

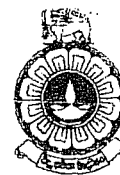
The Open University of Sri Lanka

B.Sc. Degree Programme

Environmental Chemistry – CMU 3129 – Level 5

Continuous Assessment Test I (NBT) - 2013/14

Duration: One hour



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Date: 28.02 2014 (Friday)

Time: 8.45 am – 9.45 am

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Answer all the Questions.

1.a. i. What is meant by the term ‘pollutant’?

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Consider the following air pollutants.

O<sub>3</sub>, NO<sub>2</sub>, CO, Chlorofluorocarbons (CFC) and SO<sub>2</sub>.

ii. Classify the above mentioned pollutants as primary and secondary pollutants.

Primary pollutants .....

Secondary pollutants .....

iii. Identify a source and a sink for the air pollutants.

Pollutants	Source	Sink
O <sub>3</sub>		
NO <sub>2</sub>		
CO		
CFC		
SO <sub>2</sub>		

iv. Give **one** environmental effect of each of the following air pollutants.

- O<sub>3</sub> .....
- NO<sub>2</sub> .....
- CO .....
- CFC .....
- SO<sub>2</sub> .....

(50 marks)

b. i. What is meant by the green house effect?

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ii. Give four (04) chemicals which contribute to this effect.

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iii. Explain briefly why the major constituents of the atmosphere do not contribute to the green house effect.

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iv. What is the enhanced green house effect called?

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v. What are consequences of the enhanced green house effect?

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(50 marks)

2.a. Ozone is an important oxygen - containing species found in the stratosphere.

i. How is ozone produced in the stratosphere?

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ii. Explain the role of ozone in the stratosphere.

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iii. Explain how the steady state concentration of ozone occurs in the stratosphere.

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iv. How does ozone behave in the troposphere?

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v. Write down the equations for the destruction of ozone by OH radical.

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(60 marks)

b. i. What is meant by the term 'smog'?

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ii. Give the main chemical components of photochemical smog.

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iii. What are the physical characteristics of photochemical smog?

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iv. Write the three (03) adverse effects of photochemical smog.

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(40 marks)

Answer Guide to CAT - I

- i. Refer Page 2
- ii. Primary Pollutants : CO , SO<sub>2</sub>,CFC . Secondary Pollutants : NO<sub>2</sub>, O<sub>3</sub>

iii.

Pollutants	Source	Sink
O <sub>3</sub>	Photochemical Smog	OH,NO,CFC,CO
NO <sub>2</sub>	Automobile Engines, Burning of Celluloid Combustion & fossil fuels in different thermal power stations. Microbial activity in soil , Lightning	HNO <sub>3</sub> / Acid Rain
CO	Vehicle exhaust, Incomplete combustion fossil fuel, burning of coal, Wood & Cigarette smoking, Forest fire, atmospheric oxidation of CH <sub>4</sub>	CO <sub>2</sub> by soil Bacteria
CFC	Refrigerant fluid in refrigerators, Blowing agents for expanded foams, Propellants for aerosol, Cleaning solvents for micro electronic components.	No sinks in the troposphere Photochemical reaction with O <sub>3</sub> in the stratosphere.
SO <sub>2</sub>	Roasting of metal Sulphite ores , Volcanic eruptions, Combustion & refining of Petroleum, Decomposition of organic matter via H <sub>2</sub> S Oxidation	SO <sub>3</sub> /H <sub>2</sub> SO <sub>3</sub> /Acid Rain

(iv) O<sub>3</sub>- Component of Photochemical Smog / Green House effect.

NO<sub>2</sub> .Acid rain /NO<sub>x</sub>– Photochemical smog.

CO – Health Hazard – Binds with hemoglobin and affect blood carrying capacity.

CFC – Global Warming (troposphere), Ozone Depletion (Stratosphere) , Green House Effect

SO<sub>2</sub>– Acid Rain

b. (i) Green house effect: This is a process by which thermal radiation from the earth surface is absorbed by green house gases/ Minor atmospheric gases, and is re-radiated in all directions. Part of this re-radiation is radiated back towards the earth surface and converted to heat. It results in an elevation of the average surface temperature.

(ii)  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  vapor,  $\text{CH}_4$ , CFC,  $\text{N}_2\text{O}$ ,  $\text{O}_3$

(iii) Major constituents are ( $\text{N}_2$ ,  $\text{O}_2$ ) homo nuclear gases and Ar. In order to contribute for the green house effect, there should be an interaction between IR radiation and dipole of these gaseous molecules. The interaction can change their vibration energy levels. The essential condition for this interaction is that the vibrational mode must be associated with a change of dipole moment of the interacting molecule.  $\text{N}_2$  &  $\text{O}_2$  cannot interact with IR.

(iv) Global Warming.

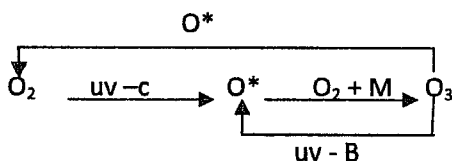
(v) Refer Page 71.

2. a. (i)  $\text{O}_2 \xrightarrow{h\nu} \text{O}^*$

$\text{O}_2 + \text{O}^* \xrightarrow{\text{M}} \text{O}_3$  (M= third body, such as  $\text{N}_2$ )

(ii) It absorbs harmful ultraviolet radiation from the Sun, thus preventing most of it from reaching the earth surface.

(iii) By Ozone- Oxygen cycle /Chapman mechanism.



(iv)  $\text{O}_3$  behaves as a pollutant in the troposphere. (Or component of photochemical smog)

(v) Refer page 36.

b. (i) Refer Page 49.

(ii) Refer Page 55

(iii) Physical Characteristics of Photochemical smog is a brown hazy fumes having a characteristic odour of  $\text{O}_3$ .

(iv) Refer Page 51