

**The Open University of Sri Lanka**

**B.Sc. Degree Programme 2017/18**

**Environmental Chemistry – CYU5309**

**Continuous Assessment Test 1 (No Book Test)**

**One Hour**

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**Date: 03.07.2018**

**Time: 4.15 p.m. – 5.15 p.m.**

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**Answer all the questions**

Distinguish between the following terms.

a. i. Pollutant and Contaminant

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ii. Natural process and Anthropogenic process

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ii. Primary pollutant and Secondary pollutant

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**(18 marks)**

b. Identify the layer of the atmosphere based on the given description.

i. The layer where weather occurs .....

ii. The layers in which the temperature decreases as elevation increases  
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iii. Ozone layer is part of this layer .....

(12 marks)

c. i. What is meant by the term 'vertical mixing'?

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ii. Explain why the vertical mixing is very much less in the stratosphere.

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(20 marks)

d. Identify the source and sink for each of the following gases.

|                  | Source | Sink |
|------------------|--------|------|
| NO               |        |      |
| N <sub>2</sub> O |        |      |

|                             |  |  |
|-----------------------------|--|--|
| CO                          |  |  |
| CH <sub>4</sub>             |  |  |
| Chloroflourocarbon<br>(CFC) |  |  |

(20 marks)

- e. Explain **three** human effects on the nitrogen cycle and predict the impact of these changes on an eco-system.

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(10 marks)

- f.i What is thermal inversion ?

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ii. How do thermal inversion relate to air pollutants?

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(20 marks)

2.a. Write the reactions that defined the Chapman mechanism for the ozone layer.

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(20 marks)

b. i. Why Los Angeles smog is called photochemical smog?

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Photochemical smog is one of the most common form of air pollution.

ii. Identify **two** primary pollutants that cause photochemical smog. Describe how they are produced.

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iii. Identify **two** secondary pollutants that make up the photochemical smog. Describe how they are produced.

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iv. Give **two** harmful effect to human.

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(30 marks)

c. i. What is greenhouse effect?

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ii. Name **four** greenhouse gases?

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iii. Discuss the hazards that may arise from the huge accumulation of CO<sub>2</sub> in atmosphere.

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(20 marks)

d. i. What are chlorofluorocarbons (CFCs)? What is the chemical formula of CFC-12?

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ii. Briefly explain the hazards that may arise from their compounds in atmosphere.

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(10 marks)

e. Write down the atmospheric reactions responsible for acid rain?

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(20 marks)

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**B.Sc. Degree Programme 2017/2018**  
**Environmental Chemistry –CYU5309**  
**Answer Guide for Continues Assessment Test 1 (No Book Test)**

1. (a) (i) **Pollutant** - Pollutant is a substance present in greater than natural concentration as a result of human activity and having a net detrimental effect upon its environment  
**Contaminant** - A contaminant is a substance present in nature due to human activity, but without harmful effects.
- (ii) **Natural process** - Natural process is the process occurs without intervention of humans.  
**Anthropogenic process** - Anthropogenic process relates to human activity.
- (iii) **Primary Pollutant**- A primary pollutant is an air pollutant emitted directly from a source  
**Secondary Pollutant**- A secondary pollutant is not directly emitted as such but forms when other pollutants (primary) react in the atmosphere.
- (b) (i) Troposphere (ii) Troposphere and Mesosphere (iii) Stratosphere
- (c) (i) Vertical mixing – It is an upward and downward movement of air that occurs as a result of the temperature gradient.  
(ii) In stratosphere temperature rises along the altitude. It gets most of its heat from the sun. Therefore it is warmer closer to the sun. The air at the bottom of it is cold. The cold air is dense. So it does not rise, as a result, there is little mixing of air in this layer.

(d)

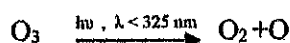
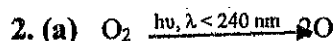
|                    | Sources                                                                         | Sink                                                                               |
|--------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| NO                 | Lighting, Combustion in auto mobile engine                                      | NO <sub>2</sub> / acid rain                                                        |
| N <sub>2</sub> O   | Biological denitrification, Oxidation of ammonia in the atmosphere              | No Stratospheric sink, Undergo photochemical reaction with O atoms in stratosphere |
| CO                 | Incomplete combustion                                                           | Soil, Microbial oxidation, Oxidation by OH radicals                                |
| CH <sub>4</sub>    | All anaerobic decay, Wetlands, Agricultural activity, emission from cattle farm | Oxidation by OH radicals. Largest sink- atmosphere                                 |
| Chlorofluorocarbon | Refrigerators, blowing agents, propellants                                      | No tropospheric sink. Undergo photochemical reactions in stratosphere.             |

- (e) - Production of nitrogen based fertilizers - It has converted large amounts of

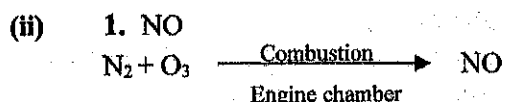


- Agriculture/ Use of fertilizer / Biomass burning – This has added large amounts of NO<sub>3</sub><sup>-</sup> to ecosystem.
- Fossil fuel based vehicles /Power plants – Release large amounts of NO<sub>x</sub> into atmosphere
- Release of sewage / Live stock effluents – It has increased N content.

- (f) (i) **Thermal inversion** – Thermal inversion occurs when a layer of warm air settles over a layer of cool air that lies near the ground. The warm air holds down cool air and prevents pollutants from rising and scattering.
- (ii) When thermal inversion occurs, vertical movement of breathing air does not occur. However horizontal displacement of the air may occur due to the existence of horizontal temperature gradient. Temperature inversion increases residence time of pollutants in the breathing zone. It allows generation of secondary pollutants from primary pollutants. Secondary pollutants are more toxic. E.g. smog

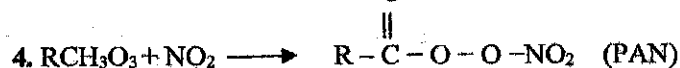
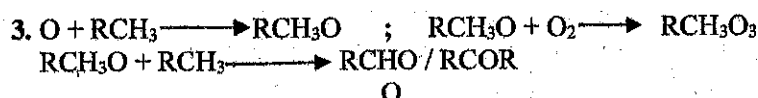
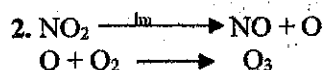
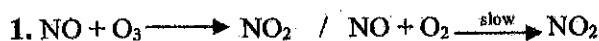


(b) (i) It is caused by the interaction between chemical pollutants and sun light.



2. Unburned hydrocarbons from vehicle exhaust

(iii)  $NO_2, O_3, RCHO$  or  $RCOR, PAN$



(iv) Respiratory diseases, decay of rubber goods, eye irritation

(C) (i) Green house effect - When sun's energy reaches the earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. This effect is known as the greenhouse effect.

(ii) Greenhouse gases -  $CO_2, H_2O$  vapour,  $N_2O, CH_4, O_3$

(iii) Huge accumulation of  $CO_2$  will lead to global warming. The hazards effects will be,

- Rise in sea level
- Change in weather patterns and climate
- Melting of polar caps
- Desertification
- Scarcity of water

(d) (i) CFCs are non-toxic, non-inflammatory chemicals containing C, Cl, and F atoms. Chemical formula of CFC - 12 is  $CF_2Cl_2$

(ii) CFCs are chemically stable compounds. They do not decompose/react in the troposphere.

Hence their residence time is long. They escape in to stratosphere where they undergo photochemical reaction to release Cl radical, which deplete ozone layer. Due to this harmful UV rays can enter the earth surface and cause harmful effect such as skin cancer etc.

