THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF BASIC SCIENCES

BACHELOR OF PHARMACY HONOURS- LEVEL 03 - 2020/21
BSU3340- PHARMACEUTICAL CHEMISTRY I
NBT I1

DATE: 05th January 2022 **DURATION: 1.5 HOURS**

TIME: 09.00 a.m. – 10.30 a.m.

REGISTRATION NO: .....

1. **This question paper consists of 10 pages with 20 Multiple Choice Questions (Part A) and 04 Short Answer Questions (Part B).**
2. **Please fill the address sheet. (See last page)**

IMPORTANT INSTRUCTIONS TO CANDIDATES

- Write your Registration Number in the space provided.
- Answer **ALL questions**.
- **Multiple Choice Questions (Part A):** Indicate answers in the answer sheet provided by placing a cross (X) in **INK** in the relevant cage.
- Answers in pencil will **NOT** be marked.
- **Short Answer Questions (Part B):** Write answers within the space provided.
- Do not remove any page/part of this question paper from the examination hall.
- Mobile phones and the electronic equipment are **NOT** allowed. Leave them outside.

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ANSWER SHEET FOR PART A

Q. No.	(a)	(b)	(c)	(d)
1.1				
1.2				
1.3				
1.4				
1.5				
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BSU3340- PHARMACEUTICAL CHEMISTRY I
NBT 01

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Part A – Multiple Choice Questions

(20 marks)

Choose the most suitable answer and indicate with a 'X' in the answer sheet provided.

1.1 A Lewis acid is defined as
a) a proton donor
b) a proton acceptor
c) an electron pair acceptor
d) a hydroxide ion producer

1.2 Calculate the pOH of a solution of 0.15 M HBr.
a) 0.82 b) 13.18 c) 7 d) 14

1.3 Hypochlorous acid (HOCl) dissociates in water to create hydronium and hypochlorite ions. $HOCl+H_2O \Leftrightarrow H_3O^+ + OCl^-$. Which of the following correctly describes the resultant effect on the concentration of HOCl upon addition of extra hypochlorite ions to the solution?
a) It remains the same
b) Increased
c) Decreased
d) It depends on the number of hydronium ions

1.4 If the dissociation constant Ka of a weak acid is 4.0×10^{-9}, Which of the following gives its equivalent Kb?
a) 2.5×10^{-6} b) 1.5×10^{-10} c) 4.5×10^{-11} d) 4.0×10^{-8}

1.5 Suppose a large organic molecule **Z** is classified as a Lewis acid, while another large molecule **Y** is classified as a Bronsted-Lowry acid. Which of the following most accurately describes a similarity in their behaviors in solution?
a) Both molecules will release hydroxide ions
b) Both molecules will release H^+
c) Both molecules will tend to acquire a net negative charge
d) Both molecules will tend to acquire a net positive charge

1.6 The conjugate acid and its conjugate base of the following reaction in aqueous solution is, $CH_3COOH + NH_3 \Leftrightarrow CH_3COO^- + NH_4^+$

a) CH_3COOH and CH_3COO^-
b) CH_3COOH and NH_4^+
c) NH_3 and CH_3COO^-
d) NH_3 and NH_4^+

1.7 If the pH of a solution increases by 2 units, then the ratio of the new to the original hydronium ion concentration is:

a) 2/1 b) 1/100 c) 100/1 d) unchanged

1.8 Of the following solutions, which has the greatest buffering capacity?

a) 0.01 M CH_3COOH and 0.50 M CH_3COONa
b) 1.0 M CH_3COOH and 0.001 M CH_3COONa
c) 0.01 M CH_3COOH and 0.0090 M CH_3COONa
d) They would all have the same capacity

1.9 Which statement is WRONG about buffer solutions?

a) Buffers are resistant to pH changes upon addition of small amounts of strong acids and bases.
b) pH of a buffer is close to the pKa of the weak acid from which it is made.
c) Buffer capacity decreases with the increase of molar concentration of acid and salt.
d) The closer the pH to pKa of the acid, higher the buffer capacity.

1.10 A buffer solution can be made by dissolving equals moles of

a) HF and NaF
b) HNO_3 and NaOH
c) HF and NaBr
d) CH_3COOH and NaCl

1.11 A buffer solution contains similar concentration of weak acid and its conjugate base. If the ionization constant of the weak acid is 10^{-8}, what is the pH of the buffer solution?

a) 7 b) 10 c) 8 d) 2

1.12 Of the following compounds given below, which compound is a diprotic oxyacid?

a) H_3PO_4 b) HBr c) H_2SO_4 d) CH_3COOH

1.13 Which of the following acid/base titrations cannot determine the equivalence point in an accurate manner?

a) Strong acid/strong base
b) Weak acid/weak base
c) Strong acid/weak base
d) Weak acid/strong base

1.14 In which direction will the following equilibrium shift if a solution of $AgNO_3$ is added?

$AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$

a) Shifts to the right
b) Shifts to the left
c) Equilibrium will not be shifted
d) Cannot be predicted

1.15 Ag_2SO_4 is a sparingly soluble salt. The solubility product constant (Ksp) expression for this salt is:

a) $Ksp = [2Ag^+(aq)]\,[SO_4^{2-}(aq)]$
b) $Ksp = [2Ag^+(aq)]^2\,[SO_4^{2-}(aq)]$
c) $Ksp = [Ag^+(aq)]^2\,[SO_4^{2-}(aq)]$
d) $Ksp = [Ag^+(aq)]\,[SO_4^{2-}(aq)]$

1.16 Gasses are most soluble in liquids at:

a) High temperature and low pressure
b) High temperature and high pressure
c) Low temperature and low pressure
d) Low temperature and high pressure

1.17 Which of the following salts is LEAST soluble in water?

a) CuS $Ksp = 8.5 \times 10^{-45}$
b) $CuCO_3$ $Ksp = 7.4 \times 10^{-21}$
c) CuBr $Ksp = 5.3 \times 10^{-9}$
d) CuCl $Ksp = 1.2 \times 10^{-6}$

1.18 The equation for the dissolving of $BaSO_4$(low soluble in water) is given below. $BaSO_4(s) + \text{energy} \leftrightarrow Ba^{2+}(aq) + SO_4^{2-}(aq)$. Which of the following changes would increase the solubility of $BaSO_4$ (s)?

a) Add Na_2SO_4.
b) Add $Ba(NO_3)_2$.
c) Add more water.
d) Increase the temperature

1.19. What is TRUE on a spontaneous reaction?

a) $\Delta H = 0$ b) $\Delta H < 0$ c) $\Delta G < 0$ d) $\Delta G > 0$

1.20 which equation is correct regarding an endothermic reaction?

a) $\Delta H = 0$ b) $\Delta H < 0$ c) $\Delta G > 0$ d) $\Delta H > 0$

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Part B –Short Answer Questions

(80 marks)

Write answers in the space provided.

1. A sample of Hydrochloric acid (HCl) was tested for purity using the following method. A 2.350 g of the acid was transferred to a volumetric flask and diluted up to 100.00 mL mark with water. A 25.00 mL of this solution was titrated with 0.10 M sodium hydroxide solution. 27.50 mL of NaOH was required for complete neutralization. (20 marks)

   a) Write the balanced chemical equation.

   b) Calculate the moles of NaOH and the moles of HCl acid used in the titration.

   c) Calculate the mass of HCl acid in the solution and the purity of the sample. Molecular weight of HCL acid is 36.46 g/mol.

2. a) Write the expression for the solubility product, Ksp, of saturated solution of a white crystalline salt MgF_2. (Marks 05)

b) An experiment is conducted to determine the solubility of magnesium fluoride, and it is found that 0.0080 g of the compound will dissolve in 500.0 mL of water. What is the Ksp for MgF_2? Molecular weight of MgF_2 is 62.30 g/mol. (Marks 15)

3. a) Consider a weak acid, HF. Provide the chemical equation for the ionization of HF in aqueous solution. (03 marks)

b) Derive the Henderson-Hasselbalch equation for HF. (05 marks)

c) Calculate $[H_3O^+]$ in a solution that is 0.10 M in HF and 0.20 M in NaF. Also calculate % ionization in pure 0.1 M HF and in the solution mixture. Which solution is less acidic? Acid dissociation constant of HF is 6.8×10^{-4} mol/L. (12 marks)

4. a) Explain whether NH_4Cl solution is acidic or basic. (04 marks)

b) Consider the equilibrium, $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$. What happens to the position of equilibrium if we add some extra chloride ions to the solution? Explain the effect of extra chloride ions to the solubility of AgCl. (06 marks)

c) A solution of AgCl ($Ksp = 1.8 \times 10^{-10}$) is equilibrated with 0.010 M NaCl solution. How many moles of AgCl will dissociate in 1.0 L of the NaCl solution? (10 marks)

Reg No:.....

Name:.....

Address:.....

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