

CHE-1

BACHELOR OF SCIENCE (B.Sc.)

Term-End Examination

June, 2005

CHEMISTRY

CHE-1 : ATOMS AND MOLECULES

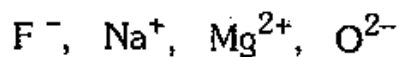
Time : 1 hour

Maximum Marks : 25

Note : Answer any **two** questions. Each question carries $12\frac{1}{2}$ marks.

1. (a) What is a black-body ? Give three main aspects of black-body radiation. $4\frac{1}{2}$
- (b) State the meaning of the following terms : 4
- (i) node
 - (ii) matter waves
 - (iii) azimuthal quantum number
 - (iv) normalization constant

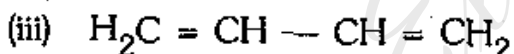
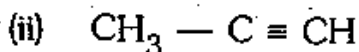
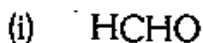
- (c) (i) Arrange the following ions in the decreasing order of their ionic radii :



Give reason in support of your answer.

- (ii) Predict the structure of BF_3 molecule using VSEPR theory. (Atomic Nos. : B = 5; F = 9). 4

2. (a) Give the type of hybridisation of all the carbon atoms in the following compounds : 4



- (b) Write the molecular orbital configuration of CO and calculate its bond order. Will it be paramagnetic ? (Atomic Nos. : C = 6; O = 8). 4

- (c) Define dielectric constant. State the expression relating dielectric constant with the total molar polarisation. State the significance of the terms used. $4\frac{1}{2}$

3. (a) What type of energy changes occur in microwave active molecules when they are subjected to microwave radiation ? 1

- (b) The lowest wave number absorption line in the rotational spectrum of $^1\text{H } ^{19}\text{F}$ is at $4.111 \times 10^3 \text{ m}^{-1}$.

Answer the following questions :

3

- (i) What is the value of lowest frequency of absorption in the rotational spectrum of HF ?
- (ii) What are the two energy levels involved in this transition ?
- (iii) What is the value of the rotational constant (B) for HF ? (Velocity of light = $3.0 \times 10^8 \text{ ms}^{-1}$).
- (c) Write the expression for vibrational energy and state the significance of the various terms used. Using it obtain expressions useful in calculating the vibrational energy for $v = 1$ and $v = 2$ vibrational levels of a diatomic molecule. Also explain the term, zero point energy.

$4\frac{1}{2}$

- (d) Explain any **two** of the following with the help of one example :

2+2

- (i) Nuclear fusion
- (ii) Nuclear fission
- (iii) Tracer technique