

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS.

EXAMINATION FOR THE AWARD OF DEGREE
OF MASTER OF SCIENCE IN CHEMISTRY

CHEM 844: ENVIRONMENTAL CHEMISTRY

STREAMS: MSc (CHEMISTRY); MSc (ENVT. SCIENCE)

TIME: 3 HOURS

DAY/DATE: WEDNESDAY 10/04/2019

2.30 P.M - 5.30 P.M.

INSTRUCTIONS

- Answer ALL Questions
- Do not write on the question paper

QUESTION ONE [15 MARKS]

(a) The ΔH° for dissociation of molecular oxygen to atomic oxygen is
 $O_2 \rightarrow 2O \Delta H^\circ = +498.4 \text{ kJ/mol}$

- (i) Calculate the longest wavelength, in nanometers, that can dissociate O_2 . [2 Marks]
- (ii) What region of the electromagnetic radiation does the wavelength fall? [½ Mark]
- (b) Describe, with the aid of relevant equations, catalytic processes for ozone destruction in the stratosphere. [4 Marks]
- (c) Discuss ozone depletion and formation of ozone holes in the Antarctica regions. [5 Marks]
- (d) Explain the health and environmental effects of UV-B radiation. [2 Marks]
- (e) Describe the greenhouse effect. [1½ Marks]

QUESTION TWO: [20 MARKS]

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- (a) Describe the formation and effects of photochemical smog in the troposphere. [4 Marks]
- (b) State the major sources of atmospheric carbon monoxide, nitrogen oxides and sulphur dioxide. [3 Marks]
- (c) Explain the health and environmental effects of nitrogen oxides and sulphur dioxides. [6 Marks]
- (d) Calculate the mass of fine particles inhaled by an adult each year, assuming that he/she inhales about 350 L of air per hour and that the average $PM_{2.5}$ index of the air is $10 \mu m^{-3}$. [2 Marks]

QUESTION THREE: [20 MARKS]

- (a) Describe the chemical processes for particle formation in the atmosphere. [3 Marks]
- (b) Discuss the sources and health effects of indoor air pollutants. [5 Marks]
- (c) Discuss the major stages in the treatment of wastewaters. [7 Marks]

QUESTION FOUR: [20 MARKS]

- (a) Describe technologies that are used to control emissions from internal combustion engines. [5 Marks]
- (b) Discuss three technologies that are used for disinfection of drinking water. [6 Marks]
- (c) Discuss the sources and health effects of mercury. [4 Marks]

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