Common Atmospheric Pollutants + Sources

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.9 Chemistry of the Atmosphere
Sub-Topic	Common Atmospheric Pollutants + Sources
Difficulty Level	Silver Level
Booklet	Question Paper 1

Time Allowed: **52 minutes**

Score: **/52**

Percentage: **/100**

Grade Boundaries:

Q1. Oxides of nitrogen are produced when fuels are burnt.

(a) Write a balanced symbol equation for the production of nitrogen dioxide (NO_2) from nitrogen and oxygen.

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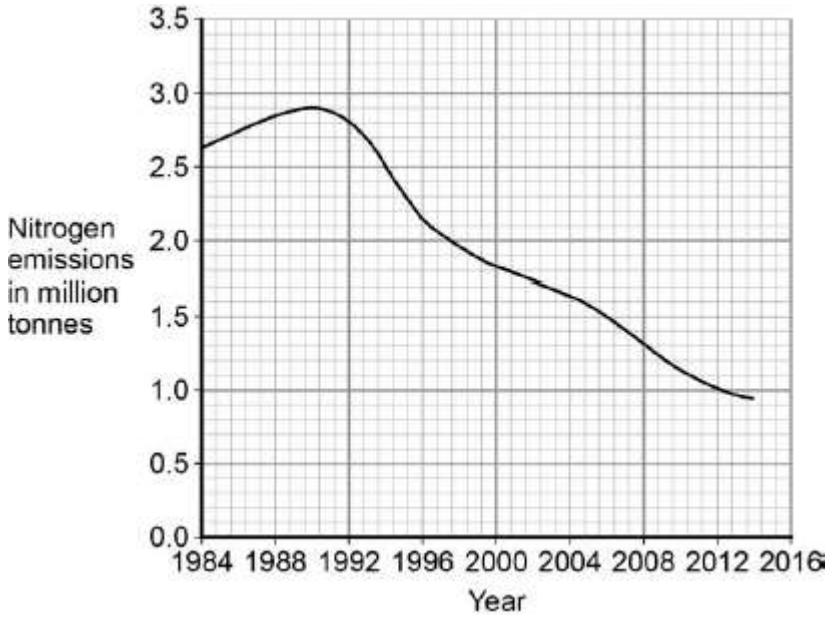
(2)

(b) The figure below gives information about emissions of oxides of nitrogen in the UK.



Calculate the percentage decrease in emissions of oxides of nitrogen from 1990 to 2014.

Give your answer to three significant figures.

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Percentage decrease = ... %

(3)

(c) Give **one** advantage of reducing the emissions of oxides of nitrogen.

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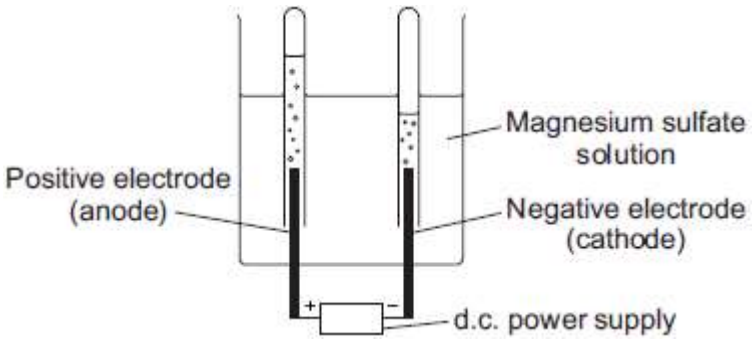
(1)
(Total 6 marks)

Q2.Diagram 1 shows the apparatus used to electrolyse magnesium sulfate solution.

Diagram 1



Gases were given off at both electrodes.

(a) The gas collected at the anode was oxygen.

Draw **one** line from the test for oxygen to the correct result.

Test	Result
	The splint relights
Place a glowing splint in the tube of the gas	The splint goes out
	There is a squeaky pop

(1)

(b) (i) The gas collected at the cathode was hydrogen.

Describe how to test the gas to show that it is hydrogen.

Test .....

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Result .....

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(2)

(ii) Why is hydrogen, and **not** magnesium, produced at the cathode?

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(1)

(c) A student wanted to use electrolysis to silver plate a metal spoon.

(i) Give **one** reason why metal spoons are sometimes silver plated.

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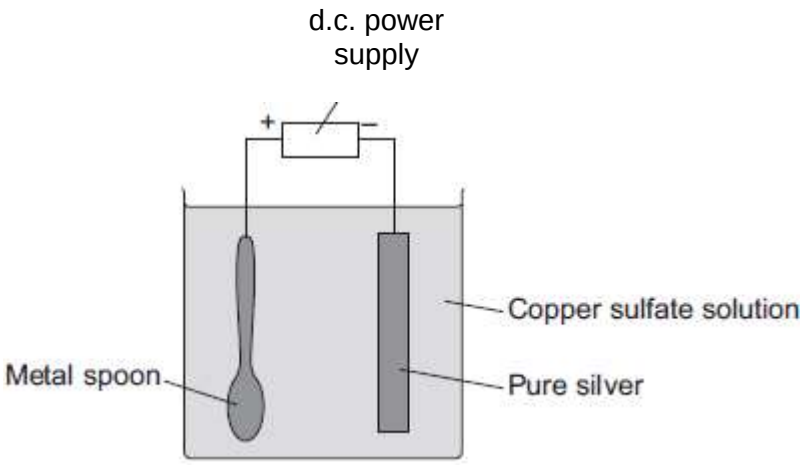
(1)

(ii) **Diagram 2** shows the apparatus the student used. The student did **not** set the apparatus up correctly.

Diagram 2



The student found that the metal spoon eroded and a thin layer of copper formed on the pure silver electrode.

Suggest **two** changes that the student must make to his apparatus to be able to silver plate the metal spoon. Give a reason for each change.

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(4)

(iii) Why is it difficult to electroplate plastic spoons?

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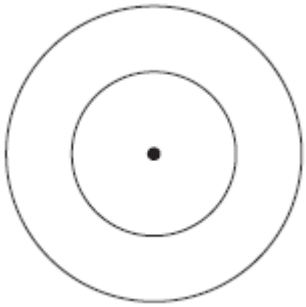
(1)
(Total 10 marks)

Q3. Fossil fuels contain carbon and hydrogen.

(a) (i) Use the Chemistry Data Sheet to help you to answer this question.

Complete the figure below to show the electronic structure of a carbon atom.



(1)

(ii) Complete the word equation for the oxidation of hydrogen.

hydrogen + oxygen ⟶ .....

(1)

(b) Coal is a fossil fuel.

Coal contains the elements hydrogen, sulfur, oxygen and carbon.

Name **two** products of burning coal that have an impact on the environment.

What impact does each of the products you named have on the environment?

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(4)
(Total 6 marks)

Q4. Crude oil is a mixture of many different chemical compounds.

(a) Fuels, such as petrol (gasoline), can be produced from crude oil.

(i) Fuels react with oxygen to release energy.

Name the type of reaction that releases energy from a fuel.

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(1)

(ii) Fuels react with oxygen to produce carbon dioxide.
The reaction of a fuel with oxygen can produce a different oxide of carbon.

Name this different oxide of carbon and explain why it is produced.

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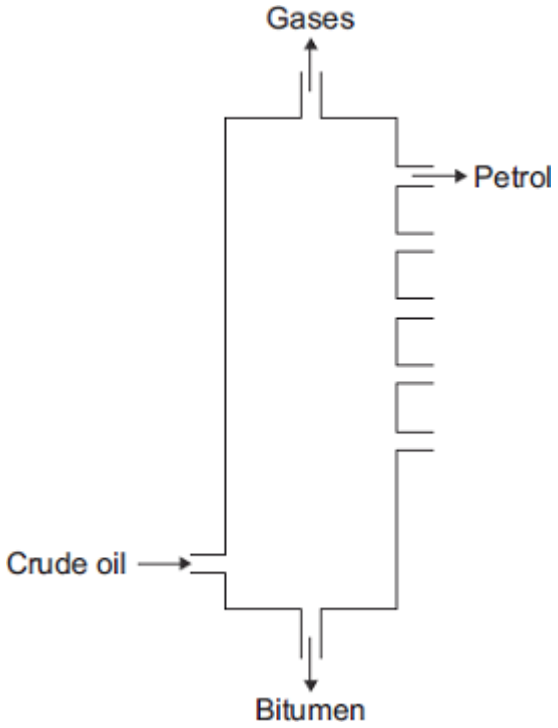
(2)

(b) Most of the compounds in crude oil are hydrocarbons.
Hydrocarbons with the smallest molecules are very volatile.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe and explain how **petrol** is separated from the mixture of hydrocarbons in crude oil.

Use the diagram and your knowledge to answer this question.

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(6)
(Total 9 marks)

Q5. A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

(a) Use the information above to answer these questions.

(i) Give the formula for heptane

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(1)

(ii) Complete the general formula of alkanes.
n = number of carbon atoms

C_nH

(1)

(b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1.**

(i) Name the carbon compound produced in **Reaction 2.**

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(1)

(ii) Give a reason why the carbon compounds produced are different.

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(1)

(c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

(i) What is the percentage of the other gases in the table?

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(1)

(ii) What is the name of the compound that makes up most of the other gases?

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(1)

(iii) Give a reason why sulfur dioxide is produced in a petrol engine.

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(1)

(iv) State how nitrogen oxides are produced in a petrol engine.

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(2)

(d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

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(2)
(Total 11 marks)

Q6. About 3000 million years ago, carbon dioxide was one of the main gases in the Earth's 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.

(a) Describe and explain how the composition of the Earth's atmosphere was changed by the formation of coal.

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(3)

(b) Today, coal is burned in power stations to release the energy needed by industry. Carbon dioxide, water and sulfur dioxide are produced when this coal is burned.

Name **three** elements that are in this coal.

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(2)

(c) In some power stations coal is mixed with calcium carbonate (limestone). The mixture is crushed before it is burned.

(i) Many chemical reactions happen when this mixture is burned. The chemical equation represents one of these reactions.

Balance the chemical equation.

$2CaCO_3(s) + 2SO_2(g) + O_2(g) \rightarrow$ ……$CaSO_4$ (s) + ……CO_2 (g)

(1)

(ii) Explain how the use of calcium carbonate in the mixture:

increases atmospheric pollution

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decreases atmospheric pollution.

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(4)
(Total 10 marks)