

The Earth's atmosphere

1. This question is about gases in the Earth's atmosphere.

In the Earth's early atmosphere	In the Earth's atmosphere today
Carbon dioxide	Nitrogen
Small amounts of: ammonia, NH ₃ methane, CH ₄	Oxygen
Water vapour	Small amounts of: carbon dioxide noble gases
	Water vapour

Match gases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

- A** ammonia
- B** helium
- C** methane
- D** oxygen

	What we can say about the gas
1	It is a hydrocarbon.
2	It is a noble gas.
3	It is a compound of nitrogen and hydrogen.
4	It is produced in the atmosphere by the activity of plants.

2. In each part choose only **one** answer.

Carbon is an essential part of all living things and it is often circulated in nature in carbon dioxide.

- A** Carbon dioxide is removed from the atmosphere when it dissolves in sea water to form soluble . . .
- 1 calcium carbonate.
 - 2 calcium hydrogencarbonate.
 - 3 carbohydrates.
 - 4 hydrocarbons.
- B** The amount of carbon dioxide in the atmosphere is also reduced by . . .
- 1 the activity of plants.
 - 2 the destruction of forests.
 - 3 the eruptions of volcanoes.
 - 4 the weathering of limestone.
- C** Carbon dioxide is released into the atmosphere from volcanoes following the decomposition of . .
- 1 carbonate rocks.
 - 2 igneous rocks.
 - 3 metamorphic rocks.
 - 4 sandstone rocks.
- D** Recently, the balance between the amount of carbon dioxide released into the atmosphere and the amount used up has been disturbed.
- This is mainly because of . . .
- 1 burning of increased amounts of fossil fuels.
 - 2 increased volcanic activity.
 - 3 planting of large areas of forests.
 - 4 the operation of more nuclear power stations.

3. (a) There was little or no nitrogen in Earth's early atmosphere, but a gaseous compound of nitrogen was present in small amounts.

This gaseous compound is . . .

- 1 ammonia.
- 2 carbon dioxide.
- 3 methane.
- 4 sulfur dioxide.

In 1892, Lord Rayleigh compared nitrogen from the air with very pure nitrogen obtained from nitrogen compounds. The density of the nitrogen was:

nitrogen from the air	= 1.2572 grams per litre
nitrogen from nitrogen compounds	= 1.2511 grams per litre.

Rayleigh and Sir William Ramsay proved that atmospheric nitrogen was not pure but contained five other gases, which together made up about 1% of the Earth's atmosphere. The gases were argon (0.94%) and traces of helium, neon, krypton and xenon.

The five gases are similar in that they show no chemical reactions but have different physical properties, eg density, melting point, boiling point.

- (b) The main reason why scientists did **not** find these five gases in the atmosphere at an earlier date was that . . .

- 1 they have a very low density.
- 2 they are present in only small quantities.
- 3 they are unreactive.
- 4 they are colourless.

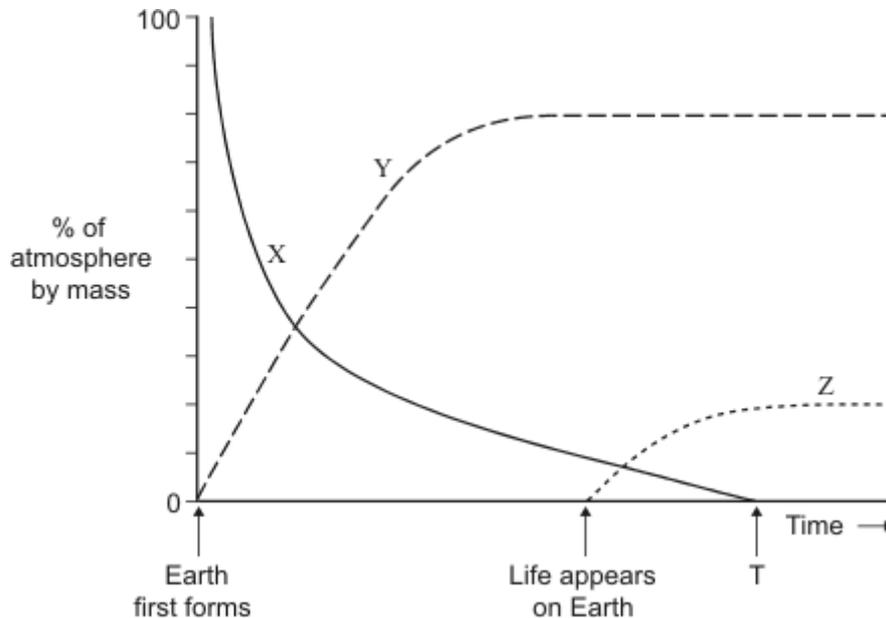
- (c) One way of separating the five gases from each other is by . . .

- 1 passing a mixture of the gases over heated carbon.
- 2 allowing them to settle, according to density, in a glass vessel.
- 3 fractional distillation of the mixture.
- 4 passing a mixture of the gases over a nickel catalyst.

- (d) From the information given in the question, it is safe to predict that . . .

- 1 nitrogen makes up about 78% of the atmosphere.
- 2 argon has a density greater than the density of nitrogen.
- 3 neon, krypton and xenon have a density lower than the density of nitrogen.
- 4 nitrogen from nitrogen compounds must contain a very light gas such as hydrogen.

4. The diagram below shows how the levels of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere have changed with time.



- (a) What is the ratio, by mass, of gas **Z** to gas **Y** at time **T**?
- 1 1:4
 - 2 1:5
 - 3 4:1
 - 4 5:1
- (b) Which one of the following correctly matches the lines on the graph?
- 1 **X** is carbon dioxide, **Y** is nitrogen and **Z** is oxygen
 - 2 **X** is oxygen, **Y** is nitrogen and **Z** is carbon dioxide
 - 3 **X** is nitrogen, **Y** is oxygen and **Z** is carbon dioxide
 - 4 **X** is carbon dioxide, **Y** is oxygen and **Z** is nitrogen
- (c) During the last 200 million years, . . .
- 1 the burning of fossil fuels has decreased the proportion of oxygen in the Earth's atmosphere.
 - 2 intense volcanic activity has substantially changed the atmosphere of the Earth.
 - 3 the percentage of carbon dioxide in the Earth's atmosphere has decreased considerably.
 - 4 the proportion of nitrogen in the Earth's atmosphere has remained fairly constant.
- (d) It is thought that there is no oxygen in the atmosphere of the planet Venus. This is because . . .
- 1 animals used it up in respiration.
 - 2 it is locked up in sedimentary rocks.
 - 3 it is locked up in fossil fuels.
 - 4 there are no plants to produce it by photosynthesis.