BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources and Coastal Engineering
Student Group : 0 < Earned Credit Hour <= 36, Final Examination (Spring) : Feb 2021

Subject: CHEM 101, Chemistry

Total: 2.00 hours **Full Marks: 180**
Section A: 1.00 hour **Section A: 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 1 and Question – 4 (Viva Voce)** in **Section A** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 2 & Q - 3)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-A

Question – 1 **(Compulsory)**

a. Discuss the postulates of Bohr atom model with its limitations. **10**

b. What is atomic spectrum? Discuss the origin of different spectral lines of hydrogen atom. **2+8=10**

c. Define orbit and orbital. The electronic configuration of carbon atom is $1s^2 2s^2 2p^2$. Write down all the possible quantum numbers for '$2p^2$'. **4+1=05**

d. State and explain De Broglie equation with suitable example. **05**

Question – 2

a. What is hybridization? Is there any change in the hybridization of B and N atoms as a result of the following reaction? **2+8=10**

$$BF_3 + :NH_3 \rightarrow F_3B:NH_3$$

Explain if your answer is positive.

b. Fluorine atom can form NF_3 but not NF_5 – explain why. **05**

c. What is molecular orbital theory (MOT)? Calculate the bond order and comment on magnetism of O_2^- with the help of MOT. **2+8=10**

d. Differentiate between bonding and anti-bonding molecular orbital. **05**

Question – 3

a. Write short notes on: **5×3=15**
   (i) Li and Mg are similar in many respects.
   (ii) d-block elements form colorful compounds.
   (iii) Variation of atomic size of Ne and Na^+.

b. According to Bronsted-Lowry concept, show that H_2SO_4 is an example of a base. **05**

c. Explain amphiprotic species with suitable examples. **05**

d. Deduce the equation of Henderson-Haselbalch for an acidic buffer solution. **05**

Question – 4 **Viva-Voce (Compulsory)** **30**
Marks allotted for Viva 30

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Subject: CHEM 101 Chemistry

Total: 2.00 hours **Full Marks: 180**
Section B: 1.00 hour **Section B: 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 5 and Question – 8 (Viva Voce)** in **Section B** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 6 & Q - 7)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-B

Question – 5 (Compulsory)

a. Define pH and pOH with examples. What are the ionic products of water and how they are related with pH and pOH? **2+8=10**

b. For a general reaction, $pP + qQ \rightleftharpoons yY + zZ$, deduce the equilibrium constant expressions in terms of partial pressure and in terms of molar concentration. Establish a relationship between K_p and K_c. **4+6=10**

c. State Le Chatelier's principle. Explain the effect of temperature, pressure and concentration changes on chemical equilibrium in any reaction according to this principle. **2+8=10**

Question – 6

a. What is a saturated, unsaturated and supersaturated solution? In a saturated solution, there exists a dynamic equilibrium between the undissolved solute molecules and the solute molecules in solution- discuss with a suitable examples. **3+7=10**

b. Define solubility? Discuss the factors influence the solubility? **2+8=10**

c. Define colligative properties. Determine the molar mass of solute from lowering of vapour pressure. **2+8=10**

Question – 7

a. Defferentiate between Voltaic cell and Electrolytic cell. Draw the suitable diagram for each case and write down the half-cell reaction. **5+5=10**

b. State and explain Le Chatelier's principle with examples. **10**

c. Show the conductmetric titration curves in case of (i) strong acid with strong base, (ii) strong acid with weak base, (iii) weak acid with strong base, and (iv) weak acid with weak base. Explain the nature of each curve with suitable examples. **10**

Question – 8 Viva-Voce (Compulsory) **30**
Marks allotted for Viva 30