



**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**SCIENCE A**

Unit 2 Modules B2 C2 P2 (Higher Tier)

**THURSDAY 5 JUNE 2008**

**H**  
**A212/02**

Morning  
 Time: 40 minutes

Candidates answer on the question paper.

**Additional materials (enclosed):**

None

Calculators may be used.

**Additional materials:** Pencil  
 Ruler (cm/mm)



Candidate  
Forename

Candidate  
Surname

Centre  
Number

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Candidate  
Number

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**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.
- 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	1	
2	6	
3	7	
4	10	
5	4	
6	2	
7	6	
8	6	
<b>TOTAL</b>	<b>42</b>	

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3

Answer **all** the questions.

- 1 This question is about the materials used to make sails for boats.



The following table shows properties of some of the materials used to make sails.

material	resistance to stretch	resistance to sunlight	strength	water absorption
cotton	medium	medium	medium	high
kevlar	very good	poor	strong	low
nylon	poor	good	very strong	low
PVC	good	good	strong	low

Many people use PVC in the sails of boats.

Use the table above to explain why PVC is chosen.

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

The properties of PVC are superior to all the other materials.

☐

PVC has the best resistance to sunlight and is the strongest material.

☐

Low water absorption is not important.

☐

PVC has the best resistance to sunlight and is also good for strength and resistance to stretch.

☐

[1]

[Total: 1]

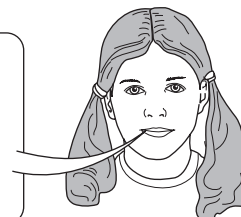
- 2 (a) Some students investigate the stretch of different materials. They each describe what they will do in the investigation.

**David**

We must take six readings for each sample to make the results accurate.

**Jess**

Our results will be reliable if we take six readings for each sample.

**Sajid**

We must use exactly the same size sample and apply the force in the same way. If we don't, the values will be inaccurate and affect the outcome.

**Rosie**

As long as we use the same material the results will be accurate whatever size of sample we use.



- (i) Which student has explained why factors must be controlled in an investigation?

answer ..... [1]

- (ii) Which student has explained why measurements should be repeated?

answer ..... [1]

- (b) The students carry out the investigation on six samples of PVC. They hang a 500 g mass on each sample and measure how much it has stretched. Their results are shown in the table.

sample number	1	2	3	4	5	6
stretch in cm	2.1	2.5	3.5	1.8	2.2	1.9

- (i) One of these results is an outlier.

Put a **ring** around the sample number that is an outlier.

1                      2                      3                      4                      5                      6

[1]

- (ii) The students use the other five results to calculate the mean value.

What is the mean of the other five results?

Put a **ring** around the number **closest** to the mean value.

1.8                      2.1                      2.3                      2.4                      2.8

[1]

5

(iii) Why are the results not all the same?

Put ticks (✓) in the boxes next to the **two** best answers.

The samples may vary.

☐

It was a fair test.

☐

You cannot rely on data.

☐

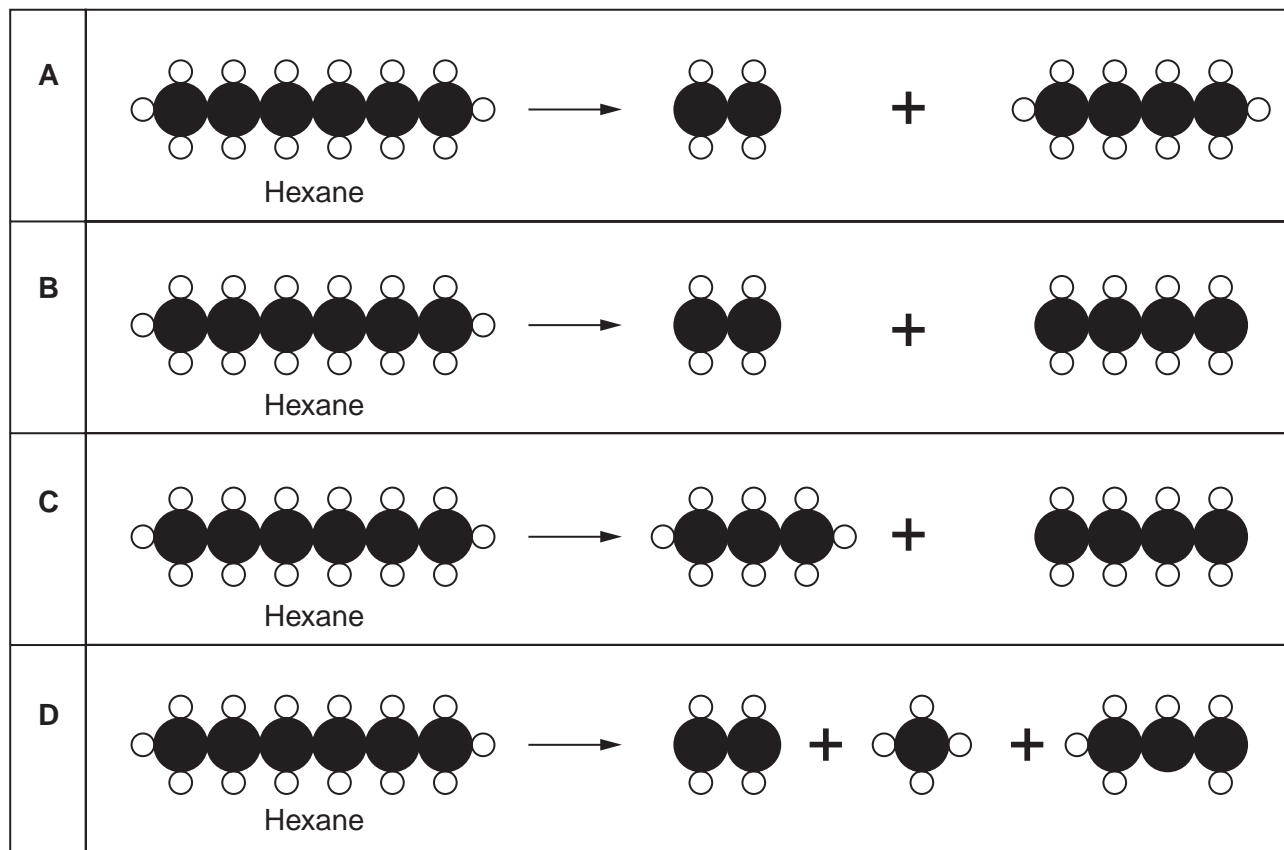
There may be errors reading the lengths.

☐

[2]

[Total: 6]

- 3 (a) Hexane ( $C_6H_{14}$ ) is a hydrocarbon that can be found in petrol. It can also be broken up in an oil refinery to make the raw materials for chemical synthesis. A, B, C and D represent the arrangement of atoms when hexane is broken up.



Which **two** of A, B, C and D show the chemical reactions that break up hexane?

..... and .....

[2]

- (b) Some polymers are made from crude oil.

Which **two** statements when put together describe this process?

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

Most crude oil is refined to make fuels and lubricants.

☐

Some crude oil is converted to smaller, more reactive molecules.

☐

A large number of products are made from these small molecules.

☐

Some small molecules join together to make long chains.

☐

Polymers are recycled to new products.

☐

[1]

7

- (c) The properties of polymers are modified by changing their molecular structure.

How do these changes affect the melting point of a polymer?

Put a tick (✓) in the correct box for each change in molecular structure.

change in molecular structure	melting point decreases	melting point increases	melting point stays the same
increased crystallinity			
plasticizer added to polymer			

[2]

- (d) A Life Cycle Assessment is done for a polymer.

This shows that incineration of the polymer is better than dumping it in landfill.

This reduces the need to burn fuel made from crude oil.

In spite of this, many local councils have refused to have incinerators in their area.

What valid reasons could they give for **not** having incinerators?

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

Some polymers do not rot away.

☐

There is a shortage of fuel.

☐

Acidic gases are put into the atmosphere when polymers burn.

☐

Some of the chemicals made when polymers burn may harm living things.

☐

Transport costs to an incinerator and to landfill are the same.

☐

[2]

[Total: 7]

- 4 (a) Rubella is caused by a virus. Most babies are vaccinated to prevent them catching the virus.

Put ticks (✓) in the boxes next to the **three** correct statements.

Vaccines never have any side effects.

☐

Vaccines contain a safe form of a virus.

☐

Vaccines cause the immune system to make antibodies.

☐

Vaccination can prevent epidemics of infectious diseases.

☐

Vaccines contain chemicals that kill viruses.

☐

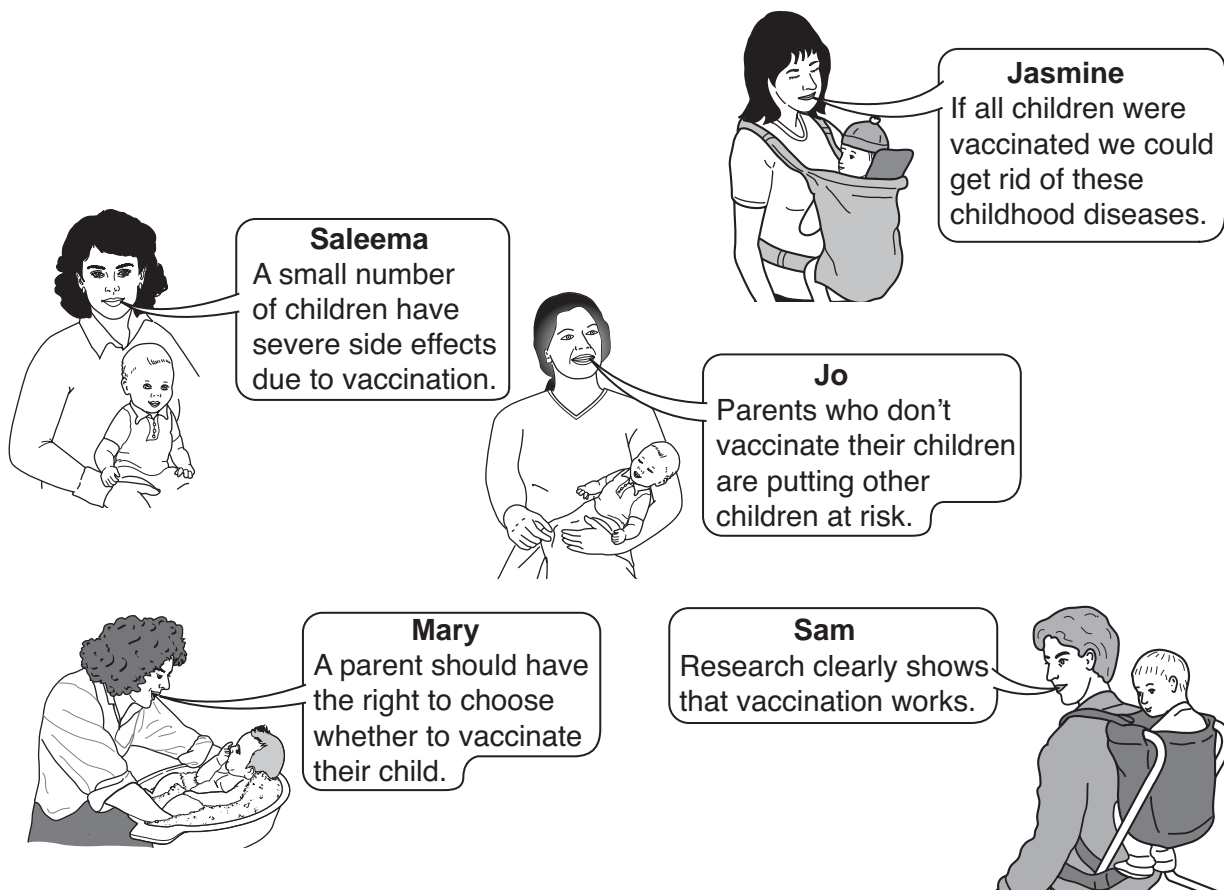
All vaccinations last a lifetime.

☐

[3]

- (b) Some parents choose not to vaccinate their children.

Read the following opinions about vaccination and use them to answer the questions.



**Saleema**  
A small number of children have severe side effects due to vaccination.

**Jasmine**  
If all children were vaccinated we could get rid of these childhood diseases.

**Jo**  
Parents who don't vaccinate their children are putting other children at risk.

**Mary**  
A parent should have the right to choose whether to vaccinate their child.

**Sam**  
Research clearly shows that vaccination works.



9

(i) Which **two** parents say that vaccination is a good thing for society as a whole?

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

(ii) Which **two** parents are considering risk when deciding about vaccination for their children?

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

(iii) Which parent is using evidence in their argument?

..... [1]

(c) HIV is another virus.

It has not yet been possible to produce an effective vaccine for HIV.

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

The immune system does not recognise HIV as an invader.

☐

The HIV virus damages the immune system.

☐

The HIV virus has a high mutation rate.

☐

The HIV virus multiplies faster than other viruses.

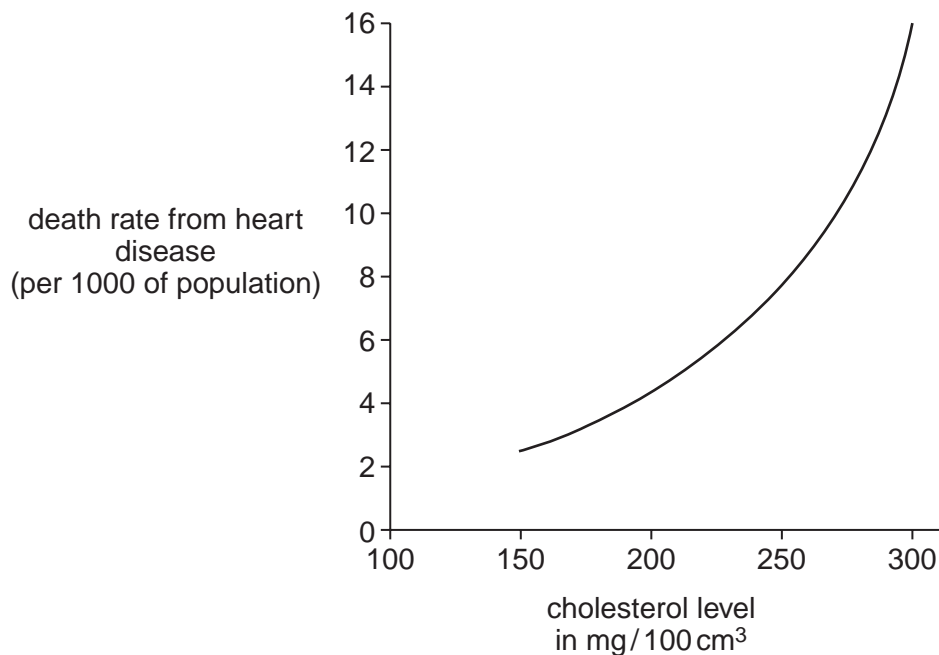
☐

[2]

[Total: 10]

10

- 5 Robert has a medical check-up for his job.  
The doctor tells him that his cholesterol level is high. He shows him this graph.



- (a) Which of these statements is true?  
Put a tick (✓) in the box next to the correct answer.

There is no correlation between cholesterol level and death rate from heart disease.

☐

There is a negative correlation between cholesterol level and death rate from heart disease.

☐

There is a positive correlation between cholesterol level and death rate from heart disease.

☐

[1]

- (b) The doctor warns Robert about his risk of a heart attack.

Here are six sentences that explain how a heart attack happens.  
They are in the wrong order.

- A** Some of the heart muscle cells start to die.
- B** The heart starts to beat irregularly. This is a heart attack.
- C** The artery supplying part of the heart muscle is blocked.
- D** A blood clot forms on the fatty deposit in the artery.
- E** The heart cells need oxygen and glucose from the blood to function.
- F** Fat builds up on the inside of the arteries supplying the heart.

Fill in the boxes to show the right order. The first and last have been done for you.

<b>E</b>					<b>B</b>
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[3]

[Total: 4]

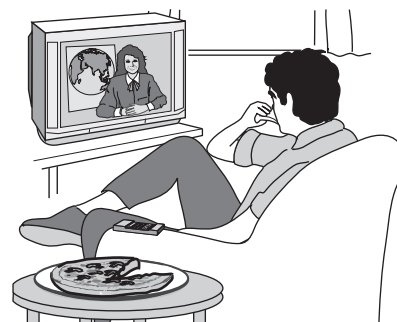
**6** This is a question about radiation.

After a hard day at work, Mike watches TV at home.

Mike uses a remote control to change channel on his TV.

He is eating a ready meal which he cooked in a plastic container.

Each of Mike's activities makes use of radiation in some way.



Which type of electromagnetic radiation is most often used for each of the following jobs?

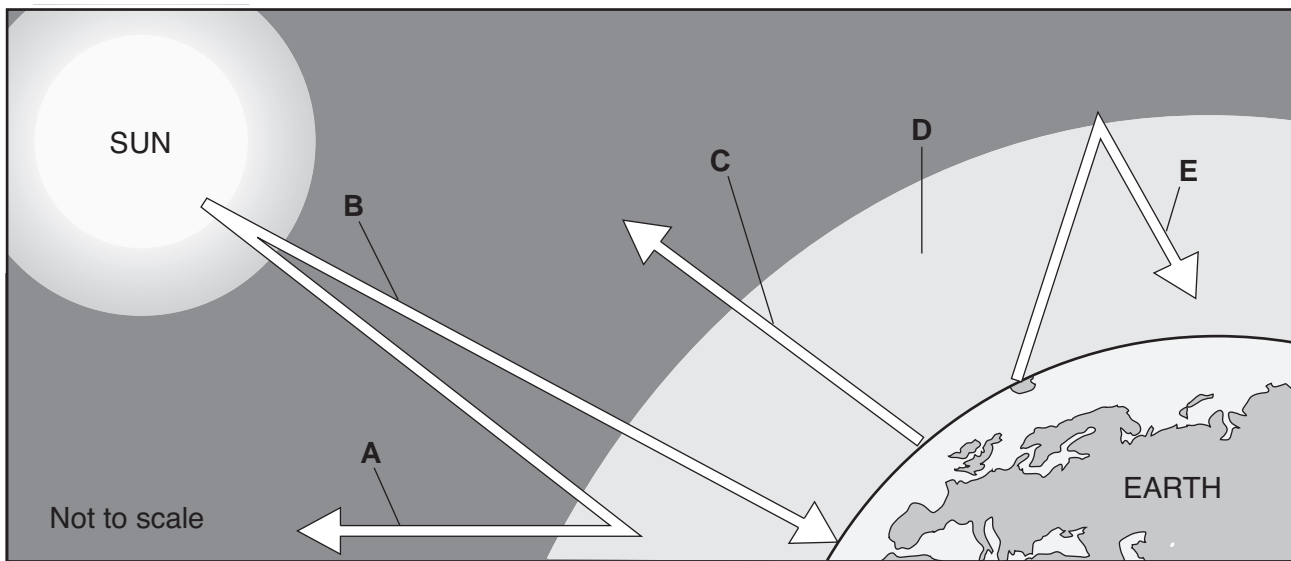
Complete the table.

job	type of radiation
sending the signal from the TV station to the TV aerial	
cooking food quickly without melting the plastic container	
sending a signal from the remote control to the TV	
Mike watching his TV	

[2]

[Total: 2]

- 7 Here is a diagram that shows what happens when light radiated from the Sun arrives at the Earth.



- (a) Radiation from the sun, shown by arrow B, delivers energy to the Earth in packets. What are these energy packets called?

answer ..... [1]

- (b) Arrow E represents part of the process of the greenhouse effect. Make a sentence describing the **greenhouse effect**. Draw straight lines to link three boxes. Use one box from each column.

Ultraviolet radiation from the Earth ...

... is absorbed by ozone in the atmosphere ...

... causing the Earth to be warmer.

Infrared radiation from the Earth ...

... is absorbed by nitrogen in the atmosphere ...

... protecting living organisms from risk of cancer.

Ultraviolet radiation from the sun ...

... is absorbed by carbon dioxide in the atmosphere ...

... increasing the need for sun protection.

Infrared radiation from the sun ...

[3]

13

(c) Most scientists agree that global warming is currently taking place.

Some of the following statements are possible consequences of global warming.

Put a tick (✓) in the box next to each possible consequence of global warming.

an increase in the number of cases of skin cancer

☐

an increase in the amount of flooding due to rising sea levels

☐

increased risk of birth defects caused by more exposure to ionising radiation

☐

difficulty in growing crops in some regions of the Earth

☐

more frequent tides in some regions of the Earth

☐

[2]

[Total: 6]

## 8 Read this article about wireless networks.

### Health risks could lead schools to remove wireless networks

Some parents want their schools to remove wireless computer networks. They fear that their children's health might be damaged.

Many parents think that microwave radiation given off by transmitters could be harmful. It may cause loss of concentration, headaches and possibly cancer. Some scientists think that children are at risk because of their thinner skulls.

The scientific evidence is not conclusive.

The Health Protection Agency says there is no real evidence of damage to health. However, they say the approach should be precautionary.

- (a) The article suggests that microwave radiation from a wireless transmitter could cause cancer.

Read the following statements.

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)

Microwave photons have more energy than photons of visible light.

☐

Microwave photons are ionising radiation.

☐

Ionising radiation can cause cancer.

☐

Microwave radiation is used by mobile phones.

☐

[3]

- (b) Having read this article, why might a school still use a wireless network?

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

There is definitely no risk to anyone involved.

☐

Students can benefit from using a wireless network in school.

☐

Parents might complain about the risk to their children.

☐

Schools have insurance to cover themselves against risk.

☐

[1]

15

- (c) The governors of a local secondary school are discussing the possible installation of a wireless network.



**Mark**

There is no way that we should install a wireless network. Even the slightest possibility of a risk is not worth it.

**Veronica**

There might be a risk, but we should have a network. We could limit its use to essential schoolwork only.



**Ann**

I think that we should not install a wireless network. It costs so much money.



**Gordon**

Forget about the risk and the expense. We have to use a wireless network. The school council would love to set up a computer games club.



- (i) Which **one** person suggests actions in line with the **precautionary** principle?

answer ..... [1]

- (ii) Which **one** person suggests actions in line with the **ALARA** principle?

answer ..... [1]

[Total: 6]

**END OF QUESTION PAPER**

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