

# **Twenty First Century Science**

## **PILOT Examination Questions**

### **GCSE Science Jan 2005**

**Food matters, Material choices, Radiation and life  
(Higher Tier)**

#### **Please note:**

- **These questions are not Sample Assessment Materials (SAMs) for the new specification (teaching from Sept 2006).**
- **The style of question varies from that used for the new specifications.**
- **For up to date SAMs see [www.gcse-science.com](http://www.gcse-science.com).**
- **These questions are provided for classroom use by teachers, to help develop students understanding of Ideas about Science.**
- **Some of the material covered in these questions is no longer part of GCSE Science specification. Teachers should check their specification document before using these questions.**

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Answer **all** the questions.

- 1 There has been discussion in the media about whether mobile phones are safe or not.

Mobile phones use microwaves to transmit information. Microwaves are part of the family of radiations called the electromagnetic spectrum.

(a) Read this article, then answer the questions which follow

People protest about phone masts. But there are few complaints about phones themselves. Is this because people *choose* to use their phones: they don't often choose to have a mast at the end of the garden radiating energy all the time.



**What about phones themselves: harmful or not?**

The energy in sunlight striking your head is higher than that from a mobile phone.

Most physicists say, the only effect that phone radiation should have on the body is to warm it slightly. A mobile phone warms the closest part of the brain by only one tenth of a degree celsius. That's less than the natural variation in brain temperature throughout the day.

What is unknown is whether there are other effects at the same time, and whether they could cause long-term problems.

**Research around the world**

Researchers in Finland reported that low-level phone radiation can cause 'stress' reactions in cells isolated from human blood vessels. This might allow toxic substances to enter the brain.

It *might* even cause cancer. But it's a big leap from the test tube to the hospital bed. In 1990, there were 500,000 mobile phone users in Britain: now there are 40 million. Yet there has been no detectable overall rise in brain cancers.

There are more than a billion mobile phones in the world. If the trend continues, half the world's population will have a mobile by the end of this decade.

How will we view mobile phones then? As a technological miracle that has enriched our lives? Or, like cigarettes and BSE, a hazard that we didn't anticipate? Only time - and more research - will tell.

Suggest **two** reasons why people in Britain are more concerned about the construction of the phone masts than they are about the risk of using a mobile phone.

1 .....

.....

2 .....

.....[2]

(b) The article discusses the heating effect of radiation from mobile phones.

(i) It is possible to reduce the heating effect your brain receives from your mobile phone.

Suggest how.

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

(ii) What evidence in the article shows that the heating effects are small?

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

(c) Researchers in Finland have shown that phone radiation can cause signs of stress to some human cells.

Why does the **Research around the world** section of the article say that, "it's a big leap from the test tube to the hospital bed"?

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

(d) What data in the article suggests that there is **not** a correlation between mobile phone use and brain cancer?

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.....[1]

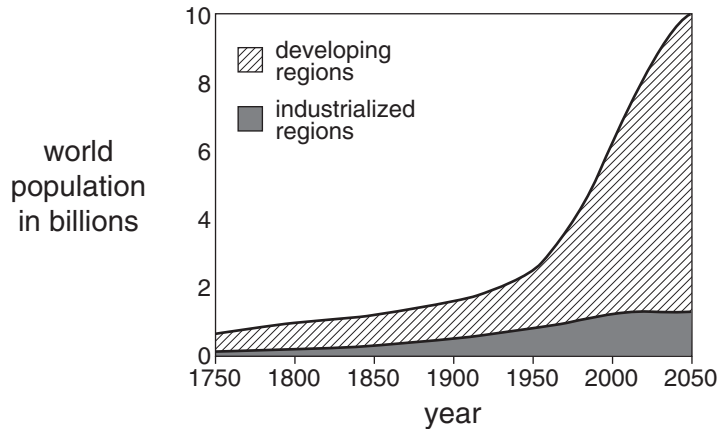
(e) The author suggests that, "If the trend continues, half the world's population will have a mobile by the end of this decade."

Do you think this forecast is likely to be fulfilled? Justify your answer.

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

[Total: 9]

- 2 The graph shows how the number of people in the world has changed since 1750 and is expected to change by 2050.



- (a) Describe the changes in world population growth as shown in this graph.

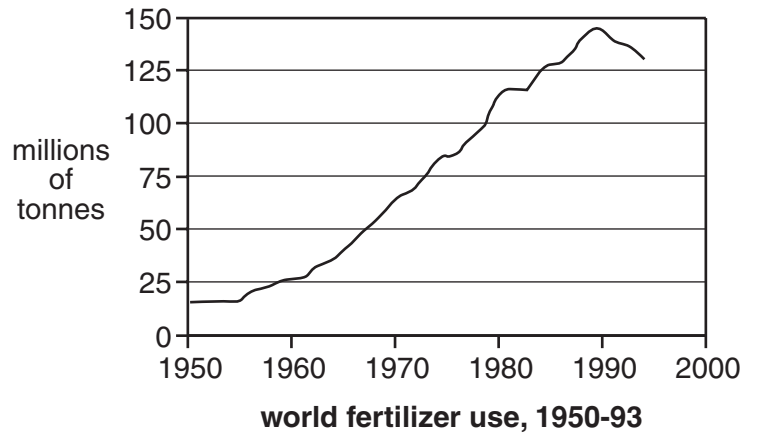
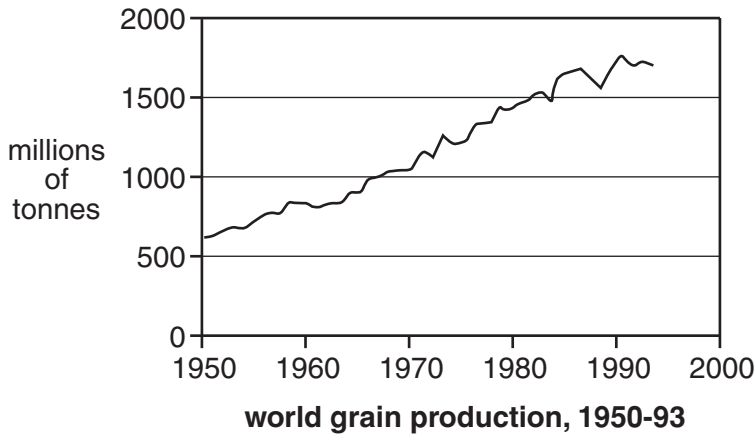
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..... [2]

- (b) These graphs show world grain production and world fertilizer use, from 1950 until 1993.



Suggest why there has been an increase in the **world fertilizer use**.

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.....

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..... [2]

(c) Most of the fertilizer used is synthetic (artificial).

(i) Describe **one advantage** and **one disadvantage** of using synthetic fertilizer compared to natural fertilizer.

**advantage** .....

.....

**disadvantage** .....

.....[2]

(ii) Describe **one** factor, other than fertilizer, that affects grain production.

.....

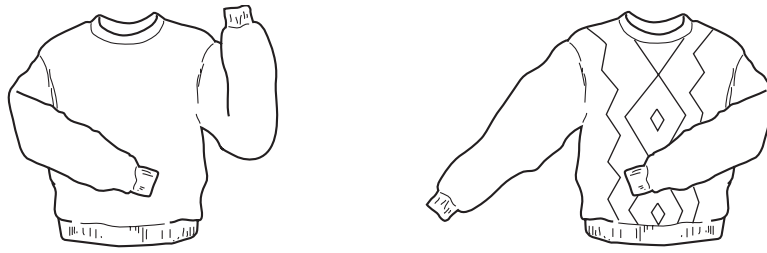
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.....[2]

[Total: 8]

- 3 A clothing import company has been offered a new type of sweater.



The label says the sweaters are made from 70% wool; 20% polyester; 10% acrylic fibre.

- (a) Suggest why the sweaters were made from a **mixture** of materials, rather than just a single type of fibre.

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

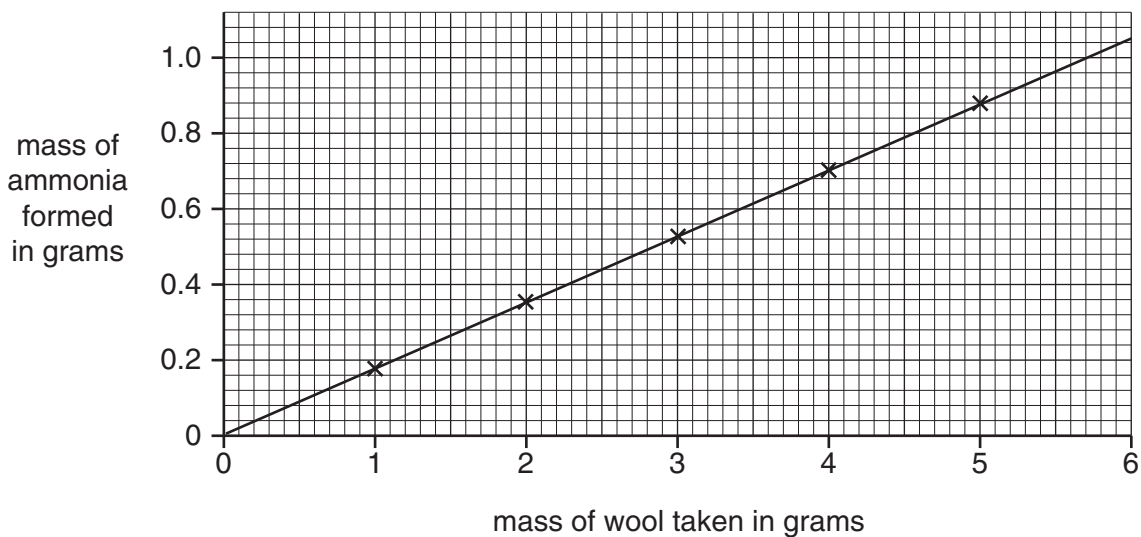
- (b) The molecules of wool are made of many smaller molecules linked together.

Wool is a protein. What type of small molecules are linked together to form proteins?

.....[1]

- (c) The company use a standard test to see how much wool the sweaters actually contain.

The graph shows how much ammonia is formed from different amounts of wool in the test.



(i) 0.4 g of ammonia was formed when a sample of material from a sweater was tested.

(I) Use the graph to help you find out what mass of wool was in the sample.

.....[1]

(II) The sample of sweater material was 5 g. What is the percentage of wool in the sweater material?

Answer: .....% [2]

(ii) Four more samples were taken from different sweaters in the batch, and each was tested.

The results for the percentage of wool in the samples were

43%            46%            48%            47%

(I) Explain how the evidence is improved by testing more than one sample.

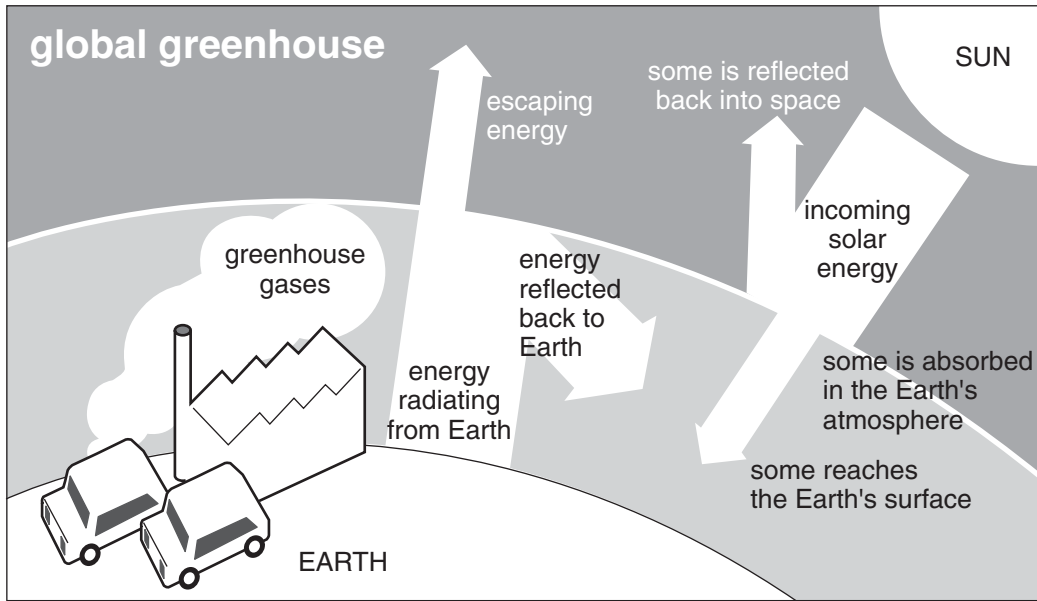
.....  
.....  
.....[2]

(II) What do these results show about the information on the label on the sweaters?

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

[Total: 10]

4 The diagram illustrates the greenhouse effect.



(a) Name **three** greenhouse gases.

- 1 .....
- 2 .....
- 3 ..... [3]

(b) The greenhouse effect may result in climate change. Describe and explain **two different** ways in which living organisms could be affected by climate change.



One mark is available for a clear, ordered answer.

- 1 .....
- .....
- .....
- 2 .....
- .....
- ..... [4 + 1]



(c) (i) Describe how some ultraviolet radiation is absorbed in the upper atmosphere.

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

(ii) Explain why this is important for life on Earth.

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

[Total: 12]

- 5 Window-frames may be made from wood, aluminium or plastic. The table shows some comparisons between these materials.

wooden frames	aluminium frames	plastic frames (uPVC)
From sustainable forestry. Waste branches and leaves used as compost or covering for new plants.	Aluminium ore (bauxite) is found in large amounts in many countries. It is dug from open-cast mines. Refining the ore causes much pollution.	Made from crude oil.
Many years needed for trees to reach maturity, but very little effort needed to extract timber.	Very large amounts of electricity needed to extract 'new' aluminium.	Manufacture needs high temperatures.
Easily cut to shape.	Easily moulded to shape.	Easily moulded to shape.
Frames need painting and gradually rot.	Very long life but may corrode in sea-side locations.	Do not rot or need painting.
Old frames are burned, producing greenhouse gases.	Metal from old frames can be recycled.	Disposed of as 'land-fill'. Burning causes severe pollution.

- (a) An advertisement for plastic window frames says, "uPVC frames need no painting or maintenance, so they have less impact on the environment than other materials."

Beside the advertisement, someone has written, "A life cycle analysis shows this is untrue."

- (i) What are the stages and factors which should be considered in a **life cycle analysis** of a material for a particular use?

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.....[3]

- (ii) Use information from the table to carry out a whole life cycle analysis of uPVC for making window frames.

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.....[3]

- (b) The **u** in the name **uPVC** is short for **un-plasticised**.

- (i) Explain what is meant by a **plasticiser** in a polymer product.

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.....[1]

- (ii) Why is it important that the PVC used for window frames does not contain plasticiser?

.....

.....[1]

- (c) Wooden window frames are often painted with gloss paint.

Gloss paint contains a polymer mixed with a solvent which evaporates easily.

The polymer has long, thin, covalently bonded molecules.

When the paint is exposed to air, oxygen reacts to form covalent cross-links between the polymer molecules.

- (i) Explain why the polymer molecules easily move past each other so that the paint can be spread on a surface.

.....

.....[1]

- (ii) Explain how the paint turns to a hard, solid layer when spread on a surface and left to dry.

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.....[1]

[Total: 10]

6 This article is about herbicides and pesticides used by farmers.

<b>EU pesticide review axes control mainstays</b>	
Two mainstays of maize and field beans weed control programmes are to be axed in the European pesticide reviews.	But, in a controversial move, paraquat has been granted approval, even though its use is already banned in a number of European countries
Simazine and atrazine, used by growers world-wide for over 40 years, have not been granted re-registration by the EU pesticide regulatory body.	Like many pesticides, paraquat is very poisonous and has caused several deaths.

(a) Explain why farmers use herbicides **and** pesticides.

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.....[2]

(b) The article states that **paraquat has been granted approval**. Explain why this is a controversial move.



One mark is available for correct spelling, punctuation and grammar.

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.....[2+1]

(c) (i) **Organic farming** restricts the use of chemicals on crops. Explain why some farmers prefer to use organic farming methods.

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.....

.....[2]

(ii) Describe the methods used in **organic farming** to protect crops against insects and weeds.

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.....[4]

[Total: 11]

**END OF QUESTION PAPER**