

WEEK 4-5

1.2 Cycles in Nature

Key Ideas

- The presence (aerobic conditions) or absence (anaerobic conditions) of oxygen affects the products of the decomposition of the organic compounds derived from living organisms.
- Photosynthesis and respiration are important processes in the cycles of carbon and oxygen.
- Nitrogen may be converted into compounds by biological processes such as fixation or by reaction with oxygen during lightning discharges and at high temperatures such as those which occur in engines and furnaces.
- Nitrogen compounds are important in the chemistry of life processes.
- Plants require substantial amounts of nitrogen and phosphorus, which they obtain from the soil.

1.3 The Greenhouse Effect

Key Ideas

- Some gases in the atmosphere, called 'greenhouse gases', serve as insulation to maintain the temperature of the Earth's atmosphere. This is known as the 'natural greenhouse effect'.
- Human activity that affects the concentration of greenhouse gases has the potential to disrupt the thermal balance of the atmosphere. This is known as the 'enhanced greenhouse effect'.

1.5 Photochemical Smog

Key Ideas

- Nitrogen oxides are formed in high-temperature engines and furnaces.
- Nitrogen oxides lead to the formation of ozone in the troposphere.
- Nitrogen oxides and ozone in the troposphere are pollutants.
- It is possible to reduce the quantities of nitrogen oxides generated by cars.

TOPIC CHECKLIST

- State, for aerobic and anaerobic conditions, the products of the decomposition of organic matter containing carbon, nitrogen, phosphorus, or sulfur.
- Describe and write equations for the processes of photosynthesis and aerobic respiration involving glucose.
- Describe and write equations for the formation of oxides of nitrogen by the reaction of nitrogen and oxygen at high temperatures.
- Describe how the nitrogen cycle operates by natural processes (e.g. lightning, nitrogen-fixing bacteria, and decay) and industrial processes (e.g. fertiliser manufacture and combustion engines).
- Explain why fertilisers need to contain nutrients in soluble form.
- Describe the action of the common greenhouse gases, carbon dioxide and methane, that serve to maintain a steady temperature in the Earth's atmosphere.
- Explain the enhanced greenhouse effect and its potential consequences for the environment.
- Write equations for the formation of nitrogen oxides NO and NO₂.
- Describe and write equations showing the role of nitrogen oxides in the formation of ozone in the troposphere.
- Explain the terms 'primary pollutants' and 'secondary pollutants' with reference to the harmful effects of nitrogen oxides and ozone in the troposphere.
- Describe how catalytic converters reduce the quantities of nitrogen oxides generated by cars.

Environmental Chemistry Assignment

QUESTION 1

DNA contains nitrogen, carbon, phosphorus, oxygen and hydrogen.

(a) State the products when DNA undergoes decay

(i) under aerobic conditions.

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(3 marks)

(ii) under anaerobic conditions.

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(3 marks)

QUESTION 2

Some gases in the atmosphere assist in maintaining the temperature of the Earth's atmosphere.

(a) State the name given to this effect.

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(1 mark)

(b) Name two gases which have this effect.

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(2 marks)

(c) Describe the means by which this effect is achieved.

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(2 marks)

(d) There is concern that human activity threatens to lead to a warming of the Earth's atmosphere.

(i) State the name given to this effect.

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(1 mark)

(ii) Explain three ways in which human activity may have this effect.

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(6 marks)

(iii) Describe two possible consequences of this global warming.

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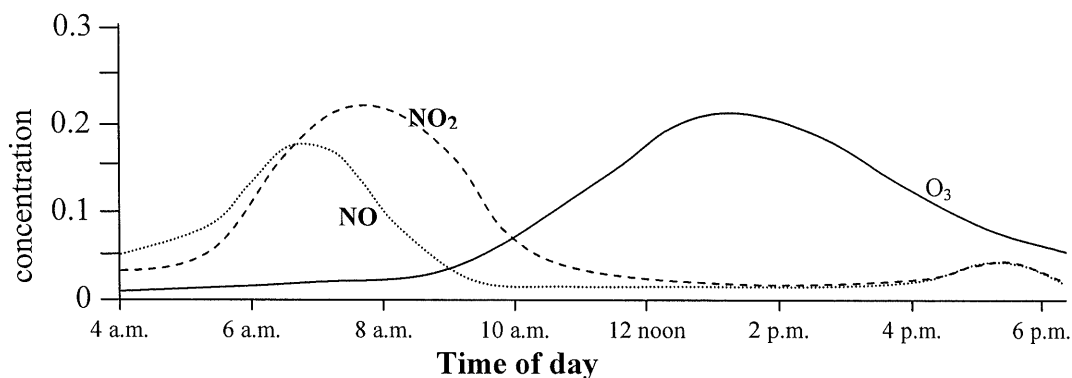
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(4 marks)

QUESTION 3

Nitrogen oxides are pollutants contributing to both acid rain and photochemical smog. During the day road traffic causes the concentrations of the gases NO, NO₂ and O₃ to vary as shown in the graph.



(a) Write balanced equations to show the series of reactions that lead to the formation of free oxygen atoms in the troposphere.

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(6 marks)

- (b) Explain why the concentration of NO peaks first, then the concentration of NO₂ while the concentration of O₃ peaks last.

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(4 marks)

- (c) The three gases are constituents of *photochemical smog*. Explain why the term *photochemical* is used in the term.

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(2 marks)

- (d) Afternoon traffic causes an increase in the levels of NO and NO₂ but has little effect on the concentration of O₃. Explain why there is little increase in the O₃ concentration in the afternoon.

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(2 marks)

- (e) Use these gases to explain the terms primary and secondary pollutants.

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(2 marks)