

C 6132

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Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION
MAY 2016

(UG—CCSS)

Core Course—Chemistry

CH 2B 03—THEORETICAL CHEMISTRY

Time : Three Hours

Maximum : 30 Weightage

Section A

I. Answer *all* twelve questions. Each question carries a weightage of $\frac{1}{4}$.

1 The geometry of IF_7 molecule is:

- (a) Octahedral (b) Square pyramidal
(c) Pentagonal bipyramid (d) Trigonal bipyramid.

2 The bond order of CO molecule is:

- (a) 1. (b) 2.
(c) 3. (d) 4.

3 The value of Rydberg constant is :

- (a) $1.0967758 \times 10^7 \text{ cm}^{-1}$. (b) $1.0967758 \times 10^8 \text{ cm}^{-1}$.
(c) $1.0967758 \times 10^7 \text{ m}^{-1}$. (d) $1.0967758 \times 10^8 \text{ m}^{-1}$.

4 The species O_2^+ is isoelectronic with :

- (a) NO. (b) N_2 .
(c) CO. (d) CO^+ .

5 Which of the following does not exist ?

- (a) He_2^+ . (b) H_2 .
(c) He_2 . (d) H_2^+ .

6 Which among the following has a distorted geometry ?

- (a) CH_4 . (b) PCl_5 .
(c) BH_3 . (d) NH_3 .

Turn over

- 7 The hybridization of S in SF_6 is :
- (a) sp^3d . (b) sp^3d^3 .
(c) sp^3d^2 . (d) dsp^2 .
- 8 The energy gap between valence band and conduction band is called _____.
- 9 The phenomenon of photoelectric effect establishes the _____ nature of light.
- 10 The Schrodinger wave equation for particle in one dimensional box is _____.
- 11 The condition for orthogonality is _____.
- 12 The Fermi level of conductors lies in the _____ band.

(12 × ¼ = 3 weightage)

Section B

II. Answer *all* nine questions. Each question carries a weightage 1.

- 13 What is Born-Oppenheimer approximation ?
- 14 Derive de Broglie relation.
- 15 What are eigen function and eigen values of an operator ?
- 16 Arrange O_2 , O_2^+ , O_2^- , O_2^{2-} in the increasing order of their bond order.
- 17 Name the different spectral series in Hydrogen spectrum.
- 18 What is the magnetic behaviour of oxygen molecule ? Give reason.
- 19 Calculate the radius of the second orbit of hydrogen atom.
- 20 Give the values of quantum numbers for the outermost electrons in the ground state of Potassium atom.
- 21 What is meant by a well behaved wave function ?

(9 × 1 = 9 weightage)

Section C

III. Answer any *five* questions. Each question carries a weightage 2.

- 22 State and explain the postulates of quantum mechanics.
- 23 Differentiate bonding and antibonding molecular orbitals.
- 24 Explain the radial probability distribution curves of 2s and 2p orbitals.

- 25 Explain photoelectric effect based on quantum theory of radiation.
- 26 How will you explain the conductivity of metals on the basis of band theory ?
- 27 Describe the potential energy diagram for the formation of H_2 molecule.
- 28 Explain sp^2 and sp^3 type of hybridizations with suitable example.

(5 × 2 = 10 weightage)

Section D

IV. Answer any *two* questions. Each question carries a weightage of 4.

- 29 (i) Draw the molecular orbital diagram of nitrogen molecule and calculate the bond order.
(ii) Explain the geometry of PCl_5 based on the hybridisation.
- 30 Set up and solve the Schrodinger wave equation for a particle in three dimensional box and get expression for the wave function and energy.
- 31 (i) Write the important limitations of Bohr model of atom and give the Sommerfeld modification of the model.

(ii) Calculate the uncertainty in locating the position of an electron moving with a speed of 300 ms^{-1} accurate up to 0.001 %.

(2 × 4 = 8 weightage)