

Candidate Forename						Candidate Surname					
Centre Number						Candidate Number					

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A212/02**

**TWENTY FIRST CENTURY SCIENCE**

**SCIENCE A**

**UNIT 2 Modules B2 C2 P2  
(Higher Tier)**

**MONDAY 18 JANUARY 2010: Morning  
DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**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)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use 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.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

## **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.**

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Answer ALL the questions.

1 Many different fibres are used to make fabric articles.

The fibre chosen depends on its properties.

The table opposite shows some properties of four fibres.

(a) Use the table to decide which fibre is best to use for each article and the property that helps you make that choice.

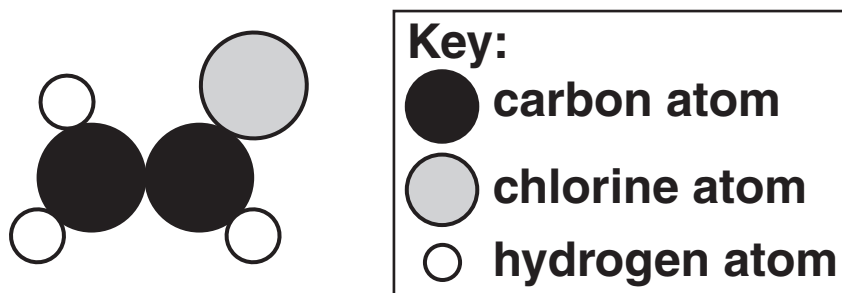
Draw a straight line from each ARTICLE to the FIBRE USED and then to the PROPERTY.

<u>ARTICLE</u>	<u>FIBRE USED</u>	<u>PROPERTY</u>
sports swimwear	cotton	heat insulation
towel	nylon	strength
coat for a cold winter	PVC	stretchiness
	wool	high water absorbance

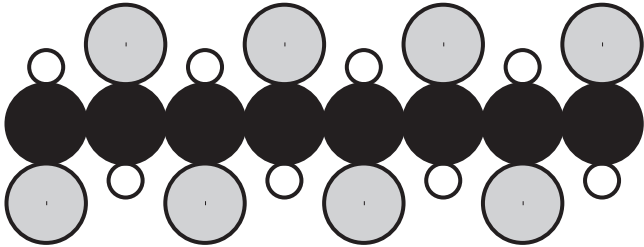
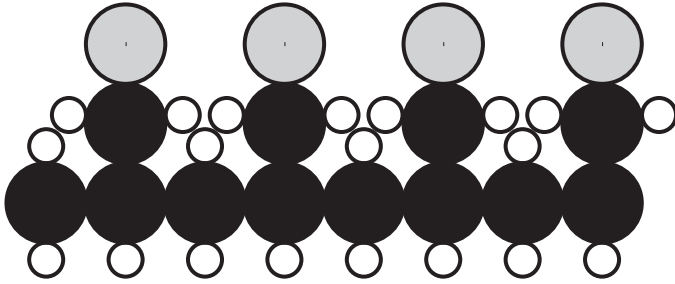
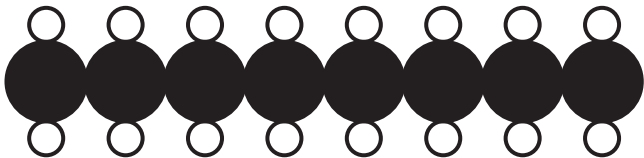
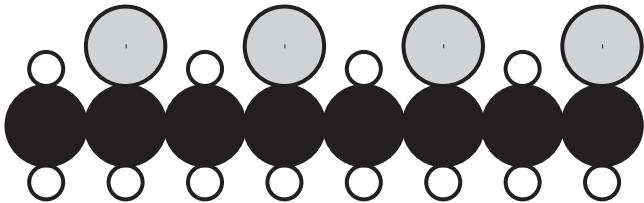
[3]

PROPERTY				
	HEAT INSULATION	STRENGTH	STRETCHINESS	WATER ABSORBANCE
cotton	good	medium	low	high
nylon	poor	high	high	very low
PVC	poor	high	low	very low
wool	very good	medium	medium	medium

(b) PVC is polymerised from a small molecule that is represented by



The diagrams A, B, C and D represent parts of some polymer molecules.

<b>A</b>	
<b>B</b>	
<b>C</b>	
<b>D</b>	

- (i) Which diagram, A, B, C or D, represents part of a PVC molecule?

answer \_\_\_\_\_ [1]

- (ii) A plasticizer is added to PVC that is used for making clothes.  
This makes PVC flexible.

How does the plasticizer do this?

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

It increases the length of polymer chains.

☐

It shortens the polymer chains.

☐

It reduces the attraction between polymer chains.

☐

It brings the polymer chains closer together.

☐

[1]

- (c) The following statements are about the Life Cycle Assessment of clothes made from PVC.  
Some parts of the life cycle of PVC are SUSTAINABLE. Others are NOT SUSTAINABLE.

Put a tick (✓) in the correct box for each part of the life cycle to show whether it is SUSTAINABLE or is NOT SUSTAINABLE.

<u>PART OF THE LIFE CYCLE</u>	<u>SUSTAINABLE</u>	<u>NOT SUSTAINABLE</u>
PVC is made from crude oil.		
Making PVC has a high energy requirement from fossil fuels.		
PVC will not rot when it is dumped in landfill.		
PVC can be broken down and used to make new polymers.		

[2]

[Total: 7]



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**2 The graph opposite shows the Olympic record height of the pole vault over the last sixty years.**

**(a) Which of the following are correct statements about the data in the graph?**

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

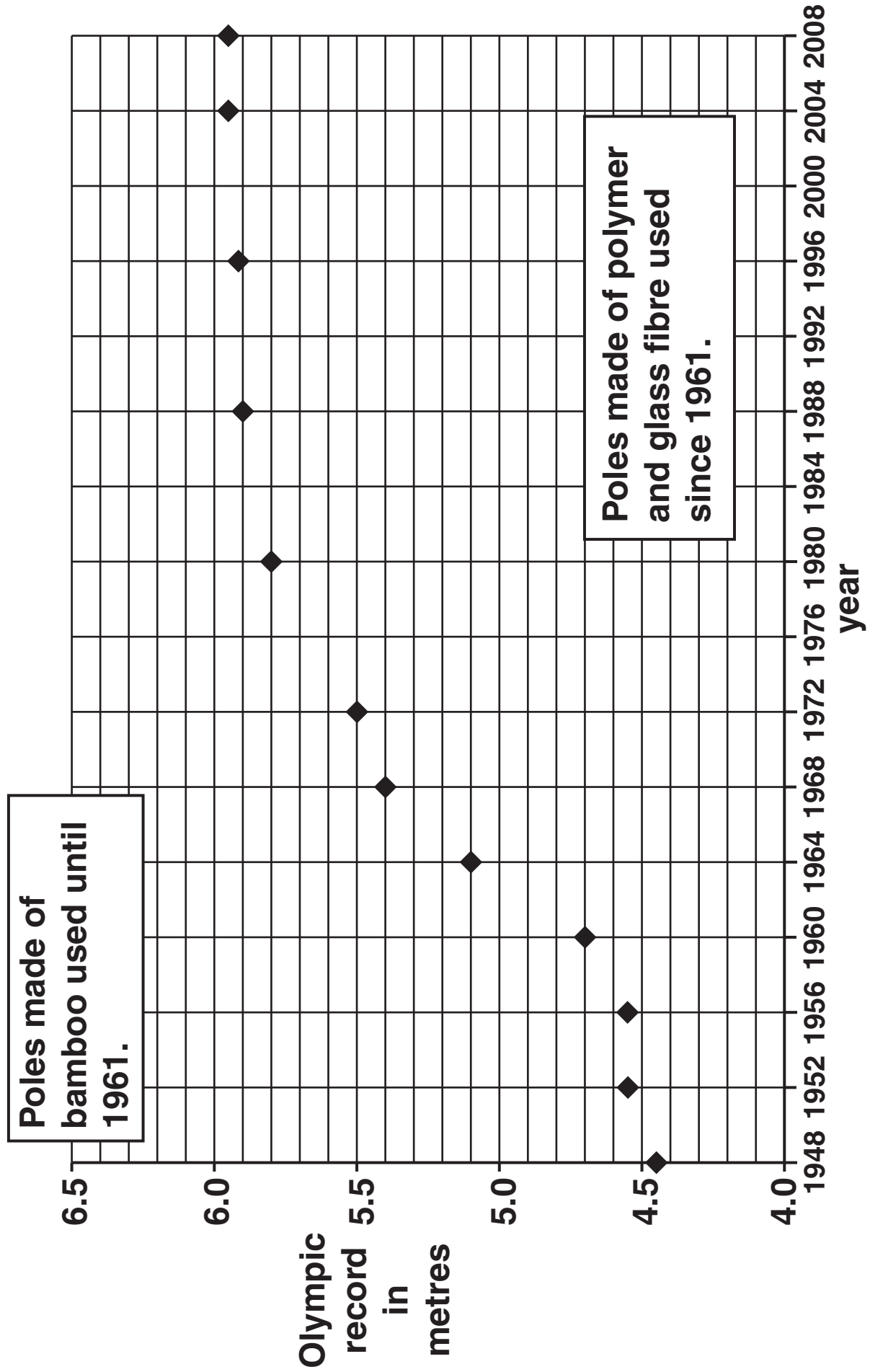
**The Olympic record increased by at least 0.5 m every 20 years.** ☐

**The most rapid increase in the Olympic record was when the material used to make the poles changed.** ☐

**The Olympic record increased more between 1996 and 2008 than between 1948 and 1960.** ☐

**The average increase in the Olympic record over the period of the graph is 0.1 m every 4 years.** ☐

**[2]**

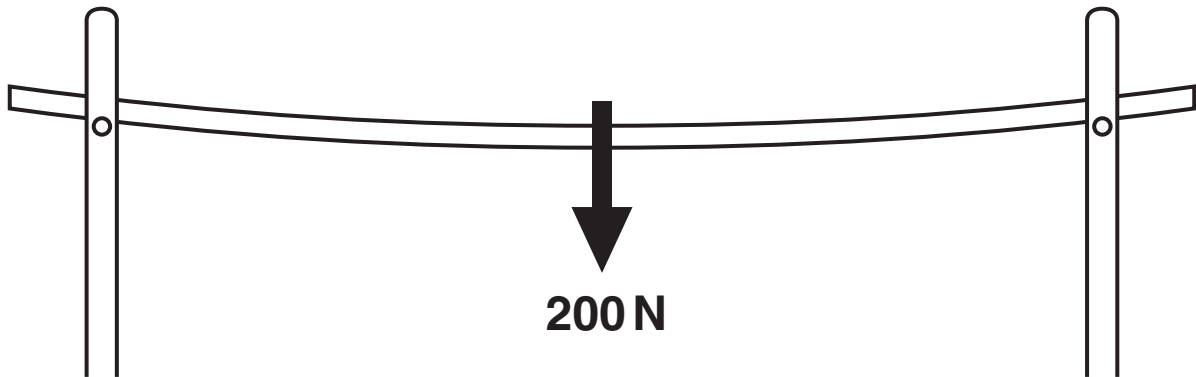


(b) Anna and Nick are investigating the properties of vaulting poles.

They know flexibility is an important property.

They support the pole at both ends as shown in the diagram.

They hang a 200 N weight from the centre of the pole and measure how far the pole bends.



(i) They repeat this measurement five times.

Suggest reasons why.

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[3]

(ii) Here are their results.

TEST NUMBER	1	2	3	4	5	MEAN
HOW FAR THE POLE BENDS IN CM	11.4	10.9	11.5	11.0	11.2	11.2

Suggest a reason why the results of these tests are different.

\_\_\_\_\_

\_\_\_\_\_ [1]

- (c) Anna and Nick repeat the investigation with a DIFFERENT vaulting pole.  
Here are their results with the second pole.

TEST NUMBER	1	2	3	4	5	MEAN
HOW FAR THE POLE BENDS IN cm	11.0	11.0	12.5	11.3	11.7	11.5

Is there a REAL DIFFERENCE in the measurements from the two vaulting poles?

Draw ONE straight line from the CORRECT ANSWER to the REASON for that answer.

### CORRECT ANSWER

### REASON

There is a real difference in the measurements.

The ranges of the two investigations overlap.

The means of the two investigations are different.

There is NOT a real difference in the measurements.

There are no outliers in the two investigations so they are reliable.

The mean of each investigation is outside the range of the other.

[1]

[Total: 7]

### 3 Arc welding is used to join metals together.

The arc is a very bright electrical spark between the welding tool and the metals being joined. This spark produces light, infrared (IR) and ultraviolet (UV) radiation.

UV can damage the cells in the outer layer of the eye. This causes intense pain and is called 'arc eye'. Arc welders need to wear special masks to protect their eyes.

(a) Infrared (IR), light and ultraviolet (UV) are three regions of the electromagnetic spectrum.

The diagram shows the electromagnetic spectrum. Most of the names of the different regions have been left out.

Write down IR and UV in the correct boxes in the electromagnetic spectrum.

radio waves						gamma rays
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[1]

- (b) Here are some statements about ultraviolet radiation.**

**Which statements explain why ultraviolet radiation is more damaging to cells than light?**

**Put a tick (✓) in the box next to each of the TWO correct answers.**

**Ultraviolet is an ionising radiation.**

☐

**Ultraviolet is an invisible radiation.**

☐

**Sun-screen can absorb ultraviolet radiation.**

☐

**Ultraviolet photons have more energy than light photons.**

☐

**[2]**

- (c) The ALARA principle should be used by firms which employ arc welders.**

**Explain why this is important.  
Include in your answer what ALARA stands for  
and an example of what should be done.**

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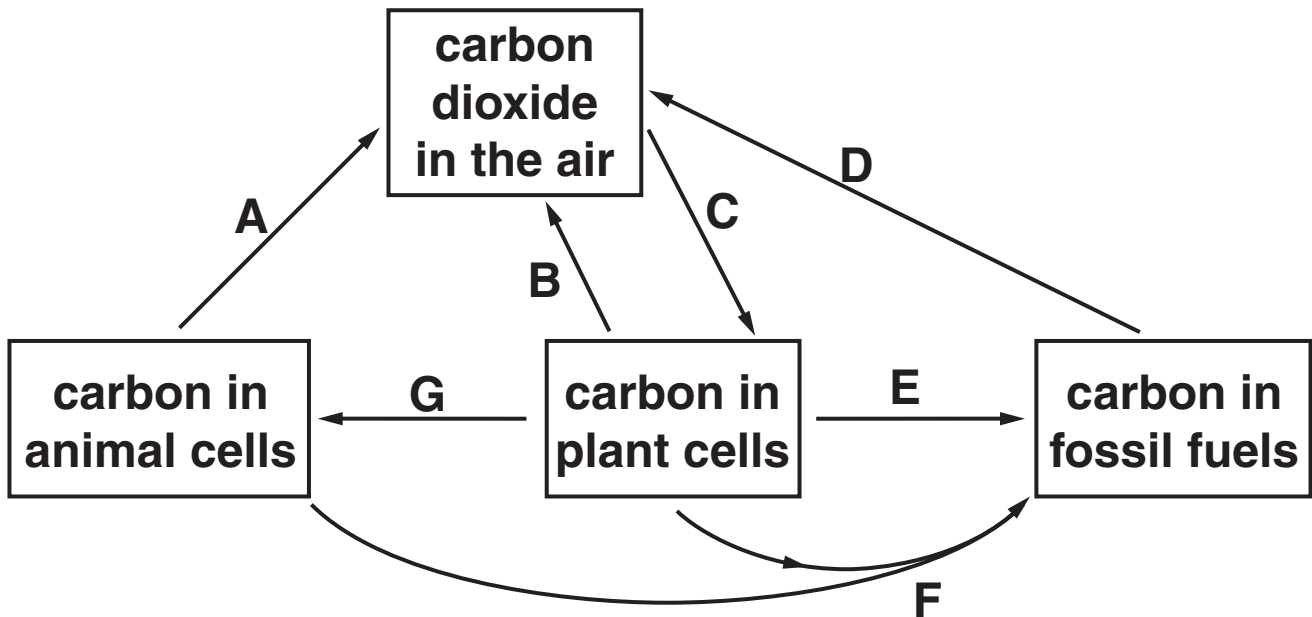
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**[3]**

**[Total: 6]**



4 (a) The diagram shows part of the carbon cycle.



The answers to (i) and (ii) are ONE OR MORE of the letters A, B, C, D, E, F and G.

(i) Which TWO arrows show respiration?

arrows \_\_\_\_\_ and \_\_\_\_\_ [1]

(ii) Which arrow has the opposite effect to respiration?

arrow \_\_\_\_\_ [1]

- (b) The amount of carbon dioxide in the atmosphere has increased during the past two hundred years.

Which of the following changes would slow down the increase of carbon dioxide in the atmosphere?

Put a tick (✓) in the box next to each of the TWO correct answers.

Stop burning forests to clear the land. ☐

Plant more grassland for cattle and sheep. ☐

Cut back on the use of fossil fuels as a source of energy. ☐

Use wind power instead of nuclear power to generate electricity. ☐

Find new sources of oil and gas to replace the ones which are running out. ☐

[2]

[Total: 4]

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**5 Read this article about the rise of the sea level in the Pacific Ocean.**

**Most people in the countries of the Pacific Ocean live near the coast.**

**Any rise in the sea level will be very serious for them.**

**Global warming is causing a rise in sea level as the sea warms up and the Earth's ice caps melt.**

**Satellite data show the sea levels in the Pacific Ocean are rising at an average rate of 2 centimetres each year.**

- (a) Three people from different islands in the Pacific have concerns about the effects of global warming.**

**ADA**

**My people live from what we catch in the sea. We don't have much to do with other islands.**

**SIU**

**I am concerned about the effects on agriculture. We export most of what we grow to other islands.**

**HAN**

**The islands where we live are very low-lying, with the highest point being a few metres above sea-level. We earn most of our money from tourism.**

Here are some possible effects of global warming.

Which of these people would be **MOST** worried by each change?

Put a tick (✓) to indicate the **ONE** name in each case.

	ADA	SIU	HAN
Sea levels may rise a lot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Some areas will have much less rain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The weather will be very unsettled in places which were once sunny.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Changes in sea temperatures mean that fish will move to different parts of the Pacific.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[3]

- (b) For a long time, data have been collected from weather stations all around the world using a variety of equipment. Data about carbon dioxide levels have been estimated over the same time period. Scientists have concluded that human activities are causing global warming.

**Explain how scientists have used the data to reach this conclusion.**

**Include in your answer**

- the difficulties in handling the very large amounts of data
- how these difficulties were overcome.

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**[2]**

**[Total: 5]**

- 6 (a) Our bodies have natural barriers to prevent the entry of microorganisms.

Write down TWO examples.

1 \_\_\_\_\_

2 \_\_\_\_\_ [2]

- (b) If microorganisms enter your body they can make you ill.

In the right conditions a bacterium can reproduce itself every 20 minutes.

How many bacteria would result from a single bacterium after 3 hours?

\_\_\_\_\_ bacteria  
[1]

[Total: 3]

## 7 Read this report.

### **DO CHEMICALS IN CHOCOLATE REDUCE HEART DISEASE IN DIABETIC WOMEN?**

Cocoa is the main ingredient of chocolate.

Cocoa is a rich source of chemicals which have been shown to reduce the risk of heart disease.

Doctors are starting a study to see if eating chocolate will reduce the risk of heart disease for women with diabetes.

They will be recruiting 150 women under the age of 70 who have type 2 diabetes.

(a) Use ONE straight line to link the boxes which correctly complete the sentence.

The article states that there is a link between...

... eating  
chocolate and  
...

or

... eating the  
chemicals in  
cocoa and ...

or

... age and ...

... an  
increase  
in heart  
disease.

or

... an  
increase in  
diabetes.

or

... a  
decrease  
in heart  
disease.

[1]



- (b) When scientists have the results of the study into the effect of chocolate on the risk of heart disease, they will publish their methods, results and conclusions in a peer reviewed journal.

Outline what is meant by 'PEER REVIEW' and explain why it is important.

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[2]

[Total: 3]

**8 Read the newspaper article.**

**MEDICAL CHIEF EXPECTS VACCINE FOR MRSA**

**The government's chief medical advisor says that a new vaccine against the superbug MRSA will be available in 10 years.**

**Other scientists think a vaccine will be difficult to produce because the MRSA bacterium is always evolving and changing.**

**These scientists claim that clean hospitals are the key to preventing infection as antibiotics become less effective.**

(a) This question is about how vaccines work.

Draw ONE straight line from the correct CONTENT OF A VACCINE to its EFFECT.

Draw ONE straight line from this EFFECT to the REASON FOR IMMUNITY.

There should be only TWO straight lines in your answer.

<u>CONTENT OF A VACCINE</u>	<u>EFFECT</u>	<u>REASON FOR IMMUNITY</u>
small number of disease-causing microorganisms	more red blood cells produced	already had the disease
a dose of antibiotics	white blood cells destroy the antibiotics	antibodies present before real infection
dead disease-causing microorganisms	white blood cells make antibodies against microorganisms in vaccine	stops microorganisms infecting the body

[2]

- (b) New drugs and vaccines have to be tested.  
They are tested on humans.  
Some tests are done on groups of healthy volunteers.  
Some tests are done on groups of people with the illness that the drug will treat.**

- (i) What are the reasons for using these groups of people?**

**Put a tick (✓) in the correct box for each group of people.**

**There should be one tick in each row.**

	<b>to test for safety only</b>	<b>to test for effectiveness only</b>	<b>to test for safety AND effectiveness</b>
<b>healthy volunteers</b>			
<b>people with the illness</b>			

**[2]**

- (ii) Often these tests using humans involve double-blind trials.  
They rarely involve the use of placebos.

Explain what is meant by a double-blind trial.

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[1]

Why are placebos rarely used in trials involving people with the illness?

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[1]

(c) The article claims that antibiotics are becoming less effective.

This is because more types of harmful microorganisms are becoming resistant to antibiotics.

Which TWO reasons, when put together, cause this change?

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

increased use of antibiotics in hospitals ☐

random changes in the genes of microorganisms ☐

increased use of disinfectants in hospitals ☐

increased use of vaccines ☐

people always finishing a course of antibiotics ☐

[1]

[Total: 7]

**END OF QUESTION PAPER**

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