and are not visible to naked eye.

Colloidal Solution is a heterogeneous mixture in which particle size of substance is intermediate of true solution and suspension i.e. between 1-1000 nm. Just like true solutions, Colloidal particles are small enough and cannot be seen through naked eye. They easily pass through filter paper.

# OR

What is chemisorption? Explain with an example.

**Answer:** If the attracting forces between the adsorbate and adsorbent are approximately equal to the strength of the chemical bonds then this phenomenon is called chemisorption.

Example, corrosion.

(c) Write with balanced equation, what happens when chlorine gas is passed into aqueous solution of sulphur dioxide.

Answer: When sulphur dioxide is passed on with chlorine gas,

H<sub>2</sub>O and H<sub>2</sub>SO<sub>4</sub> are formed.

 $SO_2 + Cl_2 + 2H_2O \longrightarrow H_2SO_4 + 2HCl$ 

#### OR

Write with balanced equation, what happens when white phosphorous is boiled with caustic soda solution.

Answer:  $P_4 + 3H_2O + 3NaOH \rightarrow PH_3 + 3NaH_2PO_2$ 

(d) How many isomers are possible for  $[Co(NH_3)4Cl_2]Cl$ ? Draw their structures.

Answer: 2 isomers



e) What is condensation polymerization? Write an example.

**Answer:** The reaction between two bi-functional monomers is called condensation polymerization.eg terylene, nylon-6,6,etc.



2. Answer the following questions (Alternatives are to be noted).

(3 x 9=27)

a) (i) What is the total number of voids in cubic closed lattice?

**Answer:** The number of tetrahedral voids per atom is two and the number of octahedral voids per atom is one. Hence, total number of void in unit atom is 3.

(ii) Metallic gold (Au)crystallizes in face-centred cubic lattice. What is the number of unit cells in 2.0g of gold ? [Au=197]

Ans) gold of 1 mole = 197g = 6.02\*1023

present in 1g of gold no. Of atoms =6.02\*1023/197

unit cell of fcc contains 4 atoms

No. of unit cell present =  $6.02 \times 1023/197 \times 4$ 

No. Of unit cell present =  $7.64 \times 1020$ 

## OR

(i) What is p-type semiconductor?

**Answer:** When the trivalent impurity is added to an intrinsic semiconductor (silicon or germanium), then it is said to be an p-type semiconductor. For example, Boron (B), Gallium (Ga), Indium(In), Aluminium(Al) etc .

(ii) A cubic crystal is made up of elements A and B. B is located at the corners of unit cell and A is at body centre. What will be the probable formula of the compound?

Answer: As atoms of B are present at the 8 corners of the cube. Number of atoms of B in the unit cell = $8 \times 1/8=1$ 

As atoms A are present at the body centre, therefore number of atoms of A in the unit cell =1

 $\therefore$  Ratio of atoms = A : B=1 : 1

(b) (i) The concentration of a solution is 0.4 M. What does it mean?

**Answer:** M denotes molality. Molality is molar concentration of a solute in a solution in terms of amount of substance in a specified amount of mass of the solvent.

(ii) How many gram of glucose when dissolved in 2 litre of water will be isotonic with blood at 37°C?

[Xblood=7.65 atm, Molar mass of glucose=180g/mol, R=0.082 L atm K-1 mol-1]

Answer:  $\pi V = (W2/M2) RT$   $\Pi = 7.65 atm$  V=2L M2 = 180 T=273+37=310 R=0.0821 W2=(7.65 x 2 x 180)/0.082 x 310W2 = 2754/25.42 = 108.33

(c) (i) The standard electrode potential of Cu2+ / Cu half-cell is +0.34V. What does it mean?

**Answer:** Positive value indicates that species can act as oxidizing agent .So copper can act as oxidising agent as it's reduction potential.

(ii) In a conductivity cell, the distance between the two P electrodes is 2.0cm and each electrode has cross-sectional area of 4.0cm2. When the cell is filled with a 0.4 molar solution of an electrolyte, the resistance of a cell is  $25\Omega$ .Calculate the molar conductivity (Am) of the solution.

**Answer:**  $A_m = K \times 1000/M$ 

 $K=1 \times 1 / R \times A$ 

 $L \times 1000 \ / \ A \times M \times R = A_m$ 

 $2 \times 1000 / 4 \times 0.4 \times 25 = A_m => 2000 / 40 = 50 = A_m$ 

(d) (i) Write balanced chemical equations for preparation of pure alumina from bauxite by bayer processs.

Answer:  $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ .

#### OR

Write balanced chemical equations how zinc blende is converted from bauxite by buyer process.

**Answer:** Concentration of ore, the gangue from zinc blende is removed by the froth floatation method.

 $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ 

 $ZnO + C \rightarrow Zn + CO$ 

Anode:  $Zn \rightarrow Zn^{2+} + 2e^{-}$ 

Cathode:  $Zn^{2+} + 2e^{-} \rightarrow Zn$ 

(e) (i) What is the general electronic configuration of d-block elements ?

**Answer:** The electronic configuration of these elements is (n-1) d 1–10ns 1–2.

(ii) Why is  $TiCl_2$  paramagnetic but  $TiO_2$  is diamagnetic? (Atomic number of Ti is 22).

**Answer:** Ticl<sub>4</sub> is paramagnetic but TiO<sub>2</sub> is diamagnetic because 56 electrons (22+17+17) in TiCl<sub>4</sub> so they are unpaired electrons so they have responsible for paramagnetic nature.

While 38 electrons (22+8+8) in TiO<sub>2</sub> so they all the electrons are paired so they have responsible for diamagnetic nature because they have paired electrons.

(f) (i) Write the structure of product(s) of following reactions:



When chlorobenzene is treated with concentrated nitric acid and concentrated sulphuric acid, it forms of two products. The products are 2-Nitrochlorobenzene and 4-Nitrochlorobenzene.

(ii) In which of the following two compounds Sn2 reaction is faster? Give reason.

CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>Cl and CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>I

**Answer:** In the  $SN_2$  as the size increases, the halide ion becomes a better leaving group.

 $R - F \leq R - Cl \leq R - Br \leq R - I$ 

Therefore,  $CH_3CH_2CH_2I$  undergoes  $Sn_2$  reaction faster the  $CH_3CH_2CH_2CI$ .

(ii) Write one harmful environmental effect of Freon's. (1+1+1)

Answer: Harmful environmental effect of Freon's:

Very high concentration in freon gases, which they cause of asphyxia, dizziness, and loss of coordination and concentration. Irritation, particularly with regard to sensitive skin (skin rashes, dermatitis, etc.) in which they may be cause. No long-term effects on health in freon which is the good news for that.

g) (i) How would you distinguish between the following pair of the compounds by a chemical reaction ?

CH3 - CH - CH3 and CH3 – CH2 – CH2 - OH I OH

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Answer: CH3CH(OH)CH3 + Na = CH3CHONaCH3 + H2
And
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CH3CH2CH2OH + Na = CH3CH2CH2ONa + H2

(ii) How would you convert?



OR

(i) How would you convert?



(ii) Write down the products of following reaction:

CH<sub>3</sub>OCH<sub>2</sub>CH<sub>3</sub>-conc HIHeat ----> CH<sub>2</sub>CH<sub>3</sub>OH + CH<sub>3</sub>I

## Answer:

(h) (i) Write the reagents for the following conversions:

Distinguish between the following two compounds by a chemical reaction:



and

## Solution:

Carbylamine test can be used to distinguish between Aniline and Nmethylaniline. Aniline is an aromatic primary amine, gives positive carbylamine test. However, N-methylaniline, being a secondary amine does not.



(i) (x) What is meant by primary structure of a protein ?

Answer: Protein primary structure is the linear sequence of amino acids in a peptide or protein.

(y) Show that sucrose is a disaccharide.

## Answer:



A disaccharide is the sugar formed when two monosaccharides are joined by glycosidic linkage that is why sucrose is the dissaccharide.

3. Answer the following questions (Alternatives are to be noted): (5\*3=15)

(i)What is meant by instantaneous reaction rate?

**Answer:** The instantaneous rate is the rate of reaction at any particular point in time that the concentration of reactants and products change by a negligible amount.

(ii)What is meant by activation energy of a reaction?

Answer: Activation energy is defined as the minimum amount of energy required by the molecules of reactant to undergo a chemical reaction.

(iii) Show that the time required for 99% completion of a first order reaction is twice the time required for 90% completion of that reaction.

Answer: For a first order reaction, the time required for 99% completion is

$$t_1 = \frac{2.303}{k} \log \frac{100}{100 - 99}$$
$$= \frac{2.303}{k} \log 100$$
$$= 2 \times \frac{2.303}{k}$$

For a first order reaction, the time required for 90% completion is

$$t_2 = \frac{2.303}{k} \log \frac{100}{100 - 90}$$
$$= \frac{2.303}{k} \log 10$$
$$= \frac{2.303}{k}$$

Therefore,  $t_1 = 2t_2$ 

Hence, the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of the reaction.

## OR

(i) Establish the integrated rate equation for a first order reaction.

**Answer:** When the sum of the powers of concentrations terms of reactants in rate law is equal to 1.

Considered the reaction,

 $A \rightarrow Products$ 

$$R = -d(A) / (A) = K(A) 1$$

$$R = -d(A) / (A) = kdt$$
Taking integration on both side
$$-\int d (A) / (A) = \int k x dt$$
Now,  $-\ln (A) = kt + I$  (1)
Let,  $(A) = (A) = (A) 0$ 

$$t = 0$$
Put the value in equation - (1)
$$-\ln (A) = kt - \ln (A) 0$$
ln (A) 0 - ln (A) = kt
ln = (A) 0 / (A) = k
l/t ln (A) 0 (A) = k
Now, if (A) 0 = a
So, (A) = a-x
$$1/t \ln a/a - x = k$$
So,  $K = 2.303 / t \log a/a - x$ 
If we plot a graph,
$$\ln[A]_0 = A$$

slope = -k

t

ln[A]<sub>t</sub>

The reaction which follows the first order kinetics is however 100% completed we can assume that at the infinite time to reactions get completed for solving the problem.

(i) Why helium does not form any compound?

Answer: Helium does not form any chemical compound because helium is an inert gas. Which means it does not have any valance electron for reaction that's why it doesn't react with other substances and thus it doesn't form any chemical compound.

(ii) Give one example of mixed oxide. Why is it called mixed oxide?

**Answer:** Mixed oxide is the name for an oxide that contains cations of more than one chemical element in several states of oxidation.

Lead dioxide (PbO<sub>2</sub>) and lead monoxide (PbO) combine to form the mixed oxide Red lead (Pb<sub>3</sub>O<sub>4</sub>).

(iii) Draw the structure of H<sub>2</sub>SO<sub>3</sub>.



## OR

An organic compound produces acetic acid and ethanol on acid hydrolysis. Write the structural formula of compound. How can you prepare the compound from acetaldehyde in one step? **Answer:** Ethanoic acid reacts with ethanol in the presence of concentrated sulphuric acid as a catalyst to produce the ester, ethyl ethanoate

Esterification: Seperate the given acetaldehyde solution in two parts. Oxidize one of the solution using any oxidizing agent (KMnO<sub>4</sub> etc.) and you will get the acetic acid CH<sub>3</sub>COOH.

 $CH_3CHO + KMnO_4 + H_2SO_4 \rightarrow CH_3COOH$ 

Reduce the second solution using any reducing agent (NaBH4, LiAlH4, etc.) the reduction of acetaldehyde leads to formation of ethanol.

 $CH_3CHO + LiAlH_4 \rightarrow CH_3CH_2OH$ 

And also you would have heard about the reaction esterification. An alcohol and a carboxilic acid react to form ester. Acitic acid and ethanol reacts to form ethyl acetate.

 $CH_3COOH + CH_3CH_2OH \rightarrow CH_3COOCH_2CH_3 + H_2O$ 

# PART – B

Select the one correct answer out of the options given against each question and write in the box provided on right hand Side bottom

(1 x 14=14)

1. The unit of cell contant is

Cm (b) cm<sup>-1</sup> (c) cm<sup>2</sup> (d) mol lit<sup>-1</sup>

Answer: (b) cm<sup>-1</sup>

2. Which of the following is required to liberate bromine from aqueous solution of HBr?

(a)  $Cl_2$  (b)  $N_2$  (c)  $CO_2$  (e)  $I_2$ 

Answer: (a) Cl<sub>2</sub>

3. What is the oxidation number of the central metal in  $[Cr(NH_3)_4(NO_2)Cl]^+$ ? (Atomic No. of Cr = 24)

(a) 0 (b) +1 (c) +3 (d) +2

**Answer:** (d) +2

4. On reaction with aqueous bromine at room temperature phenol forms which of the following?

(a) meta-Bromophenol (b) 2,6-Dibromophenol

(c) 2,4,6-Tribromophenol (d) 3,5-Dibromophenol

Answer: 2,4,6-Tribromophenol

5. Explanation: When Phenol is treated with bromine water gives polyhalogen derivatives in which all the H-atoms present at the oand the p- positions with respect to the -OH group are replaced by Bromine. Which of the following compounds is most basic?









Benzylamine

6. Which of the following artificial sweatners is methyl ester of a dipeptide?

- (a) Aspartame (b) Sucralose
- (c) Saccharine (d) Alitame

Answer: (a) Aspartame

- 7. Which of the following can be used as an antacid?
- (a) Ranitidine (b) Histamine
- (c) Equanil (d) Aspirin

Answer: (d) Aspirin

8. The number of Cl<sup>-</sup> ions present around each Na<sup>+</sup> ion in NaCl crystal lattice is

(a) 3 (b) 4 (c) 8 (d) 6

Answer: (d) 6

Explanation: Each Na+ ion is surrounded by six Cl- ions and each Cl- ion is surrounded by six Na+ ions. The ionic lattice is the large groups of ions that are fixed together as crystals by electrostatic force of attraction. Both sodium and chloride ions have fcc/ccp unit cell.

9. Which one has the higher coagulating power for feric-hydroxide sol?

(a) KCl (b) K2SO4 (c) Na3PO4 (d)NaCl

Answer: (c) Na<sub>3</sub>PO<sub>4</sub>

Explanation: The valence of chloride, sulphate and phosphate is 1,2,3 respectively. Hence Na<sub>3</sub>PO<sub>4</sub> is most effective electrolyte for the coagulation of Fe(OH)<sub>3</sub> sol which is a positively charged sol.

10. For the compounds CH<sub>3</sub>Cl , CH3I , CH3Br and which of the following is the correct order of C-halogen bond length ?

(a) <CH<sub>3</sub>Cl < CH<sub>3</sub>Br <CH<sub>3</sub>I

(b) <CH<sub>3</sub>I<CH<sub>3</sub>Br<CH<sub>3</sub>Cl





(c) CH<sub>3</sub>I<CH<sub>3</sub>Cl<CH<sub>3</sub>Br<



(d) CH<sub>3</sub>Br<CH<sub>3</sub>Cl<



11. Which of the following compounds will take part in nucleophilic addition reaction most readily?

(a) CH<sub>3</sub>COCH<sub>3</sub> (b)CH<sub>3</sub>CHO (c)C<sub>6</sub>H<sub>5</sub>CHO (d)C<sub>6</sub>H<sub>5</sub>COC<sub>6</sub>H<sub>5</sub> **Answer:** C<sub>6</sub>H<sub>5</sub>CHO

Answer the following questions (Alternatives are to be noted): (1 x 4 = 4)

12. What are the dispersed phase and dispersion medium in soap lather?

Answer: The dispersion medium is liquid and dispersed phase is gas.

13. What is the purpose of adding a food preservative to a packaged food?

**Answer:** Food preservatives are added to the packaged food to prevent rancidity, and to fight with bacteria, molds, fungi so that taste of food doesn't get spoiled.

14. How many faraday of electricity is required to liberate 1 mole of copper from a copper sulphate solution?

Answer: 2 Faraday electricity is required to liberate 1 mole of copper.

15. Which of the following exhibits highest acidic character?

### CrO, Cr<sub>2</sub>O<sub>3</sub>, CrO<sub>3</sub>

#### Answer:

CrO=Basic, Cr<sub>2</sub>O<sub>3</sub>=Amphoteric, CrO<sub>3</sub>=Acidic

Reason:

The higher the oxidation number the more acidic is the corresponding oxide CrO3 is an example for this.