

BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHEMISTRY DEPARTMENT

CH424: ENVIRONMENTAL CHEMISTRY

MAR 2024

TIME 2 HRS

ANSWER QUESTION 1 AND FOUR OTHERS. TWO FROM EACH OF SECTIONS A AND B. EACH QUESTION CARRIES 20 MARKS

- 1 (a) (i) Convert a 10 ppm ammonium ion solution to molarity. [3 marks]
- (ii) For oxygen, whose mixing ratio in air is 20.95%, calculate the concentration in mgL^{-1} . [3 marks]
- (At 0 °C and 101.3 kPa, the molar volume of a gas is 22.4 L)
- (b) (i) Define photochemical smog. [3 marks]
- (ii) List three conditions for the formation of smog in polluted air. [3 marks]
- (c) Write a two – step mechanism for the formation of the OH radical in the troposphere. [4 marks]
- (d) What is positive and negative feedback in global warming? [4 marks]

SECTION A: ANSWER ANY TWO QUESTIONS FROM THIS SECTION

- 2 (a) Describe the process for the formation and destruction of ozone in terms of the chemistry involving oxygen – containing species. [8 marks]
- (b) Starting with the species X, describe the chemistry for the catalytic decomposition of ozone in the stratosphere. [6 marks]
- (c) Determine the chemical formula for CFC – 114. [4 marks]
- 3 (a) Describe the mechanism for the oxidation of ethene, $\text{CH}_2 = \text{CH}_2$, by the OH radical in a photochemical smog. [12 marks]
- (b) By adding the steps in (a) above, deduce the overall reaction. [8 marks]
- 4 (a) Describe the mechanism for the oxidation of tropospheric methane by the OH radical.
(Assume that the aldehyde undergoes photolysis in the process) [14 marks]
- (b) By adding the steps in (a), deduce the overall reaction. [6 marks]

SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION

- 5 (a) (i) Describe the mechanism of the greenhouse effect. [6 marks]
- (ii) Explain the term enhancement of the greenhouse effect. [4 marks]
- (b) Geoengineering of the Earth's climate to combat global warming is a subject of discussion in recent times. Describe two schemes that are currently proposed to alter the planet's climate. [10 marks]
- 6 (a) Describe three schemes that are used to extract CO_2 from exhaust gases of major point sources. [9marks]
- (b) A number of different methods and locations for storing CO_2 have been proposed. Discuss any three storage schemes. [12 marks]

- 7 (a) Compare wind power and hydroelectric power in terms of payback period.
[6 marks]
- (b) Discuss the chemistry, advantages and disadvantages of water purification by chlorination.
[8 marks]
- (c) List four degradation pathways of organic pesticides in the environment.
[4 marks]

END