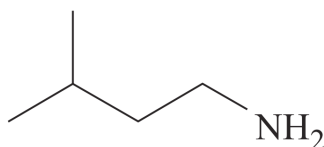


Year 12 Chemistry
Environmental Chemistry
Practice Test

1. Plants can obtain nitrogen through the decomposition of organic matter or the addition of synthetic fertiliser. The structural formula of one molecule produced in the decomposition of organic matter is shown in the diagram below:



- (a)
- (i) State whether the molecule above is the product of aerobic or anaerobic decomposition. /1
- (ii) Aerobic and anaerobic decomposition also produces compounds of sulfur.
- (1) State one aerobic product of the decomposition of organic matter containing sulfur. /1
- (2) State one anaerobic product of the decomposition of organic matter containing sulfur. /1
- (b) Ammonium sulfate is a synthetic fertiliser commonly used to provide nitrogen needed by plants. Explain why ammonium sulfate provides nitrogen in a form suitable for use by plants. /2
2. The combustion of fossil fuels is a common method of energy production, which releases CO₂ into the atmosphere. An increasing concentration of CO₂ in the troposphere is predicted to enhance the greenhouse effect.
- (a) Explain how greenhouse gases maintain a steady temperature in the Earth's atmosphere. /3
- (b) Describe one harmful consequence that the enhanced greenhouse effect is predicted to have for the human population. /2
- (c) CO₂ is used by green plants in the process of photosynthesis to make glucose. Write an equation for the photosynthesis reaction. /2
- (d) The high temperatures involved in combustion of fossil fuels also lead to the formation of oxides of nitrogen.
- (i) Write an equation for the formation of nitrogen (II) oxide in this manner. /2
- (ii) State why nitrogen (II) oxide will not form in this manner under standard conditions. /1
- (iii) State one other process by which atmospheric nitrogen may react to form a compound. /1
- (e) Describe how a catalytic converter reduces the quantity of nitrogen oxides emitted. /2
- (f) Describe how nitrogen dioxide forms ozone in the troposphere. /3
- (g) State whether tropospheric ozone is a primary or secondary pollutant. /1

- 3.
- (a) Explain why unpolluted rainwater is acidic. /2
- (b) Calculate the pH of rain with a hydrogen ion concentration of $2.0 \times 10^{-6} \text{ mol L}^{-1}$ and hence state whether or not it would be considered acid rain. /2
- (c) Write an equation for the formation of acid rain. /2
- (d) Calculate the concentration of hydrogen ions in acid rain with a pH of 4.0 /2
- (e) Acid rain has a number of undesirable effects on the environment.
- (i) Write an equation to show the effect of acid rain on metals. /2
- (ii) Write an equation to show the effect of acid rain on carbonates. /2
- (iii) State one undesirable effect of the mobilisation (leaching) of heavy metal cations in the soil by acid rain. /1
- (f) Al^{3+} ions can be used during water treatment to remove suspended matter from the water. Briefly explain. /2
- (g) Calcium hypochlorite, $\text{Ca}(\text{ClO})_2$, is commonly used for purifying swimming-pool water.
- (i) State the action of hypochlorite ions that kills bacteria. /1
- (ii) One chemical equilibrium in pool water is shown below:
- $$2\text{H}^+ + \text{OCl}^- + \text{Cl}^- \rightleftharpoons \text{Cl}_2 + \text{H}_2\text{O}$$
- With reference to the equilibrium above, explain the effect on concentration of OCl^- in pool water if the pH is increased. /2

TOTAL /40