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THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF BASIC SCIENCES
ACADEMIC YEAR 2020/2021 – SEMESTER 01
BACHELOR OF PHARMACY HONOURS

BSU3340 – PHARMACEUTICAL CHEMISTRY I – LEVEL 03
FINAL EXAMINATION

DATE: 15th MARCH 2022 **DURATION: 3.0 HOURS**

TIME: 01.30 a.m. – 4.30 p.m.

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This question paper consists of 07 pages with 20 Multiple Choice Questions (Part A) and 06 Essay Questions (Part B). Answer all questions.

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.
- **Essay Questions (Part B):** Write answers in booklets provided.
- Do not remove any page/part of this question paper from the examination hall.
- Mobile phones are **NOT** allowed. Leave them outside.
- Calculators are allowed.

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ANSWER SHEET FOR PART A

Q. No.	(a)	(b)	(c)	(d)
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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. Bronsted-Lowry acid is defined as a/an:
   a) proton acceptor b) proton donor c) hydroxide ion producer d) electron pair donor

2. Substances that can act as both acids and bases are called:
   a) amphoteric substances b) conjugate acids
   c) conjugate bases d) neutral compounds

3. Which of the following has dispersion forces as its only intermolecular forces?
   a) HBr b) NaOH c) CH_4 d) NH_3

4. Which one of the following is **NOT** a derived physical quantity?
   a) Area b) Density c) Concentration d) Mass

5. A measurement which on repetition gives same or nearly same result is called:
   a) Same measurement b) Average measurement
   c) Precise measurement d) Accurate measurement

6. Which one of the following statements is **NOT** correct?
   a) Helium has the highest first ionization energy in the periodic table.
   b) Atomic size increases to the right across a period.
   c) Bromine is a liquid at room temperature.
   d) Ionization energy increases to the right across a period.

7. Which of the following is **NOT** the electronic configuration of a noble gas?
   a) $1s^2$ b) $1s^2\ 2s^2$ c) $1s^2\ 2s^2\ 2p^6$ d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

8. The electronic configuration of an element with atomic number 26 is:
   a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3d^8$ b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$
   c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4\ 4p^2$ d) none of the above

9. Which of the following compounds has the highest melting point?
   a) CF_4 b) CCl_4 c) CI_4 d) CH_4

10. What is the empirical formula of compound with a composition of 87.5 % N and 12.5 % H?

a) NH_2 b) N_2H_3 c) NH d) N_2H

11. Which of the following is **LESS** soluble in warm water than in cold water?

a) NaCl b) CO_2 c) KBr d) $NaNO_3$

12. When two solutions are mixed together in a beaker at room temperature, a spontaneous reaction occurs while the temperature of the beaker falls to below 0° C. What information given below is true based on this information.

a) endothermic; $\Delta H > 0$; $\Delta S > 0$ b) exothermic; $\Delta H < 0$; $\Delta S > 0$
c) endothermic; $\Delta H < 0$; $\Delta S < 0$ d) exothermic; $\Delta H > 0$; $\Delta S < 0$

13. What is the concentration of copper ions in a saturated copper (II) iodate, $Cu(IO_3)_2$ solution? (*K*sp for $Cu(IO_3)_2 = 1.4 \times 10^{-7}$ mol^3/L^3)

a) 1.2×10^{-5} mol/L b) 1.4×10^{-7} mol/L
c) 6.6×10^{-3} mol/L d) 3.3×10^{-3} mol/L

14. Which of the following statement is incorrect regarding partition and distribution coefficients?

a) Partition coefficient considers the concentration ratio of unionized species of compound.
b) Distribution coefficient refers to the concentration ratio of all species (ionized and unionized) of the compound.
c) Partition coefficient pertains to liquid-solid extraction.
d) Hydrophobic drugs generally have higher partition coefficients.

15. Which one of the following is the correct expression for molality?

a) Mole solute / kg solvent b) Mole solute / L solvent
c) Mole solute / kg solution d) Mole solte / L solution

16. Which one of the following statements is **TRUE** about buffers?

a) pH of a buffer changes with dilution.
b) pH of a buffer doesn't change with temperature.
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.

17. The conjugate acid and the base of $[HPO_4]^{2-}$ are, respectively:

a) $[PO_4]^{3-}$ and $[H_2PO_4]^-$ b) H_3PO_4 and $[PO_4]^{3-}$
c) H_3PO_4 and $[H_2PO_4]^-$ d) $[H_2PO_4]^-$ and $[PO_4]^{3-}$

18. Which one of the following is a weak acid?
    a) $HClO_4$ b) HF c) HCl d) HNO_3

19. According to the balanced equation below, how many moles of permanganate ion are required to react completely with 10.0 mL of 0.200 M hydrogen peroxide?

$$2\ MnO_4^-\ (aq) + 5\ H_2O_2\ (aq) + 6\ H^+\ (aq) \longrightarrow 2\ Mn^{2+}\ (aq) + 5\ O_2\ (g) + 7\ H_2O\ (l)$$

    a) 0.08 b) 0.04 c) 0.0008 d) 0.001

20. If the crystal growth is faster than nucleation,

    a) tiny particle would result.
    b) no particle would be formed.
    c) supersaturation would result.
    d) larger crystal would result.

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Part B – 06 Essay Questions

(80 marks)

Write answers in booklets provided.

1. a) Decomposition of ammonium carbonate is an endothermic process. What would the increased temperature do to the smell of ammonia? (05 marks)

$(NH_4)_2CO_3(s) \leftrightarrows 2NH_3(g) + CO_2(g) + H_2O(g)$

b) Among ICl and Br_2, which one has the highest boiling point? Explain your answer. (04 marks)

c) Name three (03) metals which activate enzymes. (03 marks)

2. a) List four (04) factors that affect the solubility of an ionic solid. (04 marks)

b) Calculate the dissolution enthalpy of LiCl in water using the data provided below. (04 marks)

LiCl Lattice energy: -834 kJ/mol LiCl Hydration energy: -884 kJ/mol

c) Determine whether the dissolution process is endothermic or exothermic. (01 marks)

d) Does LiCl soluble in room temperature? Explain your answer in thermodynamics terms. (Hint: Use $\Delta G = \Delta H - T\Delta S$ equation). (04 marks)

3. a) Space vehicles remove carbon dioxide from cabin air through a chemical process. Cabin air passes through a canister containing solid lithium hydroxide. When carbon dioxide contacts with lithium hydroxide, it forms solid lithium carbonate and liquid water. Calculate the mass of gaseous carbon dioxide that can be absorbed by 500 g of lithium hydroxide. Molar mass of LiOH :24.0 g/mol, molar mass of CO_2 :44.0 g/mol. (06 marks)

b) Antacids neutralize excess hydrochloric acid secreted by the stomach to relieve heartburn and indigestion. The acid neutralizing capacity of an antacid is defined as the amount of acid neutralized by one gram of antacid. Very often, Baking Soda ($NaHCO_3$) and Milk of Magnesia (aqueous suspension of magnesium hydroxide ($Mg(OH)_2$) are

used as antacids. Determine the amount of HCl neutralized per gram of each antacid. Which one is the more effective antacid per gram? Molar mass of $NaHCO_3$ = 84.01 g/mol, molar mass of $Mg(OH)_2$ = 58.32 g/mol. (08 marks)

4. a) Consider a weak acid, HA. Provide the chemical equation for the ionization of HA in an aqueous solution. (02 marks)

   b) Calculate the change in pH that occurs when 0.020 mol gaseous HCl is added to 1.0 L of the following buffer solution **A**: 0.5 M CH_3COOH (HAc) /0.5 M CH_3COONa. Is **A** really acting as a buffer solution? Explain your answer. (12 marks)

   Ka of HAc = 1.8×10^{-5}.

5. a) Write the expression for the solubility product, *Ksp*, for a saturated solution of Ag_2CrO_4. (02 marks)

   b) Determine the molar solubility of Ag_2CrO_4 in aqueous solution. (03 marks)
   Ksp of Ag_2CrO_4 is 4×10^{-12} mol^3/L^3.
   c) What happens to the molar solubility of Ag_2CrO_4 if the solution is prepared in 0.150M K_2CrO_4? Explain your answer with calculations. (07 marks)

6. a) List five (05) factors affecting the dissolution rate of a drug. (05 marks)

   b) List four (04) types of solvents used in non-aqueous titrations. (04 marks)

   c) Explain why non-aqueous solvents are useful in pharmacology. (06 marks)

END