C 25892 (Pages : 3) Name...

Reg. No......................................

SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION APRIL 2017

(UG—CCSS)

Chemistry

CH 2B 03—THEORETICAL CHEMISTRY

Time : Three Hours   Maximum : 30 Weightage

I. Answer *all* the *twelve* questions. Each question carries a weightage of 0.25 :

1 The angular momentum of the electron according to the Bohr model is an integral multiple of ————.

2 A subshell with $n = 6$ and $I = 3$ is designated as ————.

3 Schrödinger wave equation is ————.

4 The Laplacian operator is defined by ∇^2 = ————.

5 The number of antibonding electrons in Nitrogen molecule is ————.

6 CO has ten bonding electrons and four antibonding electrons. Its bond order is :

   (a) 3.   (b) 7.

   (c) 1.   (d) 2.

7 Which among the following is paramagnetic?

   (a) O_2.   (b) N_2.

   (c) Be_2.   (d) O_2^{2+}.

8 Bond order is ————.

9 The Fermi level is :

   (a) Average of all available energy levels.

   (b) Energy level at the top of the valence band.

   (c) Highest occupied energy level at 0°C.

   (d) Highest occupied energy level at 0K.

10 What is the hybridization of nitrogen in Ammonia ?

Turn over

11 Which of the following species is triagonal bipyramidal ?

    (a) PCl_5.
         (b) SF_6.

    (c) XeF_2.
         (d) CH_4.

12 Fermi energy level for intrinsic semiconductor lies :

    (a) At the middle of band gap.
    (b) Close to conduction band.

    (c) Close to valence band.
    (d) None.

$(12 \times 0.25 = 3$ weightage$)$

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

13 State Heisenberg Uncertainty principle.

14 What is black body radiation ?

15 Define Photoelectric effect.

16 What is de Broglie wavelength of an electron with a velocity of 2×10^7 m/s ?

17 Write any two postulates of quantum mechanics.

18 Write the Rydberg equation and explain the terms.

19 Draw the potential energy diagram for H_2 molecule.

20 Mention the type of hybridization in the following compounds :

    (a) BH_3.
         (b) CH_4.

    (c) PCl_5.
         (d) BeH_2.

21 SF_6 molecule is octahedral in shape. Why ?

$(9 \times 1 = 9$ weightage$)$

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

22 What is Sommerfeld's modification of Bohr's atomic model ?

23 Apply quantum mechanics to a particle in one dimensional box.

24 Draw and explain the radial probability distribution curves of 2s and 2p orbitals.

25 Differentiate between bonding and antibonding molecular orbitals. Calculate the bond order of O_2^+ ion.

26 Draw the MO diagram of CO molecule.

27 Write briefly on band theory of solids.

28 Explain the hybridization in IF_7.

$(5 \times 2 = 10$ weightage$)$

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

29 Write the postulates of Bohr theory and derive the Bohr energy equation.

30 What are quantum numbers ? How are they significant ?

31 Compare the VB and MO theories of chemical bonding.

(2 × 4 = 8 weightage)