(R) Heat supplied to Carnot's Engine is 1320 Joule. Calculate the amount of useful work done by it and efficiency of engine operating between 435 K and 300 K. 4

## UNIT VI

12. (A) Derive the relationship between critical constant in terms of van der Waal's constant. 4

(B) Calculate RMS and average velocity of $CO_2$ gas at 1000 $^0C$

($M\ CO_2 = 44 \times 10^{-3}$ kg) 4

(C) Define the following terms :

(i) Triple point (ii) Phase. 4

**OR**

13. (P) Explain Maxwell-Boltzmann distribution law of molecular velocities. 4

(Q) Calculate $P_c$ and $T_c$ for a gas if a = 0·740 $dm^6$ atm $mole^{-2}$ and b = 0·0213 $dm^3$ $mole^{-1}$ (R = 0.0821 $dm^3$ atm $k^{-1}$ $mole^{-1}$). 4

(R) Draw well labelled diagram of sulphur system and explain significance of each curves. 4



**AR – 479**

First Semester B. Sc. (Part - I) Examination

# 1S : CHEMISTRY

P. Pages : 8

Time : Three Hours] [Max. Marks : 80

**Note :** (1) All questions are compulsory.
(2) Question number **one** carries **eight** marks while each of the remaining **six** questions carries **twelve** marks.
(3) Draw diagrams and write equations wherever necessary.
(4) Use of calculator is allowed.

1. (A) Fill in the blanks :—

(i) $(4n+2)\pi$ electron rule is called——— rule.

(ii) In diborane, boron atom is ——— hybridized.

(iii) The species containing positively charged carbon centre is called ——— .

(iv) The critical volume is related with van der Wall constant as ——— . 2

(B) Choose correct option from the given alternatives :

(i) Valence shell electronic configuration of alkali metals is :

(a) $ns^2$ (b) $ns^2\ np^2$

(c) $ns^2\ np^3$ (d) $ns^1$

(ii) Delocalization of σ bond electrons with π bond electron is called as :

(a) Inductive effect.

(b) Resonance effect.

(c) Hyperconjugative effect.

(d) Electromeric effect.

(iii) Which of the following group is o–p directing group :

(a) –COOH (b) $-NH_2$

(c) $-NO_2$ (d) –CHO

(iv) In water system the degree of freedom at triple point is :

(a) One (b) Two

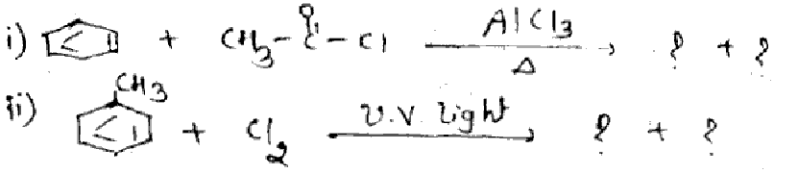
(c) Zero (d) Three. 2

(C) Answer the following in **one** sentence :—

(i) What is meant by screening effect ?



(Q) Complete the following reactions :




4

(R) Define with suitable example :

(i) Activating groups.

(ii) Deactivating groups. 4

## UNIT V

10. (A) Define the term entropy and give physical significance of it. 4

(B) Distinguish between isothermal and adiabatic process. 4

(C) The heat of vaporization of 1 mole of ethanol is 38.57646 kJ $mol^{-1}$ and its melting point is 351.5 k. Calculate the entropy change. 4

**OR**

11. (P) State first law of thermodynamics and give its limitations. 4

(Q) Describe the four steps of Carnot cycle. 4

(ii) State phase rule.

(iii) What are meta directing groups ?

(iv) Define covalent radius. 4

## UNIT I

2. (A) Define lattice energy. Give Born–Lande equation for calculation of Lattice energy giving meaning of each term. 4

(B) Explain :—

(i) Ionic bond formation.

(ii) Electron affinity value for inert gas is zero. 4

(C) Explain how ionization potential varies in a period and a group. 4

**OR**

3. (P) Define the following terms :—

(i) Electron affinity.

(ii) van der Waal's radius. 4

(Q) How will you determine electronegativity of an atom by using Pauling scale ? 4



**OR**

7. (P) Explain E1 mechanism with suitable example. 4

(Q) Define following terms with an example :

(i) Electromeric effect

(ii) Cumulated diene. 4

(R) Define free radicals. Give two methods of generation of free radicals. 4

## UNIT IV

8. (A) What are the characteristics of antiaromatic compounds ? 4

(B) Give the mechanism of Nitration of benzene. 4

(C) On the basis of modern electronic theory explain m-directing effect of $-NO_2$ group. 4

**OR**

9. (P) Discuss Kekule's structure of benzene. 4

(R) Calculate the heat of formation ($\Delta H_f$) of KF from its elements using the Born–Haber cycle. The data is :

- Sublimation energy of potassium (s) = 87.878 $kJmol^{-1}$
- Dissociation energy of $F_2(D) = 158.9\ kJ\ mol^{-1}$
- Ionization energy of $K_{(g)}$ (I) = 414.2 $kJ\ mol^{-1}$
- Electron affinity for $F_{(g)}$ (E) = –334.7 $kJ\ mol^{-1}$
- Lattice energy of $K_f(u_0) = -807.5\ kJ\ mol^{-1}$

4

## UNIT II

4. (A) Write the electronic configuration of IV A group elements. 4

(B) Define carbides. Give short account on ionic and covalent carbides. 4

(C) What is the action of following on diborane:

(i) Alkali (ii) Oxygen 4



**OR**

5. (P) Explain why alkali metals exhibit +1 and alkaline earth metals exhibit +2 oxidation state only. 4

(Q) Explain ionization energy of P–block elements. 4

(R) Explain the following terms :—

(i) Inert pair effect.

(ii) Diagonal relationship. 4

## UNIT III

6. (A) Explain the stability of carbocation on the basis of inductive effect and resonance effect. 4

(B) How will you prepare :

(i) Ethane from acetylene ?

(ii) 1, 3-butadiene from cyclohexane ? 4

(C) Write short note on :—

(i) Aromatization of alkane

(ii) Peroxide effect. 4