2016/ODD/07/20/BSCP–502/
BSMP–502/460

UG Odd Semester (CBCS) Exam., December—2016

B.Sc (Honours) B.Ed

(5th Semester)

Course No. : BSCP–502/BSMP–502

Time : 2 hours

The figures in the margin indicate full marks for the questions

Candidates are to answer *either* BSCP–502 *or* BSMP–502

CHEMISTRY

(Pass)

Course No. : BSCP–502

(General Chemistry)

Full Marks : 50
Pass Marks : 20

1. *(a)* Show diagrammatically the crystal-field splitting of *d*-orbitals in an octahedral complex. 2

(b) What is spectrochemical series? Write one of its uses in coordination chemistry. 4

(c) Write one limitation of valence-bond theory. 2

(d) Define crystal-field stabilization energy (CFSE). 2

OR

2. *(a)* Write the differences between bonding and antibonding molecular orbitals. 2

(b) Show diagrammatically the molecular orbital diagram of NO molecule and calculate its bond order. 4

(c) Using VSEPR theory, predict the shapes of XeF_4 and H_2O molecules. 4

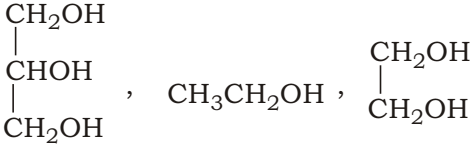
3. *(a)* Arrange the compounds in order of increasing acidity and explain the reasons : 2×3=6

(i) H_2O, CH_4, NH_3, HF

(ii) Ethylene, Ethane, Acetylene

(iii) H_3CCOOH, CH_2FCOOH, $CH_2ClCOOH$, CH_3CH_2COOH

(b) Arrange the compounds in order of increasing solubility with reason : 2



(c) Explain why chloroform $CHCl_3$ is polar but carbon tetrachloride CCl_4 is nonpolar. 2

OR

4. (a) Write the Knorr synthesis of pyrrole with mechanism. 4

(b) Why is pyridine more basic than pyrrole? 2

(c) Write the Fischer indole synthesis with mechanism. 4

5. (a) Write the mechanism of nitration of benzene. 3

(b) Write the structure of Gly-Ala peptide bond. 2

(c) Write the mechanism of Strecker synthesis of amino acid. 3

(d) What is zwitterion? Write the structure of zwitterion of alanine. 2

OR

6. (a) Complete the following reactions : 2×2=4

(i) $H_3C-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[2)\ H_2O/H^+]{1)\ H_3C\text{-}Mg\text{-}I} ?$

(ii) $H_3C-C\equiv N \xrightarrow[2)\ H_2O/H^+]{1)\ H_3C\text{-}Mg\text{-}I} ?$

(b) Prepare cyclobutane carboxylic acid from diethyl malonate (DEM). 3

(c) Prepare

$$H_3C-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$$

from suitable active methylene compound. 3

7. (a) Draw and explain the phase diagram of H_2O system. 4

(b) The value of equilibrium constant K_P for the water gas reaction

CO (g) H_2O (g) $\rightleftharpoons$ CO_2 (g) H_2 (g)

is 1 06 10^5 at 25 °C. Calculate G for the reaction. 4

(c) Write Le Chatelier's principle and its application. 2

OR

8. (a) Define colligative property with example. 2

(b) Write the Raoult's law and its mathematical form. 2

(c) Define with example the Hardy-Schulze rule. 2

(d) A solution of 12·5 g of urea in 170 g of water gave boiling point elevation of 0 63 K. Calculate the molar mass of urea. K_b 0 52 K kg mol ^{1}. 4

9. Explain the following terms : 2½×4=10

(a) Fluorescence

(b) Phosphorescence

(c) Quantum yield

(d) Non-radiative transitions

OR

10. *(a)* Write the expression of rotational energy in the Jth level. 2

(b) What is reduced mass? 2

(c) Show that rotational lines are equally spaced by a constant spacing ($2B$) during transition. 4

(d) What do you mean by zero point energy? 2

MATHEMATICS

(Pass)

Course No. : BSMP–502

(Coordinate Geometry and Linear Programming)

Full Marks : 70
Pass Marks : 28

1. *(a)* Solve the equation : 7

$$4y \quad 12y \quad 9y \quad 0$$

(b) Define second-order linear differential equation. 7

OR

2. *(a)* Find the equation of tangent of the circle $x^2 \quad y^2 \quad 6x \quad 4y \quad 12 \quad 0$ which is parallel to the line $4x \quad 3y \quad 5 \quad 0$. 7

(b) Find the pole of the line $3x \quad 5y \quad 17$ with respect to the circle $x^2 \quad y^2 \quad 4x \quad 6y \quad 9 \quad 0$. 7

3. *(a)* If a, b, h are not all zero and $h^2 \quad ab$, then prove that $ax^2 \quad 2hxy \quad by^2 \quad 0$ represents a pair of straight lines passing through origin. 7

(b) Show that the straight lines represented by $(x \quad 2a)^2 \quad 3y^2 \quad 0$ and $x \quad a$ form an equilateral triangle. 7

OR

4. *(a)* Determine the vertex and axis of symmetry for the graph of each equation : 4×2=8

(i) $y \quad 2(x \quad 4)^2 \quad 3$

(ii) $y \quad x^2 \quad 4x \quad 8$

(b) Find the equation of vertical parabola with a vertex (2, 6) and passing through the point (1, 4). 6

5. *(a)* Define equation of tangent and normal of a curve. 6

(b) Find the equation of the tangent to $f(x) \quad x^3 \quad 3x^2 \quad x \quad 1$ at the point, where $x \quad 3$. 8

OR

6. *(a)* Define plane and deduct the equation of plane passing through (x_1, y_1, z_1). 7

(b) Find the equation of the plane passing through points (2, 2, 1), (1, 2, 3) and parallel to x-axis. 7

7. *(a)* Explain linear programming model. 7

(b) What are the important assumptions of linear programming? 7

OR

8. *(a)* Define dual problem. 6

(b) Explain the relationship between primal and dual problem. 8

9. *(a)* Define dual simplex algorithm. 7

(b) Write a note on game theory. 7

OR

10. *(a)* What is test of optimality? 6

(b) Explain explicit tests of optimality in a Hilbert space. 8

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