

Twenty First Century Science

PILOT Examination Questions

GCSE Science Jan 2005

Air quality, You and your genes, Earth in the Universe
(Foundation Tier)

Please note:

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- The style of question varies from that used for the new specifications.
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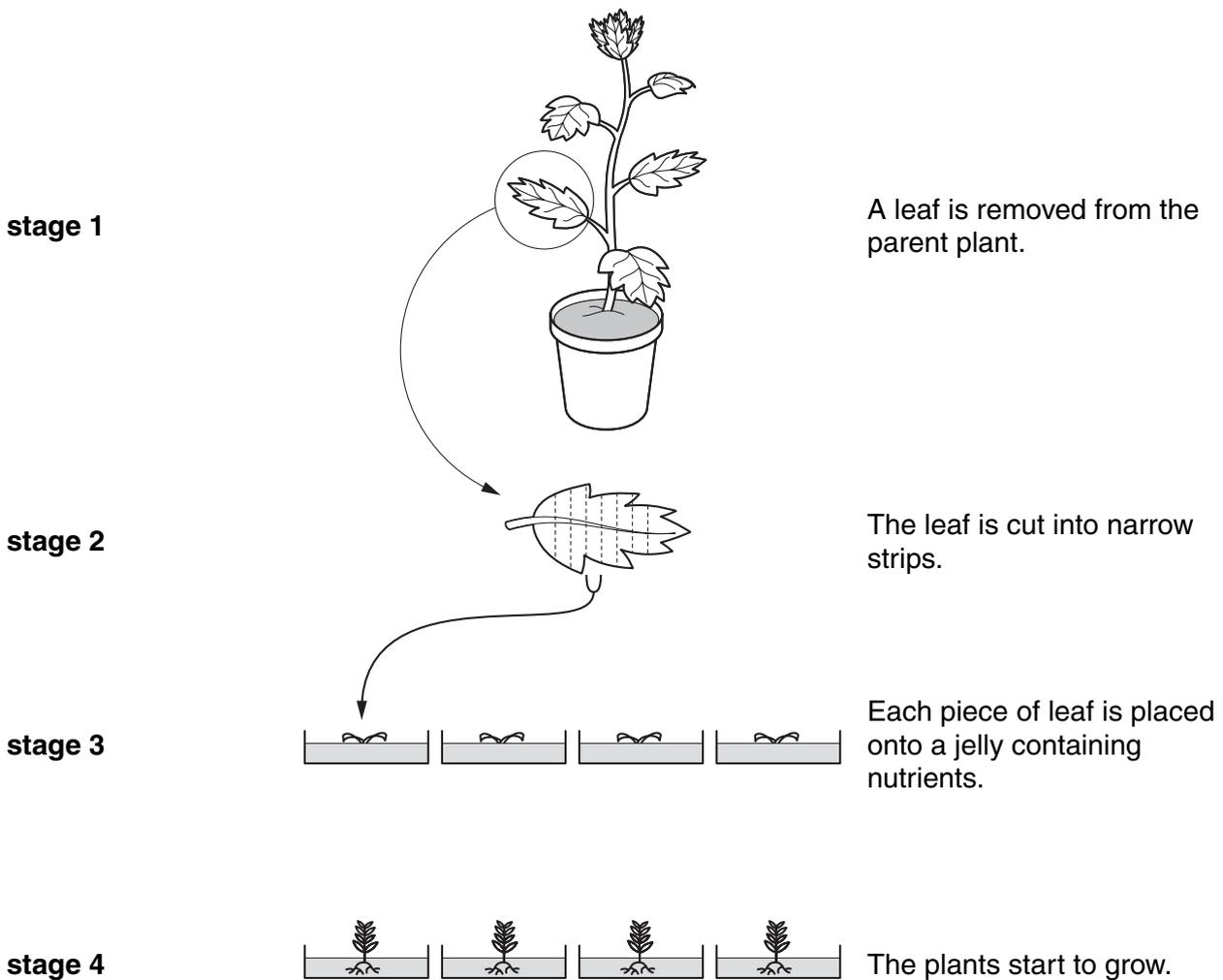
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Answer **all** the questions.

1 Liz works at the Grow More Garden Centre.

The Garden Centre has produced a new type of plant. When it is fully grown, it is about 10 cm tall, with purple and green leaves and a purple stem.

The diagram shows how Liz takes leaf cuttings to produce more plants.



- (a) (i) Liz transfers one of the young plants to a larger pot. After a few months, it has grown to full size.

Describe what this plant looks like when it is fully grown.

.....

.....

..... [2]

- (ii) The young plants are sold to customers.

The plants grow to different sizes.

Explain why.

.....

.....

.....

..... [2]

- (b) (i) Explain why only a small piece of the leaf was needed for **stage 3**.

.....

..... [1]

- (ii) At **stage 3**, the only cells in the jelly are leaf cells.

Explain how these cells can develop into young plants.

.....

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..... [2]

[Total: 7]

2 These boxes show information about some gases that can pollute the atmosphere.

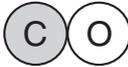
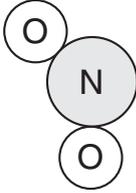
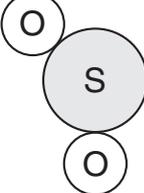
The left hand boxes show the structure of the molecules of the gases.

The centre boxes show the names of the gases.

The right hand boxes give information about where they come from and some of their polluting effects.

Draw lines to join each **molecule** to the **name of the gas** and its **polluting effect**.

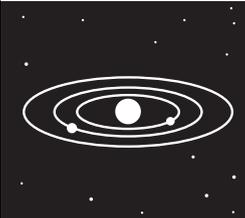
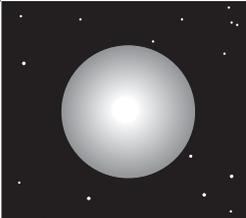
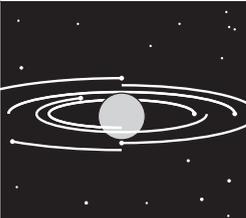
One has been done for you.

structure of molecule	name of the gas	polluting effect
	nitrogen dioxide	Formed at high temperatures in car engines. Makes asthma symptoms worse.
	carbon dioxide	Formed when fuels do not burn completely. Reacts with blood and can be fatal.
	carbon monoxide	Formed when coal or oil containing sulfur burns. Causes acid rain.
	sulfur dioxide	Formed by the complete burning of hydrocarbon fuels. Causes global warming.

[4]

[Total: 4]

- 3 (a) The diagrams show some of the stages in the life of the Sun and the Solar System. They are in the wrong order.

A	B	C	D	E
				
The planets orbit the Sun. Some debris remains.	The cloud begins to form a denser centre, which heats up as it contracts.	A cloud of dust and gases.	The Sun runs out of fuel, forming a red giant.	Remaining dust swirling round begins to form planets.

Fill in the boxes to show the right order.

The first one has been done for you.

C				
---	--	--	--	--

[3]

- (b) The Solar System has different types of bodies in orbit around the Sun. Planets are one type.

(i) Write down the names of **two** other types of bodies that are orbiting the Sun.

1.

2. [2]

(ii) Put a **ring** around the name of the force that keeps a planet in orbit around the Sun.

electrical **friction** **gravity** **magnetism** [1]

- (c) The Sun is just one star in the Milky Way galaxy. The next nearest visible star, Alpha Centauri, is about 4 light years away.

What is a **light year**?

..... [2]

- (d) The Milky Way is one of many galaxies in the Universe. It looks as though the galaxies are **moving away from us**.

Explain what this suggests about the beginning of the Universe.

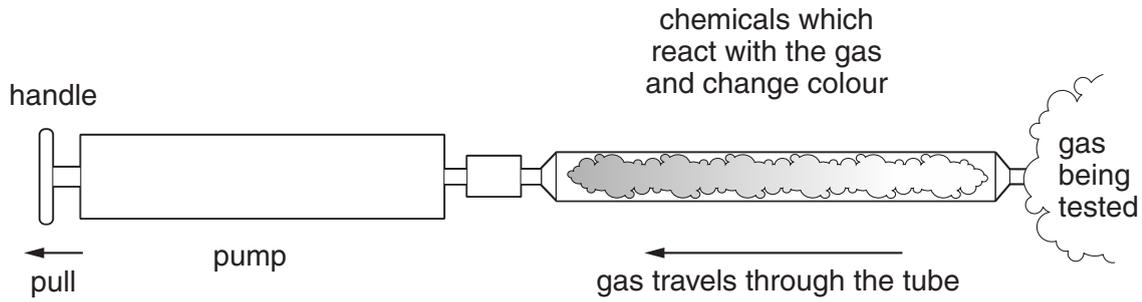
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..... [2]

[Total: 10]

- 4 York High School has a special syringe to measure the concentration of nitrogen oxides (NO_x) in car exhausts.



The students test the head teacher's car.

The car engine was well warmed up and running steadily at a constant speed.

These are the results.

test number	NO_x concentration (in parts per billion (ppb))
1	119
2	126
3	113
4	122

- (a) Suggest **two** reasons why the students took several readings.

.....

 [2]

- (b) Use the results to calculate the best estimate of the concentration of nitrogen oxides.

You **must** show how you work out your answer.

concentration = ppb [2]

(c) Calculate the **range** of the measurements.

range = ppb [1]

(d) The students now test the exhaust from the chemistry teacher's car.

The average reading is 147 ppb.

Tick the box beside the **best** description of this result.

The chemistry teacher's car definitely produces more NO_x.

The chemistry teacher's car probably produces more NO_x.

Both cars produce the same amount of NO_x.

The chemistry teacher's car definitely produces less NO_x. [1]

(e) Explain why it is important to keep the amount of NO_x in the air as low as possible.

.....
.....
..... [2]

[Total: 8]

5 Amy's mum is pregnant.



(a) Amy wonders if the baby will look exactly the same as herself.

Mum says the baby will not look the same as Amy. The baby will have some of Mum's features and some of Dad's features.

Explain why the baby will not look exactly the same as Amy.

.....

.....

..... [2]

(b) Amy wants a baby sister.

Mum says that she cannot choose what sex the baby will be.

(i) Finish the sentences. Choose the best answers from this list.

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

egg

sperm

W

X

Y

Z

All of Mum's egg cells carry an chromosome.

Amy's Dad will have either an or chromosome in each of his cells.

For Amy to have a sister, the baby will need to inherit an chromosome from her Mum and an chromosome from her dad. [4]

(ii) Complete the table below to show how sex chromosomes are inherited.

		sex chromosomes from one parent	
		X	Y
sex chromosomes from other parent	X		
	X		

[1]

(iii) What is the percentage chance of the baby being a sister for Amy?

% chance of a baby sister [1]

[Total: 8]

6 Chris has diabetes.

In the future, gene therapy may cure diabetes.

(a) Here are five sentences describing the process of gene therapy.

They are in the wrong order.

- A Put normal gene into cells of person with diabetes.
- B Find a person without diabetes to donate some cells.
- C Identify the gene that causes diabetes.
- D Cells follow instructions on normal gene, curing the diabetes.
- E Take normal gene from donated cells.

Fill in the boxes to show the correct order. The first one has been done for you.

C					
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[3]

(b) Chris reads that gene therapy could be used on human embryos, to prevent genetic conditions. He has mixed views about this.

Suggest one argument **for** and one argument **against** using gene therapy on human embryos.

one argument for

.....

one argument against

..... [2]

[Total: 5]

- 7 Nepal is a small country, high in the Himalaya mountains. 90% of its population work in agriculture, yet it is threatened with air pollution.

Nepal is building big concrete dams to supply hydroelectric power. Concrete manufacture is a dusty business.

Cement is used to make concrete.



Cement is made by mixing chalk and clay and heating to very high temperatures in a coal-fired furnace. The coal forms soot and ash.

The chalk (calcium carbonate) decomposes to form lime (calcium oxide) and carbon dioxide.

The calcium oxide then reacts with the clay to form calcium silicate. The small lumps of calcium silicate are ground to a very fine powder – cement powder.

- (a) Write the word equation for the decomposition of calcium carbonate when it is heated.

[1]

- (b) Suggest **one** cause of dust from the manufacture of cement.

.....
 [1]

- (c) The coal used to heat the furnace contains sulfur, which forms sulfur dioxide when coal burns.

Describe what happens to sulfur dioxide when it is released into damp air.

.....

 [2]

(d) There is a large concrete factory near Kathmandu, the capital of Nepal. Every year, this factory alone puts 6 000 tonnes of dust into the air around Kathmandu.

Suggest an experiment that could be done to compare the amount of dust in the air at different places around Kathmandu.



One mark will be for a clear, ordered answer.

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..... [3+1]

[Total: 8]

- 8 Not everyone agrees about the age of the Earth. Read this story of how ideas changed and then answer the questions.

How old is the Earth?



James Ussher was Archbishop of Armagh.

In 1645, he followed family histories in the Bible back in time.

He calculated that the Universe was created in the year 4004 BC, on October 23.

By the late 1700s, it was known that rocks eroded.

James Hutton, a Scottish farmer, noticed that Hadrian's Wall had not been eroded very much.

It was made from stone and had been there for over 1000 years.

He said that the Earth must be older than Ussher suggested.



By 1897, many people were studying science.

William Thomson suggested that the Earth had once been a ball of molten rock.

He said that it was cooling down gradually by conduction and radiation.

He worked out that it must be between 24 million and 400 million years old.

Radioactivity was discovered in 1896.

In 1905, Ernest Rutherford used radioactive decay of minerals to work out the age of the Earth. He said it was 500 million years old.

Today scientists estimate the age of the Earth as being much older.



(a) What is the best current estimate for the age of the Earth?

Put a **ring** around the correct answer.

6 000 years 500 million years 4 500 million years 4 500 billion years [1]

(b) (i) What data did Ussher use for saying that the Universe was created in 4004 BC?

.....
..... [1]

(ii) Ussher's announcement that the Universe was created in 4004 BC was not challenged by many people in Britain in 1645.

Suggest why.

.....
.....
..... [2]

(c) James Hutton thought that Hadrian's Wall showed that the Earth must be much more than 5 000 years old.

Explain why.

.....
.....
..... [2]

(d) The information in the question describes how estimates about the age of the Earth have changed.

Use your ideas about how science theories are developed to explain how this happened.



One mark will be for writing in sentences with correct spelling, punctuation and grammar.

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.....
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.....
..... [3+1]

[Total: 10]

END OF QUESTION PAPER