OCR
RECOGNISING ACHIEVEMENT

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A211/01

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
SCIENCE A
UNIT 1: Modules B1 C1 P1 (Foundation Tier)

**TUESDAY 15 JANUARY 2008**

Afternoon
Time: 40 minutes

Candidates answer on the question paper.
**Additional materials (enclosed):**
None

Calculators may be used.
**Additional materials:** Pencil
Ruler (cm/mm)

*CUP/T45750*

Candidate Forename | Candidate Surname

Centre Number | Candidate Number

**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 42.

| FOR EXAMINER'S USE | | |
|---|---|---|
| Qu. | Max | Mark |
| 1 | 6 | |
| 2 | 8 | |
| 3 | 6 | |
| 4 | 8 | |
| 5 | 8 | |
| 6 | 6 | |
| TOTAL | 42 | |

This document consists of **16** printed pages.

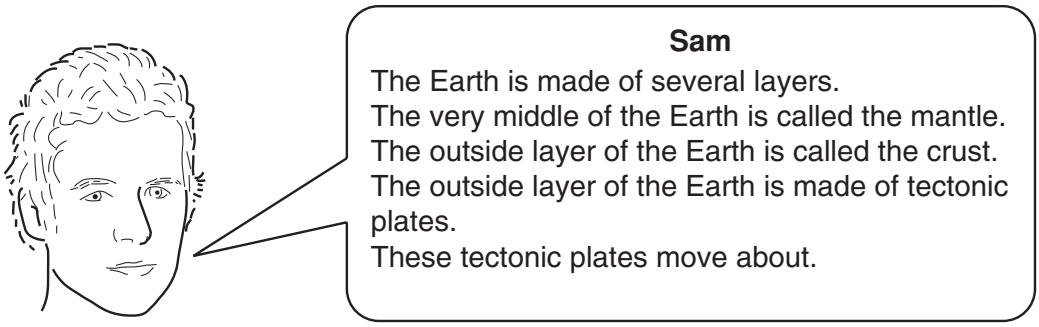


**[Turn over**

Answer **all** the questions.

**1** Sam has been watching a TV programme about the Earth.

He is trying to explain it to his friend Jo, but he has forgotten some of the information in the programme.



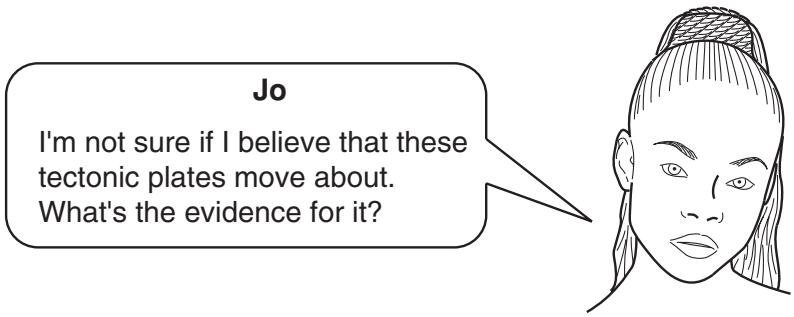

**(a)** Sam makes a number of statements of fact. Some of them are mistakes.

Write **T** in the box next to each **true** statement and **F** in the box next to each **false** one.

| | **T** (true) or **F** (false) |
|---|---|
| The Earth is made of several layers. | |
| The very middle of the Earth is called the mantle. | |
| The outside layer of the Earth is called the crust. | |
| The outside layer of the Earth is made of tectonic plates. | |

[4]

**(b)** Jo needs to be convinced of these ideas.




Here are some scientific statements about the Earth.

Put ticks (✓) in the boxes next to the **three** statements which give Jo evidence that the tectonic plates move about.

Coal and oil are fossil fuels. ☐

The centre of the Earth is mostly iron. ☐

Mountains often occur where tectonic plates meet. ☐

Seafloor spreading happens in the middle of many oceans. ☐

Volcanoes and earthquakes happen near the edges of tectonic plates. ☐

[2]

[Total: 6]

**2** When astronomers look at the night sky through telescopes, they see many stars and spiral nebulae.




In 1920, astronomers did not know what 'spiral nebulae' were, nor how far away they were. There was a great debate between two astronomers.

**Harlow Shapley**

Our Milky Way is the only galaxy there is: it's the whole Universe. It is huge: 300 000 light years across.

Spiral nebulae are clouds of gas and dust inside the Milky Way.

Our Sun is far from the centre of the Milky Way.

**Heber Curtis**

You're wrong about the size of the Milky Way - it's ten times smaller than that.

Our Sun is very near the centre of the Milky Way.

These spiral nebulae are galaxies just like our Milky Way. They are much further away from us than the edge of the Milky Way galaxy.

**(a)** The statements below are made by one or both of these astronomers.

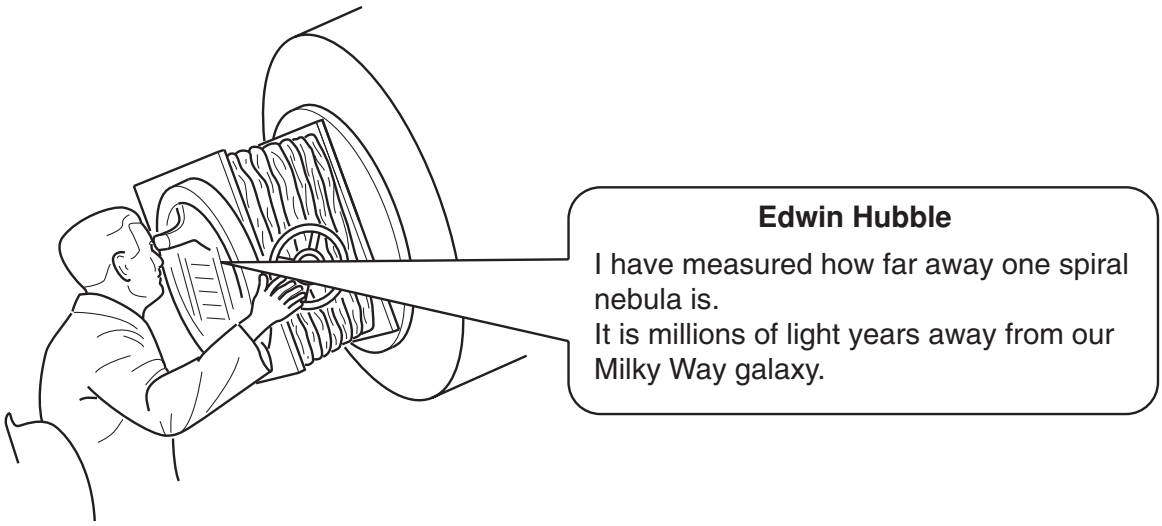
Who made each statement?

Put a tick (✓) in the correct box for each statement.

| | **Shapley** | **Curtis** | **both Shapley and Curtis** |
|---|---|---|---|
| The Milky Way is the only galaxy. | | | |
| Spiral nebulae are part of the Milky Way. | | | |
| The Milky Way has our Sun close to its centre. | | | |
| The Milky Way is thousands of light years in size. | | | |

[4]

**(b)** Another astronomer made more accurate measurements on stars and spiral nebulae.




Who could use this new evidence to support his argument?

Put a tick (✓) in the **one** correct box to show which theory about spiral nebulae is supported by Hubble's measurement.

Shapley ☐

Curtis ☐

both Shapley and Curtis ☐

[1]

**(c)** Edwin Hubble also measured the **movement** of objects in the night sky.

Use the words from this list to complete the sentence below.

**away from us**

**galaxies**

**moons**

**planets**

**together**

**towards us**

Edwin Hubble showed that distant ……

are moving …… . [2]

**(d)** Using Edwin Hubble's methods, astronomers have been able to show that the Universe began with a 'big bang'.

Put a (ring) around the number of years ago that the Universe began.

**4000 million** **5000 million** **10 000 million** **14 000 million**

[1]

[Total: 8]

**3** **(a)** It is possible to screen embryos grown outside the womb. This is done to find out what genes they have.

Embryos can then be selected before they are implanted into the mother's womb.

The stages of this process are described below.

They are in the wrong order.

**A** One cell is taken from each embryo.

**B** The fertilised eggs grow into embryos.

**C** Sperm from the father are added to the eggs.

**D** Doctors test for genes present in the embryos.

**E** Some of the mother's eggs are removed from the ovaries.

**F** Embryos without faulty genes are put into the mother's womb.

Fill in the boxes to show the right order. Two have been done for you.

| | | | | | |
|---|---|---|---|---|---|
| E | | | | | F |

[3]

**(b)** This article appeared on a website.

## Watchdog backs more embryo checks

There are new guidelines for tests on embryos.

Couples with family histories of breast cancer can now have their embryos tested.

Breast cancer does not usually affect people until they are over thirty.

Individuals with the genes linked to breast cancer have about an 80% chance of developing breast cancer.

Testing will not be allowed for conditions like asthma which can be treated with medicine.

Testing will not be allowed for schizophrenia which is not caused by a single gene.

Adapted from BBC News at http://news.bbc.co.uk, 10 May 2006

**(i)** There are **two major changes** to the tests on embryos which should be allowed.

Put ticks (✓) in the boxes next to the **two** tests which will be allowed by the new guidelines.

| | |
|---|---|
| tests for genes causing asthma | ☐ |
| tests for genes that increase the chance of cancer | ☐ |
| tests for conditions caused by many genes, e.g. schizophrenia | ☐ |
| tests for genes which do not usually affect individuals until they reach the age of thirty | ☐ |

[1]

**(ii)** The article says:

'Individuals with the genes linked to breast cancer have about an 80% chance of developing breast cancer.'

Read the explanations of this statement.

Put a tick (✓) in the box next to the **best** explanation.

20% of women with breast cancer genes will get breast cancer. ☐

80% of women with breast cancer genes will get breast cancer. ☐

Every woman with breast cancer genes will get breast cancer. ☐ [1]

**(iii)** Schizophrenia is probably caused by a combination of several inherited genes and environmental factors.

Who is **most** likely to suffer from schizophrenia?

Choose from the following people.

| individual | genes present | environmental factors present |
|---|---|---|
| Andy | yes | yes |
| Briony | no | yes |
| Chloe | yes | no |
| David | no | no |

answer ..... [1]

[Total: 6]

**4** Read the newspaper article below.

# Three sisters unite for surrogate birth

Laura, who is infertile, has a baby boy thanks to her two sisters.

Her sister Rebecca had an operation to remove an egg.

This was fertilised using sperm from Laura's husband, Simon.

The embryo was implanted into another of Laura's sisters, Hannah.

Hannah became pregnant and gave birth to a healthy boy, Jake.

**(a)** Complete the sentences using words from this list.

**calcium**

**DNA**

**many copies**

**one copy**

**two copies**

The egg cell from Rebecca and the sperm cell from Simon each contained

…… of each chromosome.

The fertilised egg cell contains …… of each chromosome.

Each chromosome is made of a chemical called …… . [3]

**(b)** Jake is a boy. His sex is determined by his sex chromosomes.
Write down the sex chromosomes Jake must have inherited.

answer ..... [1]

**(c)** Which statement best explains who Jake is most like?

Put a tick (✓) in the correct box.

Rebecca, because she donated the egg. ☐

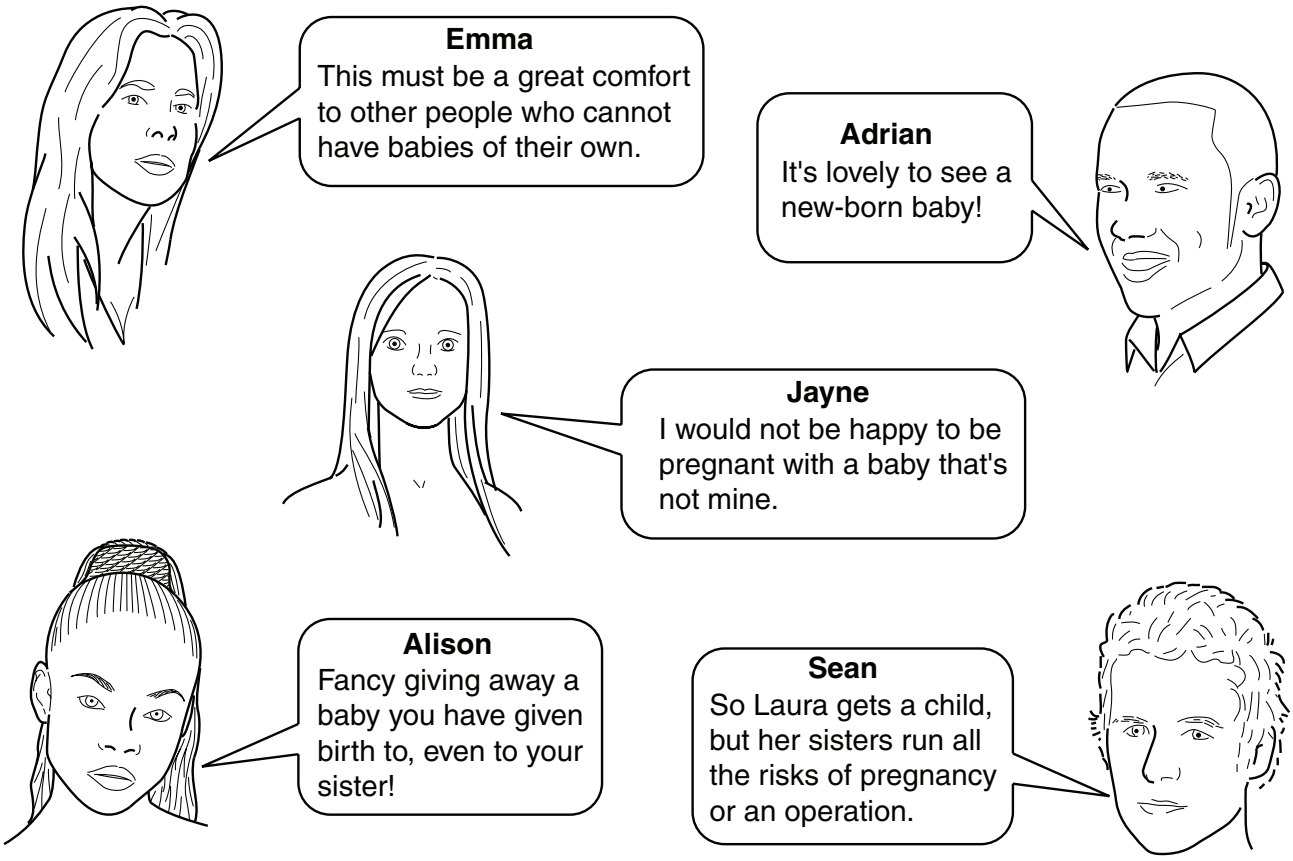
Hannah, because she was pregnant with Jake for 9 months. ☐

Rebecca, because all of Jake's genes came from her. ☐

Hannah, because half of Jake's genes came from her. ☐

[1]

**(d)** Five people have different views about this story.




Which people help to explain why this type of treatment does not happen often?

Put a tick (✓) in the box next to **each** correct name.

| | |
|---|---|
| Adrian | ☐ |
| Emma | ☐ |
| Jayne | ☐ |
| Sean | ☐ |
| Alison | ☐ |

[3]

[Total: 8]

**5** In the UK, older cars must have an MOT test every year to check that they are working properly.

One part of the test is to check that the amount of each pollutant gas in the exhaust emissions is within legal limits.

Liz tests a car exhaust. These are the results from the test.

| | Limits | Actual value |
|---|---|---|
| engine speed | 2500-3000 rpm | 2829 rpm |
| carbon monoxide | less than 0.3% | 0.03% |
| hydrocarbons | less than 200 ppm | 28 ppm |

**(a)** Complete the sentences by choosing words from this list.

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

**above** **below** **fail** **pass**

The actual value of carbon monoxide is ..... the legal limit.

The actual value of hydrocarbons is ..... the legal limit.

The car should ..... the test. [2]

**(b)** The hydrocarbons in the exhaust gases come from unburnt petrol.

Complete the sentences to show what happens to petrol when it burns normally in the car engine.

Use words from this list.

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

**carbon dioxide** **carbon monoxide** **oxygen** **water**

When petrol burns,

- **carbon** atoms in the petrol react with oxygen to form

  ..... and .....

- **hydrogen** atoms in the petrol react with ..... to

  form ..... . [2]

**(c)** Liz uses an electronic sensor to take five measurements of the percentage of carbon monoxide in the car exhaust.

These are her results.

| test | percentage of carbon monoxide (%) |
|---|---|
| 1 | 0.12 |
| 2 | 0.03 |
| 3 | 0.04 |
| 4 | 0.03 |
| 5 | 0.02 |

**(i)** Liz treats test 1 as an **outlier**.

Why does she do this?

Put a tick (✓) in the box next to the **best** answer.

The first test is just a rough trial. ☐

This result is higher than the mean of the other results. ☐

This result lies well outside the range of the other results. ☐

This result is not a best estimate. ☐

[1]

**(ii)** Complete the sentence about the true value of the percentage of carbon monoxide.

The true value lies in the range ..... . [1]

**(iii)** Why does Liz repeat the test five times?

Put ticks (✓) in the **two** boxes next to true reasons for repeating the test.

She is looking for a correlation. ☐

The electronic sensor may not work reliably. ☐

The data is more accurate. ☐

It is important to control other factors when measuring. ☐

The percentage of carbon monoxide in the exhaust may vary. ☐

[2]

[Total: 8]

**6** Air in cities contains pollutants that affect the air quality.

**(a)** The pie chart shows the amounts of the three main gases in **clean air**.

Label the pie chart.

Choose words from this list.

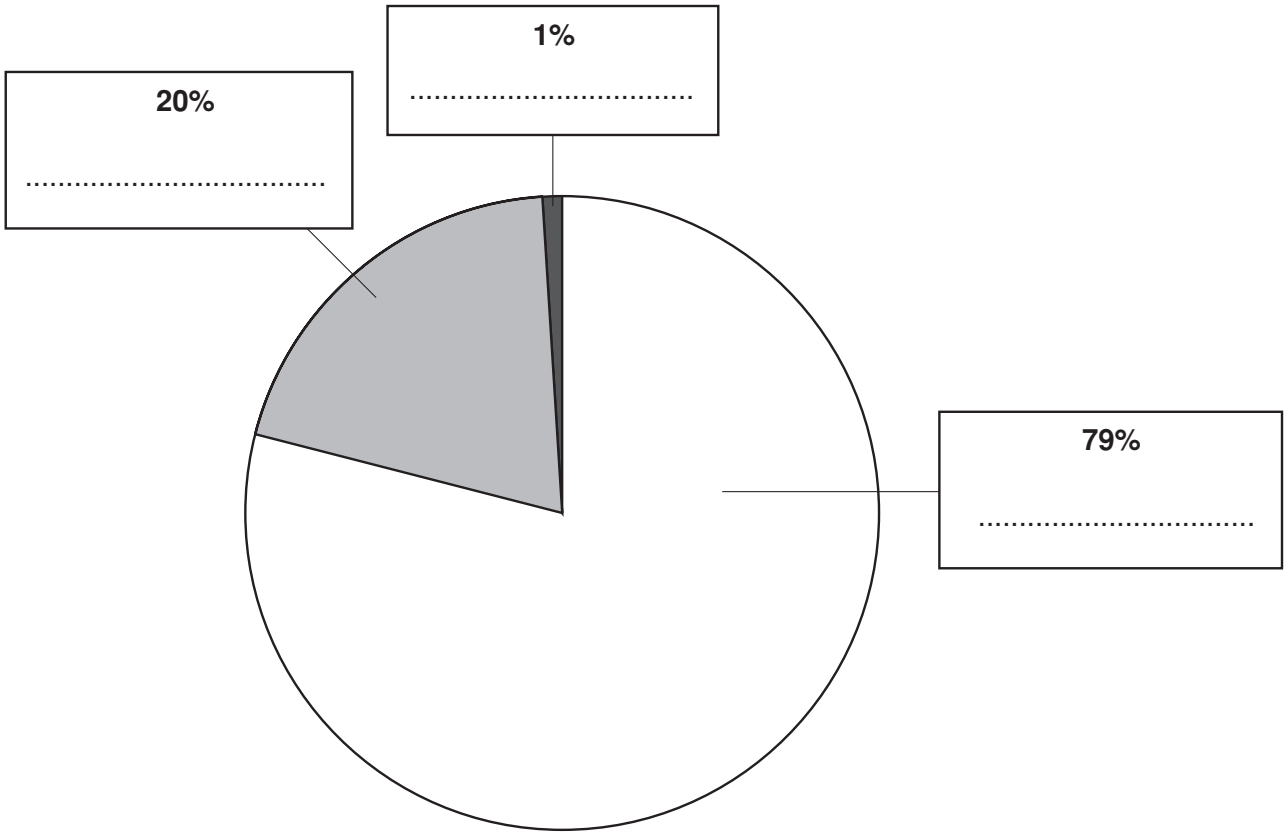
**argon**

**carbon dioxide**

**nitrogen**

**oxygen**

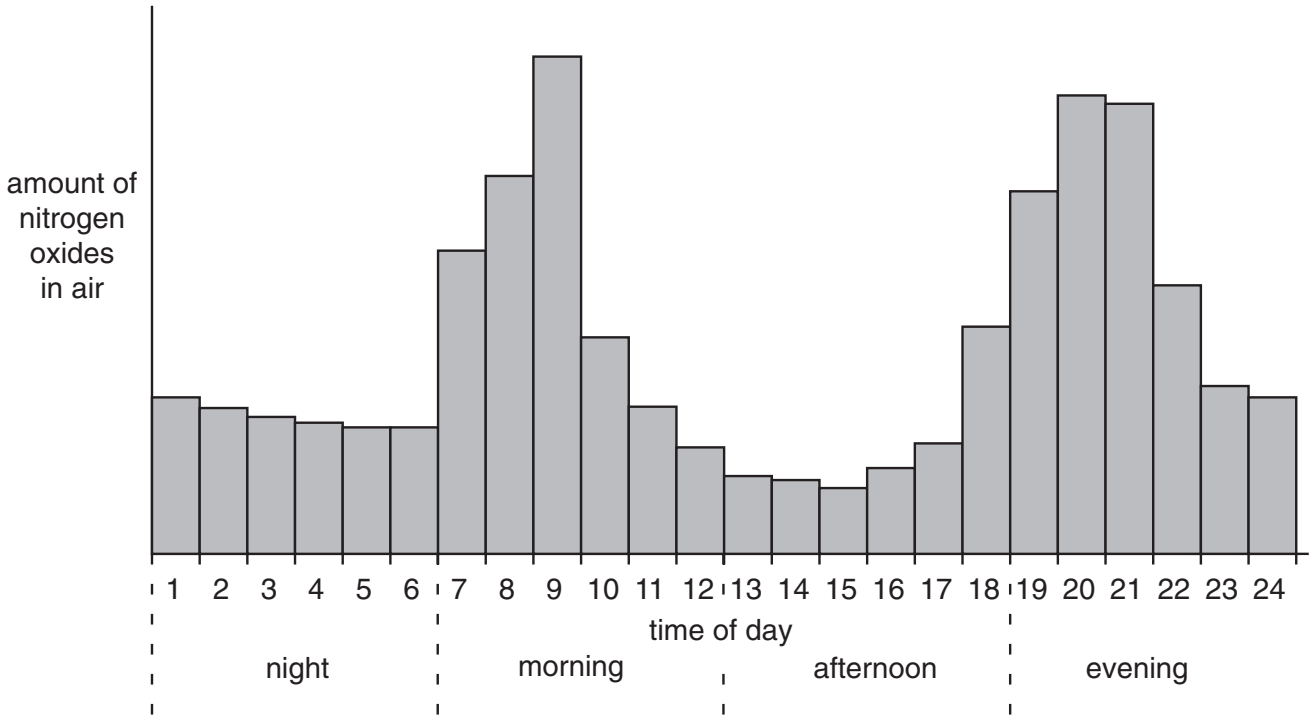
**sulfur**




[2]

**(b)** Some of the gases that affect air quality are nitrogen oxides.

This graph shows how the amount of nitrogen oxides in air changes over a typical day in a city.




Which of the following conclusions can be made from the graph?

Put ticks (✓) in the **two** correct boxes.

The amount of nitrogen oxides is highest every day at 4 in the morning. ☐

The highest amounts of nitrogen oxides usually occur in the morning and evening. ☐

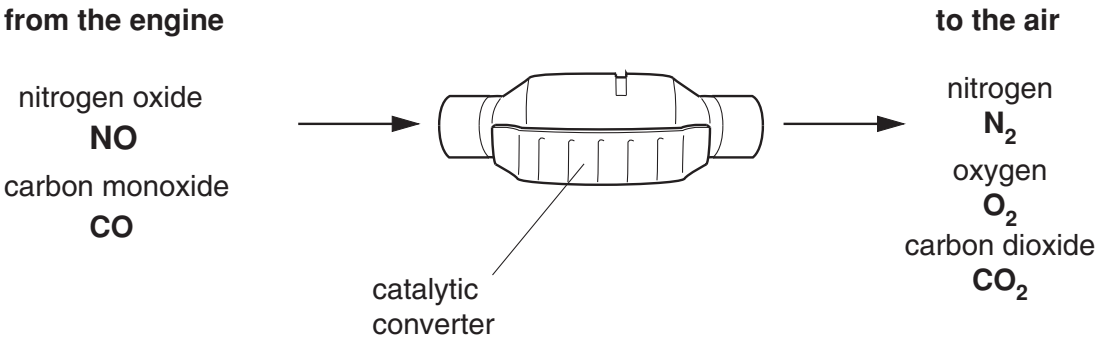
Nitrogen oxides are produced by motor vehicles. ☐

The amount of nitrogen oxides in the air usually decreases overnight. ☐

[2]

**(c)** One way of reducing the amount of nitrogen oxides in the air is by using catalytic converters in cars.

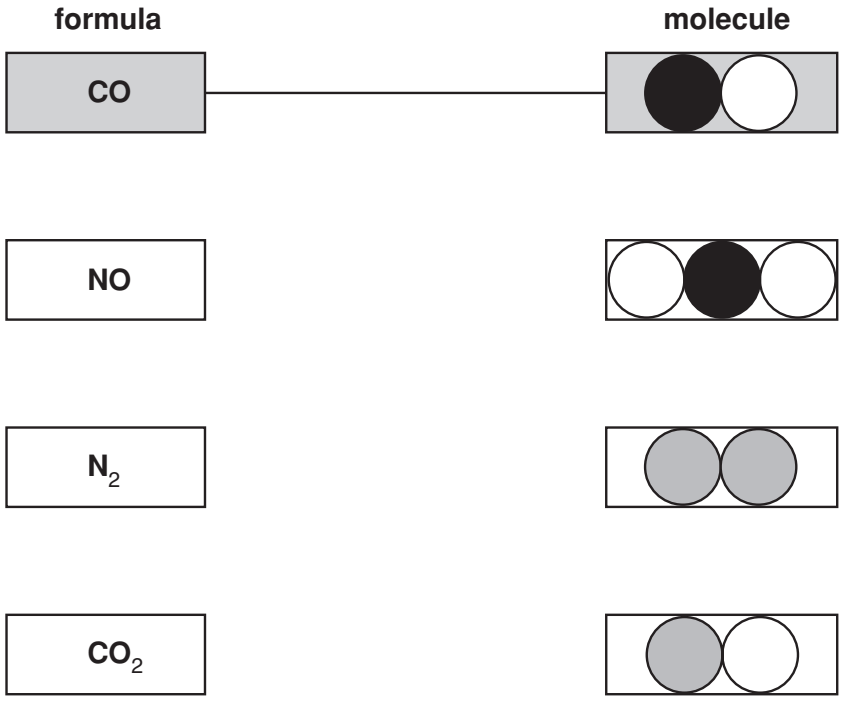
This diagram shows what gases go in and out of a catalytic converter.




The boxes below show the formulae and molecules of some of the gases that go in or out of the converter.

Draw a straight line from each **formula** to the correct **molecule**.

One has been done for you.




[2]

[Total: 6]

**END OF QUESTION PAPER**

*Acknowledgements:*

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Q.3b Article adapted from *Watchdog backs more embryo checks,* 10 May 2006, © BBC News, http://news.bbc.co.uk