



Uva Wellassa University of Sri Lanka
Faculty of Applied Sciences
Department of Science and Technology 3040
100 level 1st Semester Examination – July/Aug 2019
SCT 131-2 General Chemistry



Instructions to candidates

Duration: Two(02) hours

Number of questions: Three (03) Essay Questions

Mark allocation: 60 marks

Answer all questions.

Scientific calculators are allowed.

Index No:

1. Answer all the questions

- i. Write the Le Chatelier's principle. (5 marks)
- ii. Explain the common ion effect in terms of Le Chatelier's principle. (5 marks)
- iii. Calculate the weight of Ag_2CrO_4 that will dissolve in 250 mL of $0.010 \text{ mol dm}^{-3}$ K_2CrO_4 solution. K_{sp} for Ag_2CrO_4 is $9.0 \times 10^{-12} \text{ mol}^3 \text{ dm}^{-9}$ and the molar mass of Ag_2CrO_4 is $331.75 \text{ g mol}^{-1}$. (5 marks)
- iv. Solubility product of barium sulfate(BaSO_4) is 1.08×10^{-10} at 25°C . Will barium sulfate precipitate if 10.0 mL of $0.0020 \text{ mol dm}^{-3}$ Na_2SO_4 is added to 100 mL of $3.2 \times 10^{-4} \text{ mol dm}^{-3}$ BaCl_2 ? (5 marks)

2. Use diagrams to explain and show your work for the following questions.

- i. Briefly describe Bohr's theory of the hydrogen atom and how it explains the appearance of an emission spectrum. How does Bohr's theory differ from concepts of classical physics? (5 marks)
- ii. Calculate the wavelength (in nanometers) of a photon emitted by a hydrogen atom when its electron drops from the $n = 5$ state to the $n = 3$ state. The Rydberg constant for hydrogen-like ions is $(1.097 \times 10^7 \text{ m}^{-1})$. (5 marks)
- iii. Following questions are based on Lewis structures and molecular orbital diagrams.
 - a. Draw the Lewis structure for CN^- and state the formal charge on each atom. Draw possible resonance structures for the CN^- ion. (5 marks)
 - b. Draw a detailed molecular orbital diagram of CN^- ion and write the molecular electronic configuration and calculate the bond order. (5 marks)

3. Charith has prepared **seven** solution mixtures as follows. Consider the following descriptions about the solution mixtures

Solution	Description
P	Aqueous solution of 0.20 mol dm^{-3} , NaOH
Q	Aqueous solution of 0.10 mol dm^{-3} , NH_3
R	Aqueous solution of 0.01 mol dm^{-3} , NH_3
S	Aqueous solution mixture of 0.10 mol dm^{-3} , NH_3 and 0.10 mol dm^{-3} , NH_4Cl
T	Aqueous solution mixture of 0.10 mol dm^{-3} , NH_3 and 0.05 mol dm^{-3} , NH_4Cl
U	The closed bottle filled with freshly prepared distilled water
V	Aqueous solution mixture of $C_1 \text{ mol dm}^{-3}$, CH_3COOH (acetic acid, Dissociation constant K_1) and $C_2 \text{ mol dm}^{-3}$, HCOOH (formic acid, Dissociation constant K_2)

- By consider the solution mixtures from **P** to **T**, rearrange the order of the solution mixtures according to the way of increasing the value of pH.
(5 marks)
- Solution **S** was diluted **ten times**. Is there a change in the pH value of the solution? Briefly explain your answer.
(5 marks)
- A small amount of NaOH was added to both **S** and **T** solution mixture. Among those two solutions, which solution is more resistant to the change of pH value?
(2.5 marks)
- Solution **U** was exposed to the atmosphere. What will be the expected change in the pH value ?
(2.5 marks)
- Consider the solution mixture **V**. The concentrations of acetic acid and formic acid are C_1 and C_2 . The dissociation constants are K_1 and K_2 . By using these parameters drive an equation for concentration of H^+ in solution mixture **V**.
(5 marks)

