CHEM 304

KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SPECIAL EXAMINATION
THIRD YEAR EXAMINATION FOR THE AWARD OF
THE DEGREE OF BACHELOR OF EDUCATION SCIENCE
FIRST SEMESTER 2021/2022
(JULY, 2022)

CHEM314: ATMOSPHERIC CHEMISTRY

STREAM: Y3 S1 **TIME: 2 HOURS**

DAY: WEDNESDAY, 11.30 AM – 1.30 PM **DATE: 20/05/2022**

INSTRUCTIONS:

1. ***Do not write anything on this question paper.***
2. ***Answer ALL Questions in section A and any TWO Questions in Section B.***

SECTION A: 40 marks

1. Outline various pollution effects that result from the use of washing detergents. (3 marks)
2. Discuss sources and health hazards of radioactive materials in the environment. (3 marks)
3. The shortest wavelength of visible light penetrating the troposphere is about 300nm.

   (i) Calculate the energy of this light in Kj mol^{-1}. (3 marks)

   (ii)Is this energy sufficient to cause molecular dissociation of O_2 ?

   $O_2 \longrightarrow 2O\cdot \quad \nabla H = 494$ Kj mol-1 (2 marks)

4. Which is a more effective greenhouse gas CO or H_2O? Explain. (1 mark)

5. (a)Define the following terms as used in environmental Chemistry:

(i) Residence time

(ii) Negative lapse rate

(iii)Aerosal

(iv) Sink

(v) Secondary pollutants (5 marks)

6. The shortest wavelength of U. V. Light reaching the stratosphere is 200 nM (U.V. -). Calculate the energy of this light (J / mole) and determine whether this light is sufficient to cause the dissociation of molecular $O_{2\,(g)}$ [Bond dissociation energy for $O_{2\,(g)}$.

$\triangle$H =494 Kjmol-1 . (3 marks)

7. (i) The concentration of $NO_{2(g)}$ in an air sample at 20^{OC} and 0.987 atm is 0.1 ppm. Express this concentration in the SI units (µg / m^3). (3 marks)

8. (i) Explain how carbon monoxide poisoning occur in human beings. (2 marks)

(ii)The concentration of Coin a lorry Cabin was found to a average 104 ppm. During a long journey. Calculate the expected % blood COHb in the drivers blood. Take M= 210. (3 mark)

9. (i) Name the gas that is largely responsible for the acid rain phenomenon. (2 marks)

(ii) Discuss detrimental effects of acid rain. (4 marks)

10. (i) Discuss two industrial processes that lead to acid rain. (2 marks)

(ii) Suggest ways of curbing acid rain (4 marks)

SECTION B

(11)(a) (i) Discuss the main sources of NO_X gases. (2 marks)

(ii) SO_2 is considered by most health workers to be the most serious air pollutant. Explain this observation. (3 marks)

(iii)Give the value of air quality standard of SO_2 gas. (1mark)

(1v)Explain how chlorofluoro carbons (CFC's) can contribute to ozone destruction.

(3 marks)

(b) Define the term greenhouse effect. (2 marks)

(b) Discuss causes of greenhouse effect. (4 marks)

(12) (a) (i) Explain the origin of randon gas in buildings. (2 marks)

(ii) Discuss the health hazards of randon gas in the environment? (2 marks)

(b) (i)The growth limiting nutrients, phosphorus and nitrogen; can cause eutrophication problems in our natural water sources.

(i)What is eutrophication? (2 marks)

(ii) Discuss he sources of such nutrients in water. (3 marks)

(iii) Discuss the effect of eutrophication process in aquatic life. (3 marks)

(iv) suggest ways in which eutrophication process can be avoided. (3 marks)

(13) (i) What is photochemical smog? (2 marks)

(ii) Discuss how photochemical smog is formed. (5 marks)

(iii)Suggest ways to minimize the formation of photochemical smog. (5 marks)

(iv) Distinguish between primary and secondary pollutants. (5 marks)

Useful Data

$R=8.314$ J $mole^{-1}K^{-1} = 0.082056$ L atm $mole^{-1}$ k^{-1}

1 atm = 101325 N $/M^2$ =760 mmHg

% composition of O_2 in air = 21%, $h = 6.63 \times 10^{-34}$ JS ,

$N_A = 6.02 \times 10^{23}$, $C = 2.998 \times 10^8$ M /S , Atomic mass: S =32, O = 16