C9
CHEMISTRY OF THE ATMOSPHERE
TEST 1

GCSE
CHEMISTRY
AQA - COMBINED SCIENCE

Materials
For this paper you must have:
- Ruler
- Pencil, Rubber, Protractor and Compass
- Scientific calculator, which you are expected to use when appropriate

Instructions
- Answer all questions
- Answer questions in the space provided
- All working must be shown
- Do all rough work in this book. Cross out any rough work you don't want to be marked

Information
- The marks for the questions are shown in brackets

www.examqa.com
The Earth has a layered structure and is surrounded by an atmosphere.

(a) The diagram shows the layers of the Earth.

Complete the labels on the diagram.
(b) The data in the table shows the percentages of the gases in the Earth’s atmosphere.

<table>
<thead>
<tr>
<th>Name of gas</th>
<th>Percentage (%) of gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>78</td>
</tr>
<tr>
<td>Oxygen</td>
<td>21</td>
</tr>
<tr>
<td>Other gases</td>
<td>1</td>
</tr>
</tbody>
</table>

Present the data in the table on the grid below.
Millions of years ago a large meteorite hit the Earth. The meteorite heated limestone in the Earth’s crust to a very high temperature. The heat caused calcium carbonate in the limestone to release large amounts of carbon dioxide.

Draw a ring round the correct answer to complete each sentence.

(i) Carbon dioxide was released because the calcium carbonate was ______________

   [decomposed. evaporated. reduced.]

(ii) More carbon dioxide in the Earth’s atmosphere causes ______________

   [acid rain. global dimming. global warming.]

(Total 7 marks)
About 3000 million years ago carbon dioxide was one of the main gases in the Earth’s early atmosphere.

About 400 million years ago plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

Today coal is burned in power stations to release the energy needed by industry.

(a) The bar chart shows the percentage of some of the elements in this coal.

(i) This coal contains 85 % carbon. Draw the bar for carbon on the chart.
(ii) Coal is burned in the atmosphere to release energy. Two of the products of burning coal are shown.

Draw one line from each product to its environmental impact.

<table>
<thead>
<tr>
<th>Product</th>
<th>Environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>Acid rain</td>
</tr>
<tr>
<td>Carbon particles</td>
<td>Global dimming</td>
</tr>
<tr>
<td></td>
<td>Global warming</td>
</tr>
</tbody>
</table>

(b) Use the information above and your knowledge and understanding to answer these questions.

(i) How did the formation of coal decrease the amount of carbon dioxide in the Earth’s early atmosphere?

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(ii) How does burning coal affect the amount of carbon dioxide in the Earth’s atmosphere? Explain your answer.

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(Total 6 marks)
(a) What percentage of the Earth's atmosphere is nitrogen?

Tick one box.

5% 20% 50% 80%  

(b) During the first billion years of the Earth’s existence the amount of nitrogen in the atmosphere increased.

Give one source of this nitrogen.

___________________________________________________________________  

(c) Nitrogen is used to make ammonia.

The word equation for the reaction is:

\[
\text{nitrogen} + \text{hydrogen} \quad \rightarrow \quad \text{ammonia}
\]

Write the correct symbol in the equation to show that it is a reversible reaction.

(d) A reversible reaction can reach equilibrium.

Complete the sentence.

Equilibrium is reached when the forward reaction and the reverse reaction happen at the same ________________ .  

(e) Fertilisers are formulations containing nitrogen.

What is a formulation?

___________________________________________________________________

___________________________________________________________________  


The table below shows percentages of chemical elements in a fertiliser.

<table>
<thead>
<tr>
<th>Element</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N)</td>
<td>7.0</td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>3.1</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Draw the bar for potassium on Figure 1

Use the information in the table above.

Figure 1
(g) A fertiliser contains 0.225 g of iron per 3.0 g of fertiliser.

Which calculation gives the percentage of iron in the fertiliser?

Tick one box.

\[
\frac{0.225}{3.0 \times 100}
\]

\[
\frac{3.0 \times 100}{0.225}
\]

\[
\frac{0.225 \times 3.0}{100}
\]

\[
\frac{0.225 \times 100}{3.0}
\]

(h) Figure 2 shows the use of fertiliser in four different countries, A, B, C and D, in 2003 and 2015.
A student said:

‘**much** more fertiliser was used in 2015 than in 2003’

Is the student correct?

Use data from **Figure 2** to justify your answer.

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(3)

(Total 10 marks)

This question is about the Earth’s atmosphere.

(a) Carbon dioxide is a greenhouse gas.

What is another greenhouse gas?

Tick **one** box.

Argon

Methane

Nitrogen

Oxygen

(1)
(b) Greenhouse gases cause global climate change.

Give **two** effects of global climate change.

1. _________________________________________________________________
   ___________________________________________________________________

2. _________________________________________________________________
   ___________________________________________________________________

(c) 4.1 kg of a plastic, used to make plastic bottles, has a carbon footprint of 6.0 kg of carbon dioxide.

Calculate the carbon footprint of **one** plastic bottle of mass 23.5 g

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Carbon footprint = _______________________ kg of carbon dioxide

(d) Give **one** way that carbon dioxide emissions can be reduced when a plastic bottle is manufactured.

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(2)

(1)
(e) Explain how the percentages of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere today have changed from the Earth's early atmosphere.

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(6)
(Total 12 marks)

The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was formed.
The amount of carbon dioxide continues to change because of human activities.

(a) Cement is produced when a mixture of calcium carbonate and clay is heated in a rotary kiln. The fuel mixture is a hydrocarbon and air.

Hydrocarbons react with oxygen to produce carbon dioxide. Calcium carbonate decomposes to produce carbon dioxide.

(i) Complete each chemical equation by writing the formula of the other product.

\[
\text{CH}_4 + 2\text{O}_2 \rightarrow 2 \text{..........} + \text{CO}_2
\]

\[
\text{CaCO}_3 \rightarrow \text{.......} + \text{CO}_2
\]
(ii) Hydrocarbons and calcium carbonate contain *locked up* carbon dioxide.

What is *locked up* carbon dioxide?

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(2)

(b) **Graph 1** shows how the percentage of carbon dioxide in the atmosphere changed in the last 4500 million years.

Use information from **Graph 1** to answer these questions.

(i) Describe how the percentage of carbon dioxide has changed in the last 4500 million years.

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(2)
(ii) Give **two** reasons why the percentage of carbon dioxide has changed.

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(2)

(c) **Graph 2** shows how the percentage of carbon dioxide in the atmosphere changed in the last 250 years.

![Graph 2](image)

Should we be concerned about this change in the percentage of carbon dioxide?

Explain your answer.

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(2)

(Tota 10 marks)
Petroleum diesel is a fuel made from crude oil. Biodiesel is a fuel made from vegetable oils. To make biodiesel, large areas of land are needed to grow crops from which the vegetable oils are extracted. Large areas of forest are cleared by burning the trees to provide more land for growing these crops.

(a) Use this information and your knowledge and understanding to answer these questions.

(i) Carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere.

Suggest why adverts claim that using biodiesel is carbon neutral.

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(2)
(ii) Explain why clearing large areas of forest has an environmental impact on the atmosphere.

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(2)

(b) Why is there an increasing demand for biodiesel?

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(1)

(c) Suggest why producing biodiesel from crops:

(i) causes ethical concerns

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____________________________________________________________________________________________

(1)

(ii) causes economic concerns.

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____________________________________________________________________________________________

(1)

(Total 7 marks)
Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone. This prevents sulfur dioxide from entering the atmosphere and causing acid rain. One disadvantage of using limestone in a power station is that it releases ‘locked up carbon dioxide’ into the atmosphere.

(a) How does the limestone used in a power station:

(i) release carbon dioxide

(ii) remove sulfur dioxide?

(b) The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide.

Explain how carbon monoxide would be formed.
(c) The use of limestone in a power station releases ‘locked up carbon dioxide’ into the atmosphere.

(i) Explain the meaning of ‘locked up carbon dioxide’.

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(ii) Why does the release of this carbon dioxide cause an environmental problem?

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(Total 7 marks)

8

In the last 200 years the concentration of carbon dioxide in the Earth’s atmosphere has risen.

Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.

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(Total 6 marks)