

1 The three states of matter are solid, liquid and gas.

(a) Complete Table 1.1 to describe the structures of solids, liquids and gases in terms of particle separation, particle arrangement and particle motion.

Table 1.1

state of matter	particle separation	particle arrangement	particle motion
solid	touching		
liquid			
gas		random	random

[3]

(b) Substances can physically change.

Name each physical change:

- solid to liquid
- gas to liquid
- solid to aqueous.

[3]

(c) Gases diffuse.

(i) Describe, in terms of particles, why gases diffuse.

..... [1]

(ii) State what determines the relative rate of diffusion of gases at constant temperature.

..... [1]

(d) Gaseous oxides of nitrogen are atmospheric pollutants. One adverse effect of oxides of nitrogen is the formation of acid rain.

State **two other** adverse effects of oxides of nitrogen.

1.....

2.....

[2]

(e) In a catalytic converter, oxides of nitrogen are removed by reaction with the toxic gaseous product of the incomplete combustion of hydrocarbon fuels. Two non-toxic gases are formed in this reaction.

(i) Name the toxic gaseous product of the incomplete combustion of hydrocarbon fuels.

..... [1]

(ii) Name the **two** non-toxic gases formed in the catalytic converter.

1

2 [2]

[Total: 13]

31 Which statements about carbon dioxide are correct?

- 1 Carbon dioxide absorbs thermal energy from the Earth.
- 2 Carbon dioxide increases the thermal energy loss to space.
- 3 The level of carbon dioxide in the atmosphere has increased due to the burning of fossil fuels.
- 4 Carbon dioxide is the only gas that causes global warming.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

30 Which gas contributes to increased global warming?

- A** argon
B carbon dioxide
C nitrogen
D oxygen

31 Which statement describes how greenhouse gases increase global warming?

- A** Greenhouse gases absorb thermal energy from the Sun, reducing the Earth's temperature.
B Greenhouse gases reflect thermal energy back into space, cooling the Earth's surface.
C Greenhouse gases absorb and re-emit thermal energy radiated from the Earth's surface.
D Greenhouse gases release thermal energy from the Earth into space.

32 Nitrogen monoxide is produced in a car engine when petrol is burned.

The gases from the car engine are passed through a catalytic converter.

In the catalytic converter, the nitrogen monoxide, NO, reacts with carbon monoxide, CO, to form nitrogen and carbon dioxide.

Which statement is **not** correct?

- A** Carbon monoxide is oxidised in the catalytic converter.
- B** Carbon monoxide is produced by the complete combustion of petrol.
- C** Nitrogen monoxide is formed by the reaction of nitrogen and oxygen.
- D** Nitrogen monoxide is reduced in the catalytic converter.

1 A list of substances is shown.

bauxite	calcium oxide	ethanol	graphite	methane
nitrogen	oxygen	propane	propene	sulfur dioxide

Answer the questions using the list of substances.

Each substance may be used once, more than once, or not at all.

State which of the substances:

(a) is a basic oxide

..... [1]

(b) contains carbon atoms only

..... [1]

(c) is manufactured by fermentation

..... [1]

(d) is produced by the decomposition of vegetation

..... [1]

(e) contains aluminium oxide

..... [1]

(f) causes acid rain

..... [1]

(g) is a simple molecule with 11 atoms

..... [1]

(h) is produced when limestone thermally decomposes in the blast furnace

..... [1]

(i) is a gas that is approximately 21% of clean, dry air

..... [1]

(j) is a monomer in addition polymerisation.

..... [1]

[Total: 10]

1 Using numbers only, state the:

(a) percentage of nitrogen in clean, dry air

..... [1]

(b) typical operating temperature of the Contact process in °C

..... [1]

(c) number of metals in Period 3 of the Periodic Table

..... [1]

(d) number of halogens which are gases at r.t.p.

..... [1]

(e) typical temperature for the fermentation of aqueous glucose in °C

..... [1]

(f) number of unbranched structural isomers of C₄H₈ which decolourise aqueous bromine

..... [1]

(g) number of covalent bonds in one molecule of ethanol

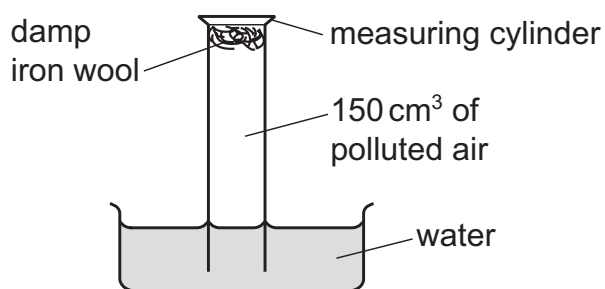
..... [1]

(h) number of carbon atoms in one molecule of propyl butanoate.

..... [1]

[Total: 8]

33 An experiment to find the percentage of oxygen in 150 cm^3 of polluted air is shown.



The apparatus is left for one week.

After this time, the volume of gas in the measuring cylinder is 122 cm^3 .

What is the percentage of oxygen, to the nearest whole number, in the polluted air?

- A** 19% **B** 21% **C** 28% **D** 81%