

1 Clean dry air contains mainly nitrogen and oxygen.

(a) Name **two** other gases that are in clean dry air.

.....
..... [2]

(b) Air often contains pollutants.

Identify **three** common gaseous pollutants in air and state how each of these pollutants are produced.

pollutant gas 1

how it is produced

.....

pollutant gas 2

how it is produced

.....

pollutant gas 3

how it is produced

.....

[6]

[Total: 8]

2 This question is about compounds of nitrogen.

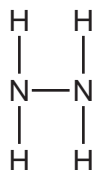
(a) (i) Describe the Haber Process giving reaction conditions and a chemical equation. Reference to rate and yield is not required.

.....
.....
.....
.....
..... [5]

(ii) Give **one** use of ammonia.

..... [1]

(b) The diagram shows the structure of a hydrazine molecule.



Draw the electron arrangement of a hydrazine molecule. Show the outer shell electrons only.

[2]

(c) Hydrazine is a base.

(i) Define the term *base*.

..... [1]

(ii) Complete the chemical equation to show that hydrazine acts as a base when added to water.



(d) Nitrogen dioxide is an atmospheric pollutant.

(i) State **one** environmental problem caused by nitrogen dioxide.

..... [1]

(ii) Explain how oxides of nitrogen, such as nitrogen dioxide, are formed in car engines.

.....
..... [2]

[Total: 13]

3 (a) Polluted air contains two oxides of carbon and two oxides of nitrogen. A major source of these pollutants is motor vehicles.

(i) Describe how carbon dioxide and carbon monoxide are formed in motor vehicle engines.

.....

.....

.....

..... [3]

(ii) State **one** adverse effect of each of these gases.

.....

..... [2]

(iii) Nitrogen monoxide, NO, is released by motor vehicle exhausts.

Explain how nitrogen monoxide is formed in motor vehicle engines.

.....

..... [2]

(iv) When nitrogen monoxide is released into the atmosphere, nitrogen dioxide, NO_2 , is formed.

Suggest an explanation why this happens.

..... [1]

(b) Predict the possible adverse effect on the environment when this non-metal oxide, NO_2 , reacts with water and oxygen.

.....

..... [2]

(c) How are the amounts of carbon monoxide and nitrogen monoxide emitted by modern motor vehicles reduced? Include an equation in your answer.

.....

.....

..... [3]

[Total: 13]

4 Three common pollutants in the air are carbon monoxide, the oxides of nitrogen, NO and NO₂, and unburnt hydrocarbons. They are all emitted by motor vehicles.

(a) Describe how the oxides of nitrogen are formed.

.....
..... [2]

(b) Describe how a catalytic converter reduces the emission of these three pollutants.

.....
.....
.....
.....
..... [4]

(c) Other atmospheric pollutants are lead compounds from leaded petrol.
Explain why lead compounds are harmful.

.....
..... [1]

[Total: 7]

5 Air is a mixture of gases. The main constituents are the elements oxygen and nitrogen.

(a) (i) Name another element in air.

..... [1]

(ii) Give the formula of a compound in unpolluted air.

..... [1]

(b) Common pollutants present in air are the oxides of nitrogen and sulfur dioxide.

(i) How are the oxides of nitrogen formed?

.....
.....
..... [2]

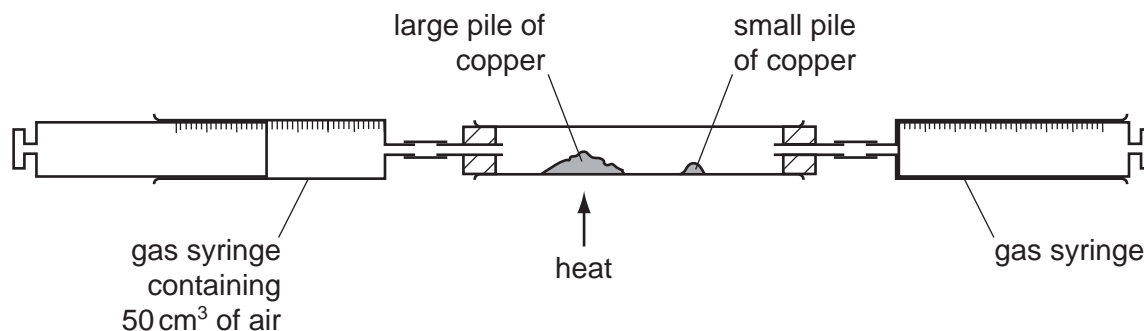
(ii) How is sulfur dioxide formed?

.....
.....
..... [2]

(iii) These oxides are largely responsible for acid rain.
State **two** harmful effects of acid rain.

.....
..... [2]

(c) The percentage of oxygen in air can be determined by the following experiment.



The gas syringe contains 50 cm^3 of air. The large pile of copper is heated and the air is passed from one gas syringe to the other over the hot copper. The large pile of copper turns black. The gas is allowed to cool and its volume measured.

The small pile of copper is heated and the remaining gas passed over the hot copper. The copper does not turn black. The final volume of gas left in the apparatus is less than 50 cm^3 .

(i) Explain why the copper in the large pile turns black.

.....
..... [2]

(ii) Why must the gas be allowed to cool before its volume is measured?

..... [1]

(iii) Explain why the copper in the small pile did not turn black.

..... [1]

(iv) What is the approximate volume of the gas left in the apparatus?

..... [1]

[Total: 13]

6 (a) State a use for each of the following gases.

(i) chlorine [1]

(ii) argon [1]

(iii) ethene [1]

(iv) oxygen [1]

(b) Describe how oxygen is obtained from air.

.....
..... [2]

[Total: 6]