

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

A212/02

Unit 2: Modules B2 C2 P2 (Higher Tier)

**Friday 24 June 2011
Afternoon**

Duration: 40 minutes

Candidates answer on the question paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)



Candidate
forename

Candidate
surname

Centre number

Candidate number

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1 Mike is the manager of a large department store.
He wants to know if it is better for the environment to use paper or poly(ethene) bags in his store.
He uses ideas about Life Cycle Assessment (LCA).

The table shows energy used and pollution made at different stages of the life cycle for paper and poly(ethene) bags.

	paper		poly(ethene)	
	energy in MJ	pollutants in gCO ₂	energy in MJ	pollutants in gCO ₂
manufacture of materials	0.8	0.9	0.7	0.5
manufacture of bags from materials	0.1	0.6	0.1	0.3
delivering bags to store	0.5	0.6	0.4	0.1
taking bags to landfill	0.3	0.8	0.2	0.3

- (a) The following factors need to be considered in the Life Cycle Assessment of these bags.

For each factor, look at the information in the table and then decide whether

- paper bags are better for the environment, or
- poly(ethene) bags are better for the environment, or
- you cannot tell which type of bag is better for the environment.

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

You should **only** use information in the table to help you decide.

	paper bags are better	poly(ethene) bags are better	cannot tell from the information in the table
the materials a bag is made from	☐	☐	☐
the energy used in the life cycle of a bag	☐	☐	☐
the pollution made in the life cycle of a bag	☐	☐	☐
whether the bag is recycled or sent to landfill	☐	☐	☐

[3]

3

- (b) Lorries deliver the bags to the store.
One lorry can carry many more poly(ethene) bags than paper bags.

How does this affect the **environmental impact** of using paper bags compared to poly(ethene) bags?

.....

.....

.....

..... [2]

[Total: 5]

- 2 John is a scientist.
 He works for a company that makes tyres.
 He tests the hardness of two types of rubber.
Rubber A has crosslinks. **Rubber B** does not.
 John tests each type of rubber five times.
 Here are the results.

type of rubber	hardness in arbitrary units				
rubber A	48	52	47	54	49
rubber B	12	13	14	34	17

- (a) (i) Calculate the best estimate of the true value of the hardness of **rubber A**.

best estimate = [1]

- (ii) John says that the true value for the hardness of **rubber B** lies in the range 12 to 17.
 Explain why.

.....

 [2]

- (b) Complete these sentences about rubber.

Use words from this list.

atoms breaking durable flexible
 fibres molecules sliding past each other
 strong tangling with each other

Rubber is heated with sulfur.

The sulfur makes crosslinks between the long rubber

This stops the chains

This makes the rubber harder and less

[1]

[Total: 4]

5

3 This question is about polymers made from crude oil.

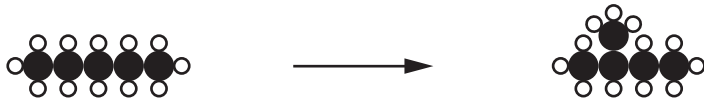
- (a) (i) Crude oil is a mixture of hydrocarbons.
Name the two elements found in hydrocarbons.

elements and [1]

- (ii) Some of the molecules in crude oil react to make new chemicals.

Bob draws diagrams to show what he thinks happens to one of these molecules.

A, B, C and **D** show his diagrams.

A	
B	
C	
D	

Which **two** diagrams from **A, B, C** and **D** represent correct chemical reactions?

diagrams and [1]

- (b) (i) Name the process when small molecules join together to make long chain molecules.

process [1]

6

(ii) Long chain molecules in plastics can be modified to change their properties.

What effect do the following modifications have on the **melting point** of a plastic?

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

modification	decreases melting point	increases melting point	melting point stays the same
shorter chain length			
increased crystallinity			
adding a plasticizer			

[2]

[Total: 5]

- 4 (a) The diagram shows the electromagnetic spectrum, with some regions shown as the letters **A**, **B**, **C**, **D** and **E**.

A	B	infrared	C	D	X-rays	E
----------	----------	-----------------	----------	----------	---------------	----------

Which letter is microwaves?

answer

Which letter is radio waves?

answer

[1]

- (b) Infrared, microwaves and radio waves are each used for transmitting information.

For **each** of these, describe an example of its use and state what information is transmitted.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (c) Which one of the following statements explains why microwaves can heat food but radio waves cannot?

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

- Microwave photons have more energy than radio wave photons. ☐
- Microwaves have more photons each second than radio waves. ☐
- Radio waves have a lower intensity than microwaves. ☐
- Microwaves can make particles in the food vibrate, but radio waves cannot. ☐

[1]

[Total: 5]

Turn over

5 Read this article about ultraviolet radiation.**A little ultraviolet is good for you**

People in northern Europe often have fair skin. This allows the skin to absorb more ultraviolet and produce more vitamin D, which the body needs.

Unfortunately, the sunlight that reaches us these days has much more ultraviolet than it used to have. This can be damaging to the skin, causing skin cancer.

(a) Two people read this article.**(i)** Who refers to a correlation in the article?

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

Dean only

☐

Kate only

☐

both Dean and Kate

☐

neither of them

☐**[1]**

9

(ii) Who mentions both risk **and** benefit?

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

Dean only

☐

Kate only

☐

both Dean and Kate

☐

neither of them

☐

[1]

(b) Here are a number of statements about ultraviolet radiation (UV).

They are not all true.

Put a tick (✓) in the correct box after each statement to show whether it is **true** or **false**.

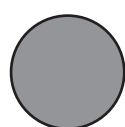
	true	false
UV can be good for you.	☐	☐
UV can damage living cells.	☐	☐
UV is a non-ionising radiation.	☐	☐
UV is part of the electromagnetic spectrum.	☐	☐
UV has more energetic photons than X-rays.	☐	☐

[2]

[Total: 4]

10

- 6 (a) Here are diagrams of some gases found in the atmosphere, showing the atoms in each molecule.



argon



carbon dioxide



methane



nitrogen

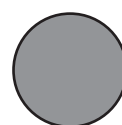


oxygen



water

key to atoms



argon



carbon



hydrogen



nitrogen



oxygen

- (i) Which of these are molecules of greenhouse gases?
Put a tick (✓) in the box next to the correct answer.

only those which contain oxygen atoms

☐

only those which contain carbon atoms

☐

only those which contain hydrogen atoms

☐

only those which contain more than two atoms

☐

[1]

- (ii) Which of the gases below are involved in photosynthesis?
Put a tick (✓) in the box next to **each** correct answer.

argon

☐

carbon dioxide

☐

methane

☐

nitrogen

☐

oxygen

☐

[1]

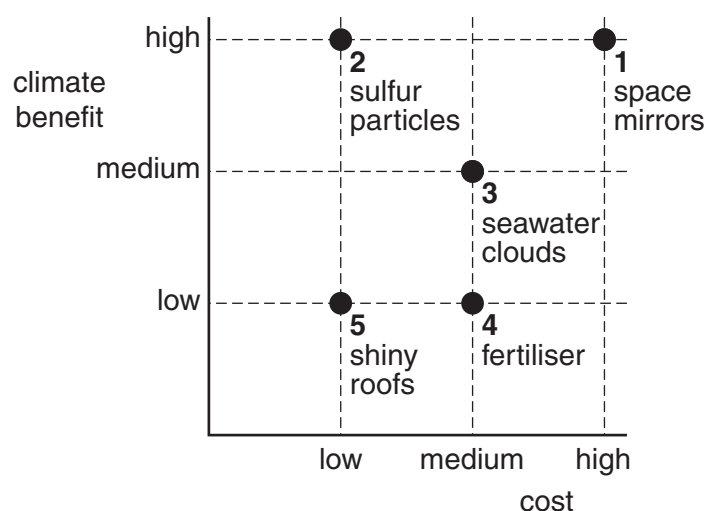
(b) Read this article about geoengineering.

Geoengineering

A new approach to stopping global warming has been suggested – geoengineering. Five different methods have been suggested.

1. Put huge mirrors into orbit above the atmosphere.
2. Put fine sulfur particles high in the atmosphere to reflect solar radiation.
3. Build special ships to squirt seawater high into the air to form clouds.
4. Add fertilisers to the sea to encourage the growth of tiny plants.
5. Make house roofs of light-coloured, shiny materials.

For each of these methods, both the benefit to the climate and the financial cost need to be considered. This is shown in the graph.



(i) Which **one** of these methods, **1, 2, 3, 4** or **5**, would be the **least** cost effective?

method [1]

(ii) Which **one** of these methods, **1, 2, 3, 4** or **5**, would decrease the amount of greenhouse gases in the atmosphere?

method [1]

(iii) Which of these methods from **1, 2, 3, 4** and **5** decrease the amount of the Sun's radiation being absorbed by the Earth?

methods [1]

[Total: 5]

7 Read the information about measles.

Information about measles

1. Measles is a disease that is caused by a virus.
2. It can cause a high temperature and a rash.
3. About 1 in 15 people with measles have complications such as chest infections, fits and, in very rare cases, brain damage.
4. In 1987, before MMR vaccination started, 86 000 children caught measles and 16 died.
5. Measles is one of the most infectious diseases known.

- (a) (i) Complete the sentences to explain how the measles virus **causes the symptoms** of the disease.

Once the measles virus infects someone it reproduces inside their body cells.

As a result of this process, the human cells are

This causes the release of

[1]

- (ii) Antibiotics cannot be used to treat measles.

Which types of microorganisms can be killed by antibiotics?

1

2

[1]

- (b) (i) The MMR vaccine protects against measles, mumps and rubella.
A scientist claimed that MMR vaccination could have serious side effects.
He claimed that, in rare cases, it could be linked to a condition called autism.

After this claim, a number of parents decided not to have their children vaccinated against measles.

Explain how deciding **not** to have your child vaccinated with MMR affects society as a whole.

.....

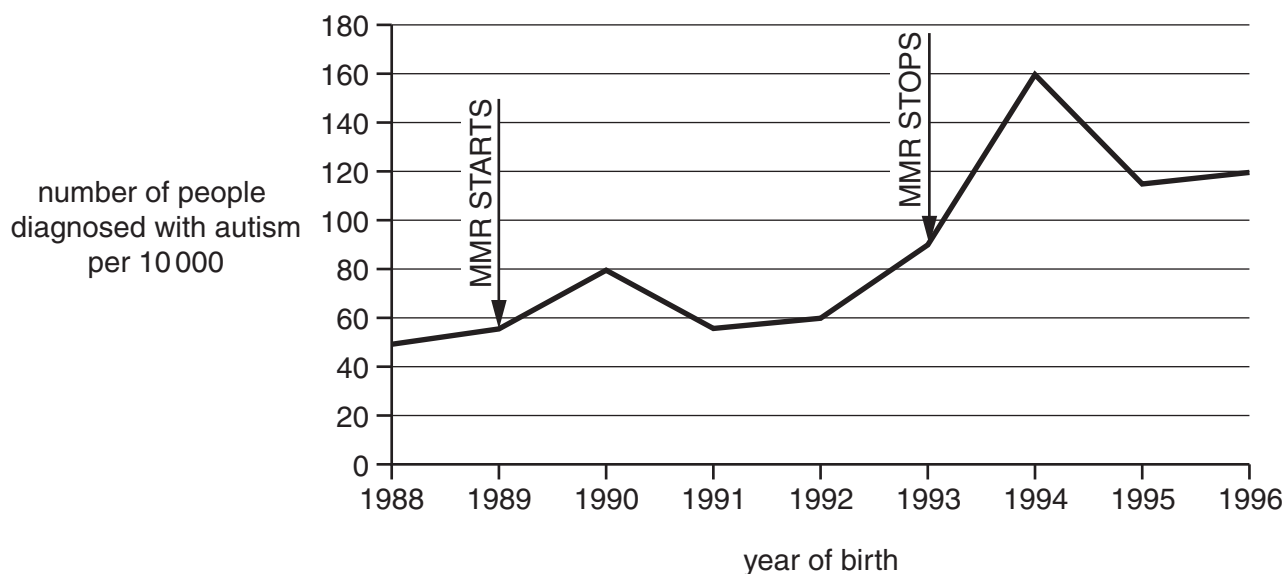
.....

.....

..... [3]

13

- (ii) In Yokohama, a city in Japan, MMR vaccination started in 1989 and was stopped in 1993. Data about MMR vaccination and autism were collected. The data are shown in the graph.



Use **one** straight line to link the correct **description** of these data with the correct **conclusion**.

Draw only **one** line.

description

conclusion

MMR vaccination did not change the trend in numbers of autism cases.

Another vaccine causes autism.

When MMR vaccination stopped, the numbers of autism cases decreased.

MMR could cause autism.

When MMR vaccination started, the numbers of autism cases remained the same.

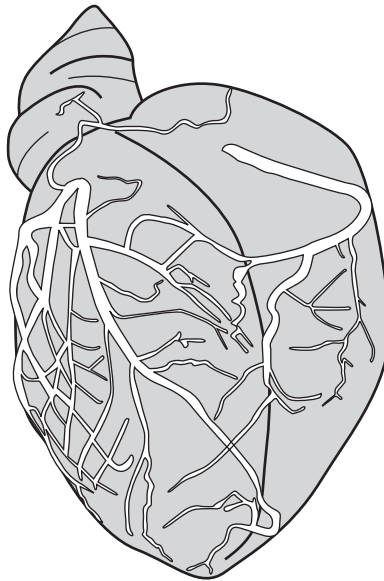
MMR stops autism.

MMR is not linked to autism.

[2]

[Total: 7]

8 Look at the diagram of the heart.



- (a) The diagram shows coronary arteries that supply the heart muscle with blood. Explain how the structure of arteries is related to their function.

.....

 [2]

- (b) Changes to the coronary artery can cause a heart attack. Complete the sentences describing this process.

The heart muscle has its own blood supply to provide food and

The blood supply also removes

A heart attack can occur when the blood vessels that supply the heart muscle

become blocked with [2]

- (c) Read this report.

Spain is a country with relatively high alcohol consumption but relatively low levels of heart disease. The results of a 10-year study in Spain have been published.

The study involved 15 500 men and 26 000 women aged from 29 to 69.

Records were kept of each person's alcohol consumption and whether they developed heart disease.

The Spanish researchers concluded that

- drinking alcohol every day reduced the risk of heart disease
- for men, the higher the amount of alcohol drunk the bigger the reduction of risk
- female drinkers did not reduce their risk as much as men.

The Spanish researchers suggest that in men, alcohol could raise levels of high-density lipoprotein (HDL) in the blood. HDL protects against heart disease.

15

- (i) Public health specialists warn people that this study should **not** encourage them to drink more alcohol.

Put ticks (✓) in the boxes next to the **two best** reasons for this advice.

Not enough data has been collected.

☐

Drinking alcohol can lead to other problems not related to heart disease.

☐

The study was too short for heart disease to develop in people.

☐

There is evidence from other research that drinking large amounts of alcohol increases the risk of heart disease.

☐

[1]

- (ii) What additional evidence would increase confidence in the conclusions made by the Spanish researchers?

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

Different scientists in another study found similar results.

☐

Research was repeated with people who already had heart disease.

☐

Research was repeated with only males.

☐

Alcohol was shown to affect levels of HDL.

☐

[1]

- (iii) If the research is published in a peer-reviewed journal it will be regarded as more reliable.

Put a tick (✓) in the box next to the statement which **best** describes a key feature of the peer review process.

Publishers of the scientific journal check the research before it is published.

☐

Specialist scientists check for outliers before it is published.

☐

Specialist scientists evaluate the research before it is published.

☐

The researchers double check all their results and conclusions before the research is published.

☐

The men and women who took part in the study check the research before it can be published.

☐

[1]

[Total: 7]

END OF QUESTION PAPER

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