

# **Twenty First Century Science**

## **PILOT Examination Questions**

### **GCSE Science June 2004**

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

#### **Please note:**

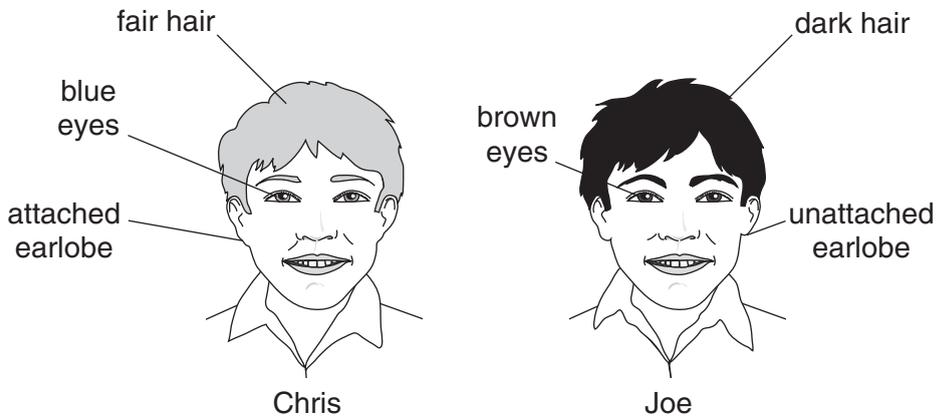
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- **The style of question varies from that used for the new specifications.**
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Answer **all** the questions.

- 1 Chris and Joe are brothers.  
They have the same parents.



- (a) Chris and Joe look different from each other.

Choose the **best** explanation for this.  
Put a tick (✓) in the correct box.

Chris is older than Joe.

They have different combinations of alleles.

They are both boys.

[1]

- (b) Chris and Joe look like their parents in some ways.

Explain why.

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

- (c) Complete the following sentences about the inheritance of ear shape.

Choose from this list.

**a gene**      **a protein**      **chromosomes**      **DNA**      **recessive**

Ear shape is determined by ..... with two different alleles.

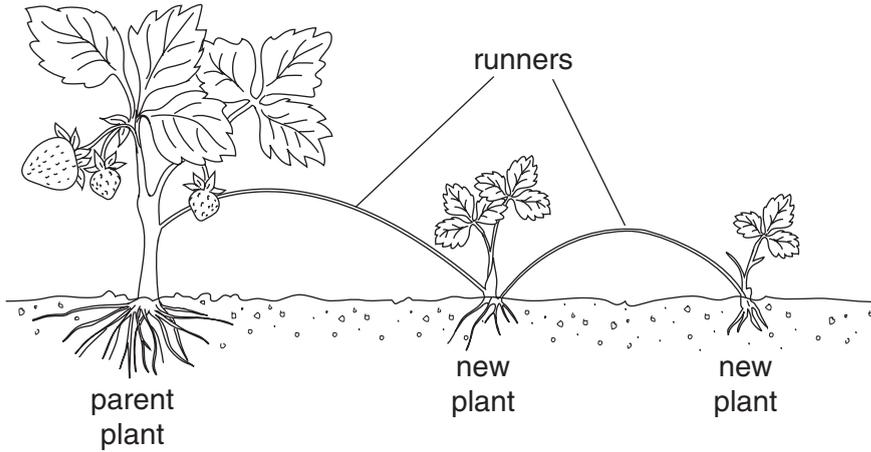
One allele is dominant, the other is .....

The alleles are carried by ..... inside the cell nucleus.

[3]

[Total: 6]

- 2 Jean grows strawberry plants in her garden.  
The diagram shows how the parent plant produces new plants using runners.



- (a) The new plants are clones.

What is a clone?

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

- (b) Jean could also grow new strawberry plants from seeds.

Write down **one** advantage of growing plants from clones rather than from seeds.

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

- (c) Jean notices that the strawberry plants growing nearest to the garden wall are very small and produce a poor crop.

Suggest an explanation.

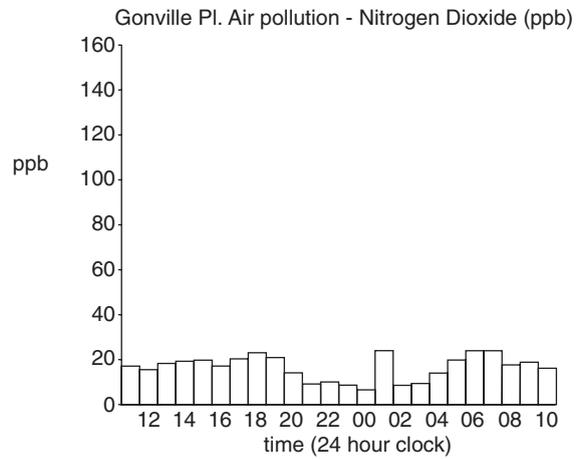
.....  
 .....[1]

[Total: 4]

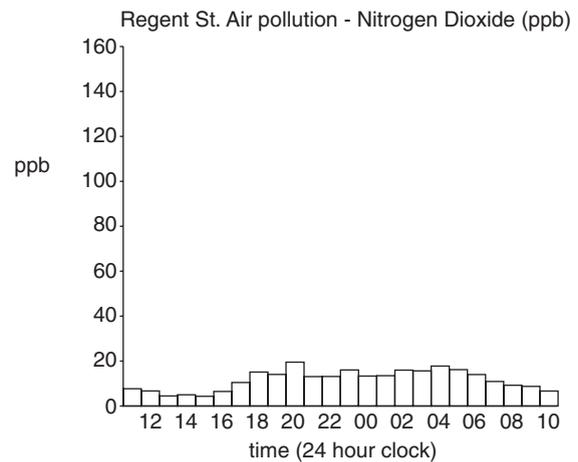
- 3 Councils measure local air pollution. The information helps them to decide what action they should take to improve air quality. The table shows information about three streets in Cambridge. The sites are normally very busy with traffic.

The graphs show the level of nitrogen dioxide in parts per billion (ppb) in each street on the same day in August 2003.

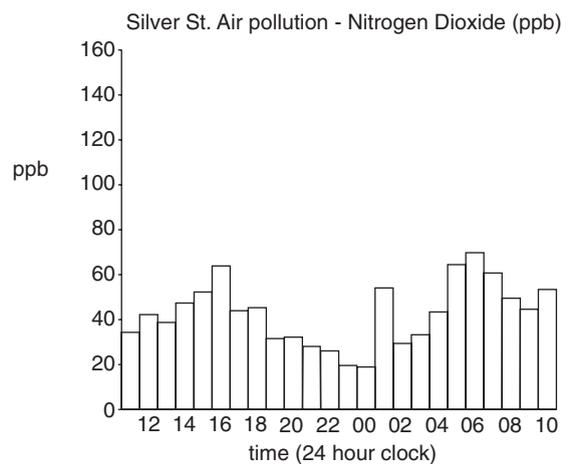
Gonville Place



Regent Street



Silver Street



(a) A local paper made four claims about the pollution levels shown in these graphs.

Tick the boxes to show which **two** statements are true:

The worst nitrogen dioxide pollution was in Silver Street.

The highest level of pollution in Regent Street was at 12 hours.

Pollution levels varied throughout the day.

The highest level of pollution shown is 100 parts per billion (ppb).

[2]

(b) In all three streets, the nitrogen dioxide level is low at midnight (00 hours).

Suggest and explain why.



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

.....  
.....  
.....  
.....[2+1]

(c) Look at the pictures of the three streets. All three normally have heavy traffic.

(i) What correlation can you see between the buildings in these streets and the level of pollution?

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

(ii) Suggest a reason for this correlation.

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

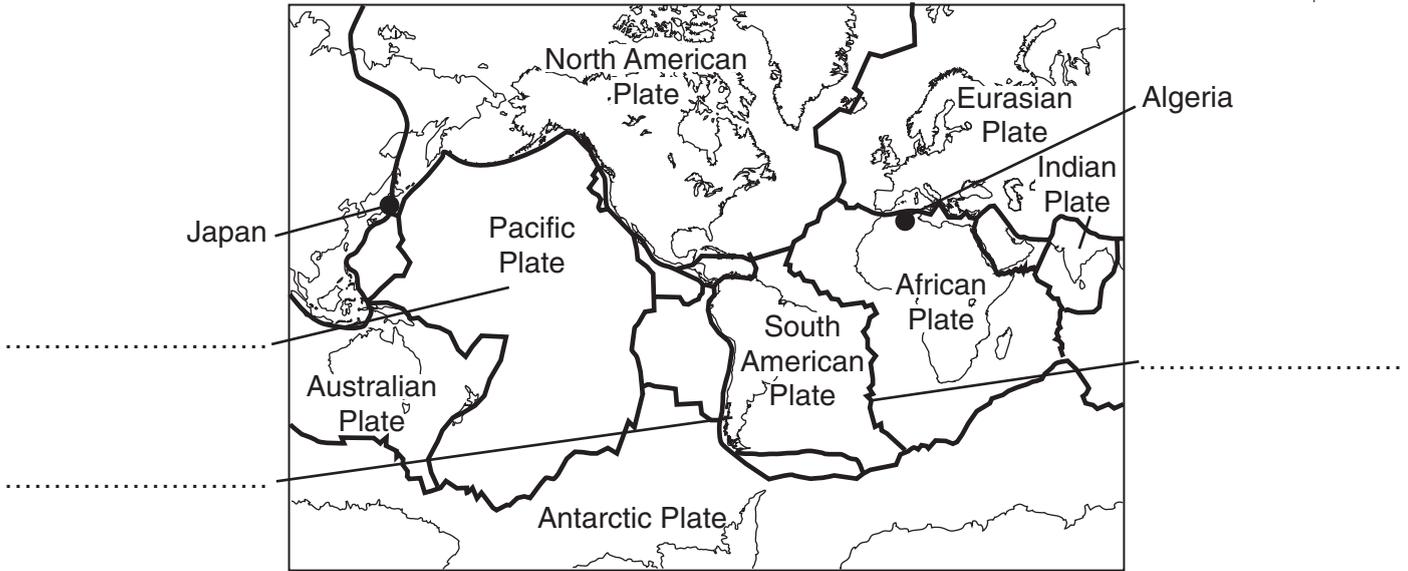
(d) Silver Street has now been closed to traffic.

Suggest **two** reasons why local people might object to this.

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

[Total: 10]

- 4 This question is about earthquakes.  
The map shows some of the tectonic plates that cover the surface of the Earth.



- (a) Finish labelling the map. Use these words.

**mountains**  
**oceanic plate**  
**oceanic ridge**

[2]

- (b) In May 2003, there were earthquakes in Algeria and Japan.

Explain why earthquakes are likely to occur in Algeria and Japan.

Use the information shown on the map to help you.

.....

.....

.....

.....[2]

- (c) The earthquakes in Algeria and Japan were of similar strengths. The earthquake in Japan caused little damage to buildings. The earthquake in Algeria killed more than 2000 people and left over 10 000 people homeless. A newspaper article reporting the earthquake in Algeria said:

## Why did so many die?



Northern Algeria's slums and luxury villas are now piles of rubble. Local residents blamed illegal property deals for the poor construction. The initial shock turned to anger, with victims turning on developers. "Why is it that the new buildings have collapsed and the old ones are still standing?" asked one man, surveying a pile of flattened buildings. Many people are believed to be still buried in the rubble. Entire areas of housing crumbled like houses of cards. When the quake struck, families were gathering at home for dinner, or to watch the UEFA Cup football final on the television.

*based on a report in The Times 24th May 2003*

- (i) Explain why so many people died in this earthquake in Algeria.

.....[1]

- (ii) Suggest ways in which the government in Algeria could help to prevent future earthquakes causing so much damage.

.....  
 .....  
 .....[3]

[Total: 8]

5 Read this newspaper article about DNA.

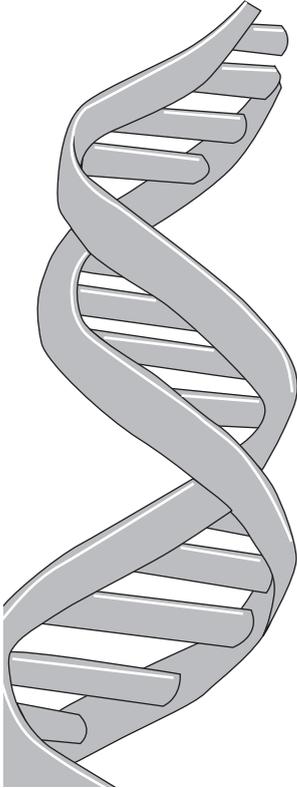
**The story of DNA.**

**1940**

Oswald Avery showed that chromosomes contain DNA which carries genetic information.

**1987**

Colin Pitchfork was the first murderer to be convicted by DNA evidence.



**1953**

Francis Crick and James Watson worked out that the structure of DNA was a double helix.

**1996**

Bones in Russia were identified by genetic testing as being from the murdered Tsar Nicholas.

**1985**

DNA fingerprinting was invented by Alex Jeffreys at Leicester University.

**1999**

Genetic tests prove President Clinton is not the father of Danny Williams, as claimed.

(a) (i) Which part of the cell contains DNA?

Put a ring round the correct answer.

**cell wall**                      **chromosome**                      **membrane**                      **vacuole**  
[1]

(ii) What did Francis Crick and James Watson find out about the structure of DNA?

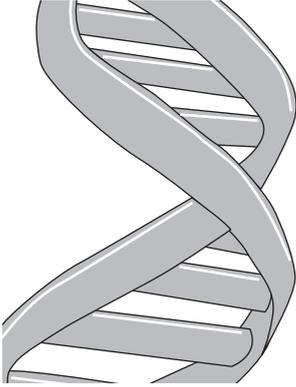
.....  
.....[1]

(iii) The article shows how information from DNA can be used.

Write down **one** of the uses described in the article.

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

(b) The newspaper article also suggests how DNA could be used in the future.

<p>2010 DNA samples used to make up a picture of what a criminal looks like.</p>		<p>2015 DNA records of every person kept on a Government database available to police and medical research organisations.</p>
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Some people agree with these possible future uses of DNA. Other people disagree.

Suggest **two** reasons why people might agree and **two** reasons why people might disagree.

Reasons for agreeing

1 .....

2 .....

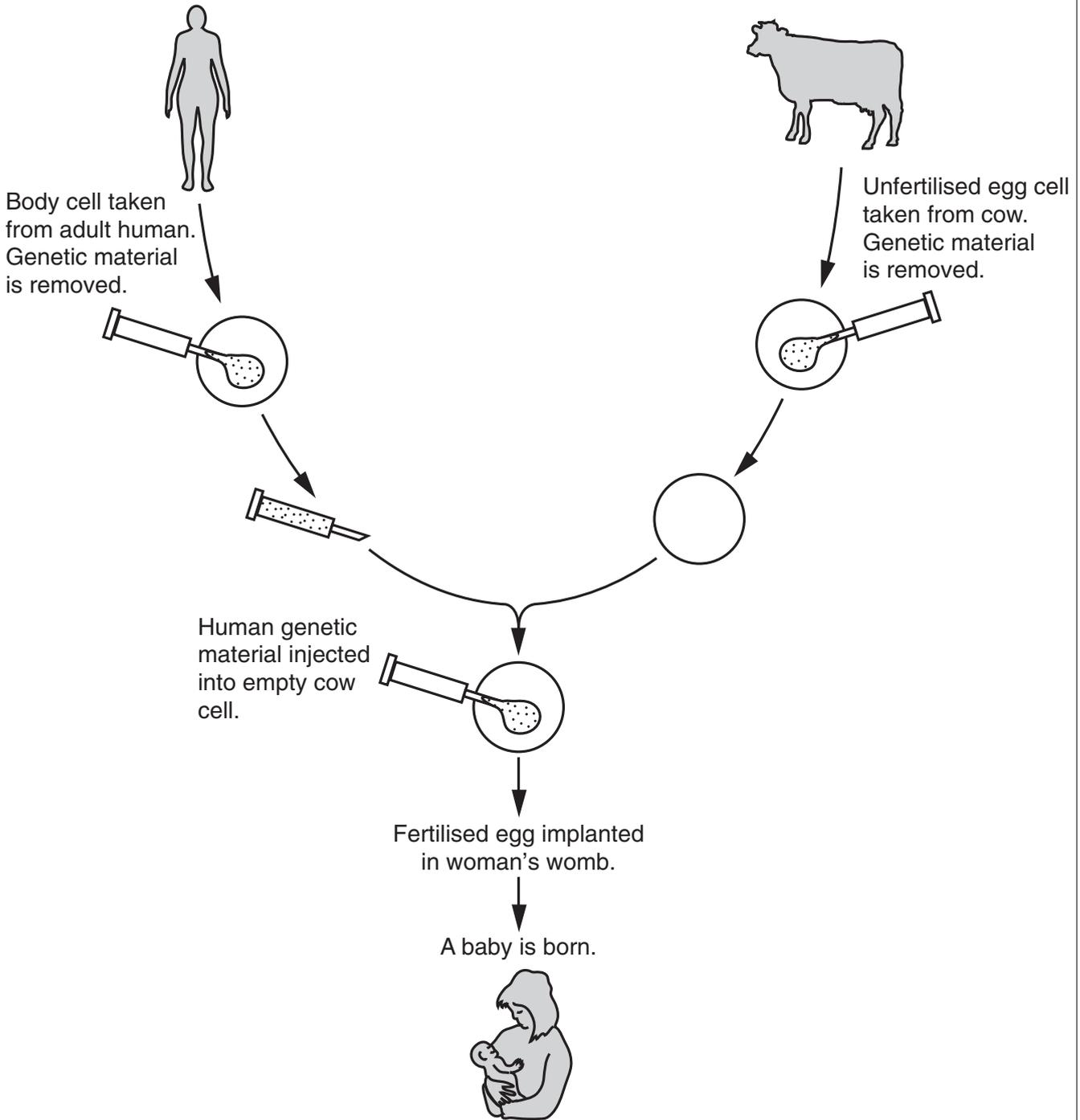
Reasons for disagreeing

1 .....

2 .....[4]

[Total: 7]

6 Scientists think it may be possible to produce a human from a cow's egg.



(a) The baby produced would not have cow characteristics. It would have human characteristics.

Explain why.

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

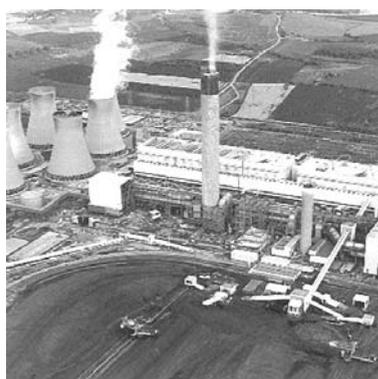
(b) This method uses cow eggs instead of human eggs.

Write down **two** advantages of using cow eggs instead of human eggs.

1 .....  
.....  
2 .....  
.....  
.....[2]

[Total: 4]

- 7 These power stations use different fuels in the production of electricity.

**A****B**

- (a) Power station **A** burns natural gas.

Natural gas contains methane.

Methane contains **only** carbon atoms and hydrogen atoms.

- (i) What is the name given to chemicals that contain only carbon atoms and hydrogen atoms?

..... [1]

- (ii) When natural gas is burned, two main products are given off.

Write down these **two** products.

1 .....

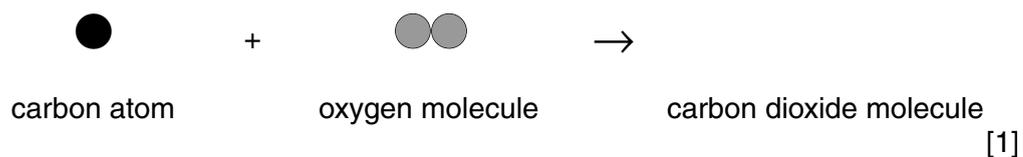
2 ..... [2]

- (b) Power station **B** burns coal.

Coal contains mostly carbon. It burns in plenty of air to form carbon dioxide, which enters the atmosphere.

- (i) The diagram shows the reaction between carbon and oxygen.

Finish this diagram to show what is produced.



(ii) Some carbon dioxide is removed from the atmosphere.

State **two** ways that carbon dioxide is removed from the atmosphere.

1 .....

.....

2 .....

.....[2]

(c) Burning coal or natural gas can also produce sulfur dioxide as a pollutant.

Scientists in both of the power stations shown have taken steps to reduce this sulfur dioxide pollution.

(i) State **one** way to reduce sulfur dioxide pollution caused by a coal burning power station.

.....[1]

(ii) State a **different** way to reduce sulfur dioxide pollution caused by a natural gas burning power station.

.....[1]

(iii) The government has agreed to reduce all air pollution from power stations.

Suggest **one** way this can be done.

.....[1]

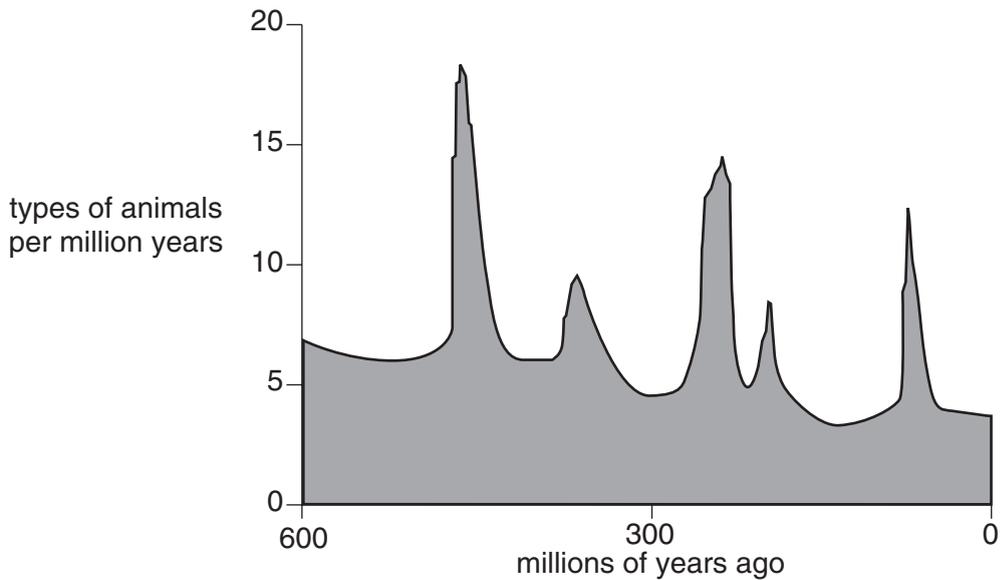
[Total: 9]

8 This question is about the possible cause of the extinction of the dinosaurs. One theory suggests that an asteroid hitting the Earth caused the extinction of the dinosaurs.

(a) What is an asteroid?

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

(b) The graph shows the rate at which types of animals have become extinct over the past 600 million years.



The data comes from fossil records, which show that sometimes there are sudden changes in the fossil evidence.

This shows that many species have become extinct at the same time. This is called a **mass extinction**.

How many mass extinctions are shown on the graph?

.....[1]

(c) A student makes these notes about the extinction of the dinosaurs.

65 million years ago:

- dinosaurs died out
- so did flying reptiles and marine reptiles.

Rocks from 65 million years ago show unusually high amounts of iridium.

Iridium is not found in the Earth's crust.

Iridium is found in asteroids and in material from volcanoes.

Discuss whether an asteroid hitting the Earth caused the extinction of the dinosaurs.

Use your ideas about asteroid collisions and the student's notes to help you with your answer.



One mark will be for a clear, ordered answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3+1]

[Total: 7]

9 This question is about the place of the Earth in the Universe.

(a) Here is a list of objects.

- A comet
- B Earth
- C Milky Way galaxy
- D Sun
- E Universe

Fill in the boxes to show them in order of size, starting with the smallest. The first one has been done for you.

A				
---	--	--	--	--

[3]

(b) This is a question about the age of objects in the Universe.

Answer the questions using the best estimate of time periods from the list.

4 500 million years

5 000 million years

13 700 million years

(i) What is the age of the Earth? .....million years [1]

(ii) What is the age of the Sun? .....million years [1]

[Total: 5]

**END OF QUESTION PAPER**