OCR
Oxford Cambridge and RSA

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Monday 19 June 2017 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE BIOLOGY A/FURTHER ADDITIONAL SCIENCE A

A163/02 Module B7 (Higher Tier)

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)

Duration: 1 hour

A163/02

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

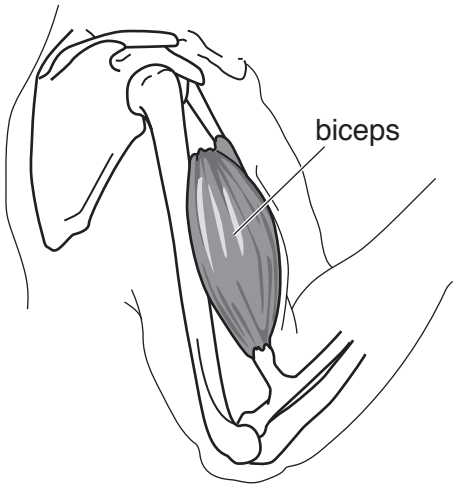
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- 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 **60**.
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 A student draws a diagram to explain how muscles move bones at the elbow joint.



(a) On the diagram draw and label:

(i) the antagonistic muscle to the bicep **[1]**

(ii) the tendons **[1]**

(b) Describe how muscles at a joint allow the joint to move.

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

(c) Joints are made of many different parts.

Draw a straight line to link each **part** to its **properties** and its **job**.

Part	Properties	Job
cartilage	bands of tough elastic tissue	transmits forces between muscle and bone
ligament	smooth shock-absorbing surface	reduces friction between bones
tendon	tough band of inelastic tissue	stabilises joints while allowing movement

[3]

[Total: 7]

2 Blood transports molecules around the body.

(a) Write about the different components of the blood and the molecules they transport.

The quality of written communication will be assessed in your answer.

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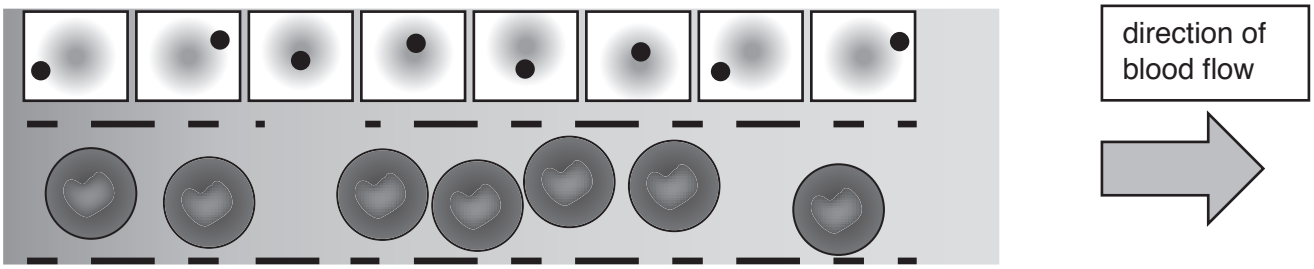
..... **[6]**

(b) Tissue fluid assists with the exchange of chemicals between capillaries and cells.

A student draws a diagram to show how the tissue fluid is formed.



Finish labelling the diagram by adding:

- An arrow labelled **tissue fluid** to show where tissue fluid is formed.
- A letter **A** to show where the blood pressure would be the highest in the capillary.
- A letter **B** to show where the blood pressure would be the lowest in the capillary. **[2]**

[Total: 8]

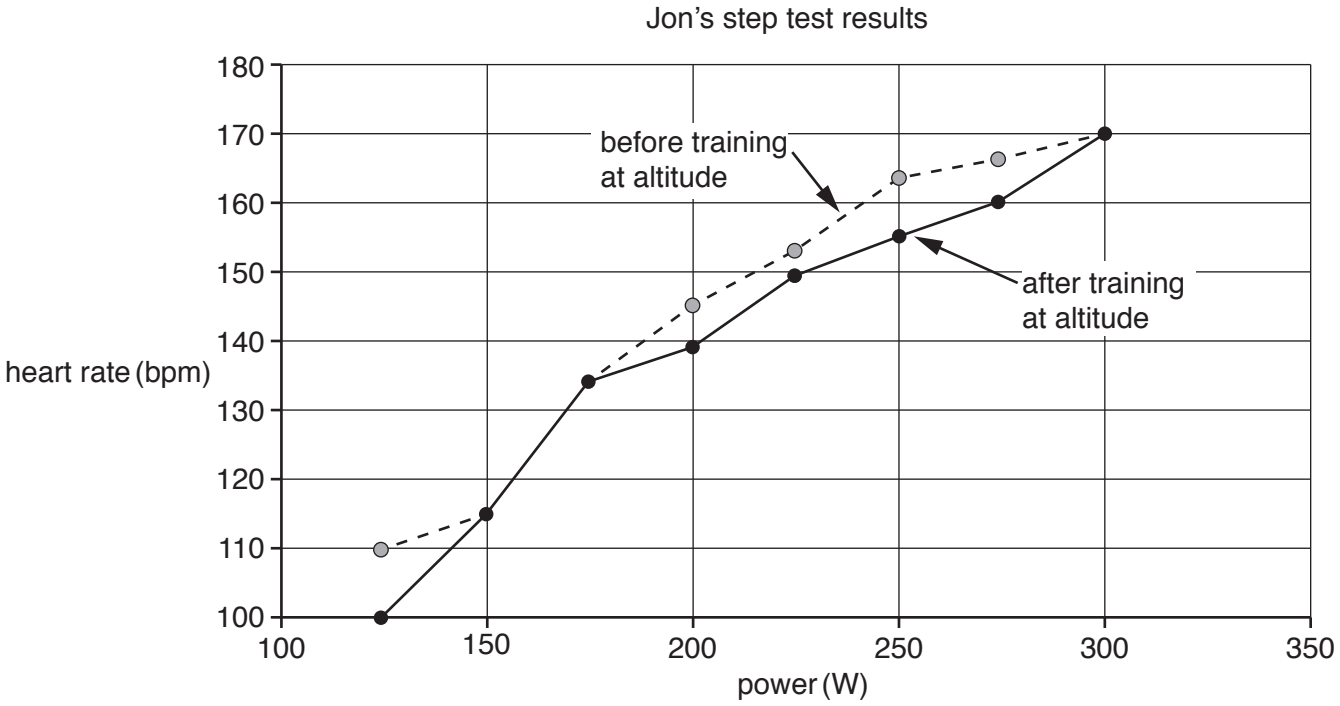
3 Jon is a cyclist. As part of his training he trained at altitude.

When training at altitude Jon cycled high up in mountains.

Jon did a step test before and after training at altitude.

The test showed how Jon's heart rate changed when his power increased as a result of him stepping faster.

The results of the tests are shown in the graph.



(a) (i) Use the graph to find Jon's heart rate when his power output is 125 W.

before altitude training …….. bpm

after altitude training …….. bpm **[1]**

(ii) During training, Jon's heart rate changes.

Calculate the percentage increase in Jon's heart rate before training at altitude.

Show your working.

percentage increase = ... % **[1]**

(b) Jon uses the step test results to make some conclusions.

Put a tick (✓) in the correct box to show whether the conclusion **fits the data** from the graph or **does not fit the data** from the graph.

Conclusion	Fits the data	Does not fit the data
There is a correlation between power output and heart rate.	☐	☐
For a given power output, the heart rate after altitude training is always less than before altitude training.	☐	☐
The greater the power output the greater the difference between altitude training heart rates.	☐	☐
Heart rates are always lower at altitude.	☐	☐

[3]

(c) Describe the extra evidence Jon could collect to make him more confident in his conclusions.

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

(d) After the step test Jon's face and skin are redder than usual.

Explain the cause of Jon's skin colour change.

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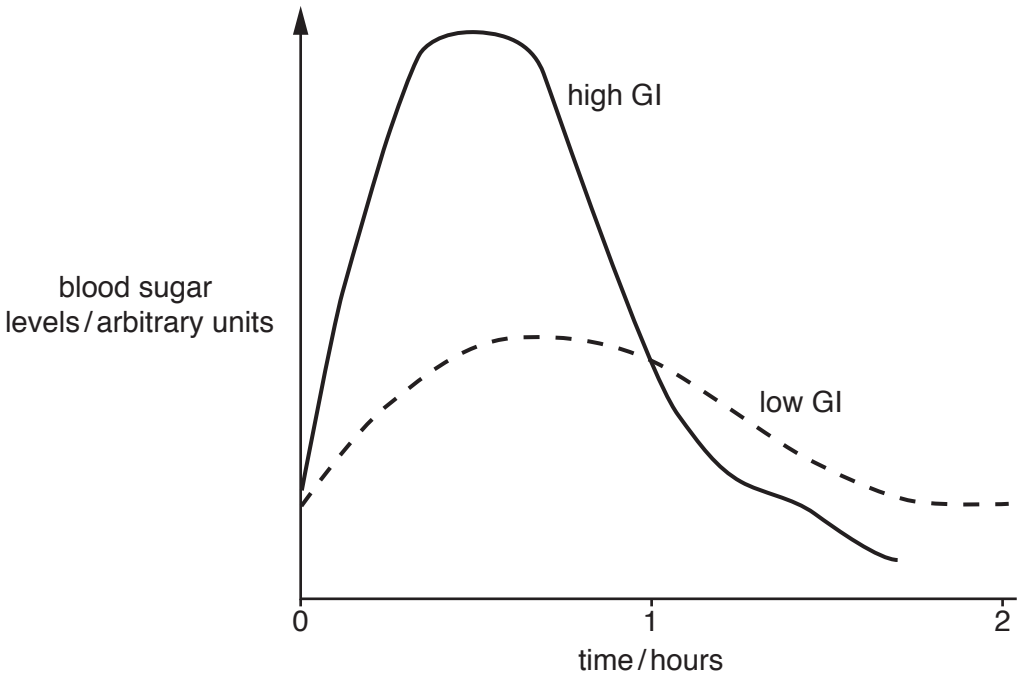
..... **[2]**

[Total: 9]

4 Glycaemic Index (GI) is a measure of how quickly the food raises blood sugar levels in the blood.

The graph shows the effect of high GI and low GI foods on blood sugar levels.



The table shows the GI values for five types of foods.

Food with a GI of 70 or higher is considered **high**.

Food with a GI of 55 or below is considered **low**.

Glycaemic Index (GI)									
Snacks	**GI**	**High in starch**	**GI**	**Vegetables**	**GI**	**Fruits**	**GI**	**Dairy**	**GI**
milk chocolate	49	brown rice	55	broccoli	10	apple	38	custard	43
doughnut	76	pancakes	67	beetroot	64	bananas	56	ice cream	60
energy bar	58	baked potatoes	85	carrots	49	cherries	22	plain yoghurt	14
popcorn	55	spaghetti	38	green peas	48	dates	103	soy milk	31
pretzels	83	white rice	38	onions	75	watermelon	72	whole milk	30

Use the information provided opposite to explain how diabetics can benefit from GI information and suggest foods from each food type which are suitable for diabetics.

The quality of written communication will be assessed in your answer.

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[Total: 6]

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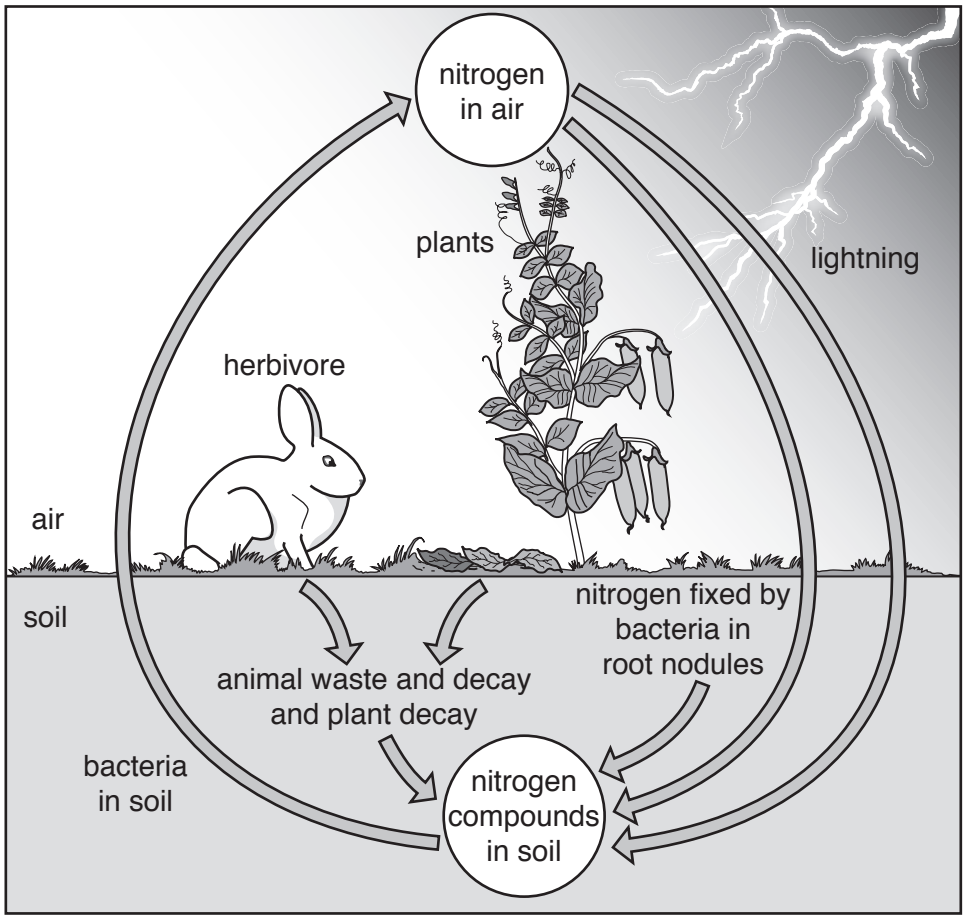
5 The diagram shows a natural nitrogen cycle.



(a) No ecosystem or cycle is a perfect closed loop.

Use the diagram to suggest **two** ways nitrogen can be lost from an ecosystem.

1 .....

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2 .....

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[2]

(b) Nitrogen compounds can be added to the soil in many ways.

The table shows data for three ways in which nitrogen compounds are added to soil for four countries.

Country	Total amount of nitrogen compounds added to soil per year. (1000 Tonnes)	Percentage of nitrogen compounds added to the soil through		
		Biological fixation (%)	Manure (%)	Inorganic fertilisers (%)
France	4760.1	3.0	34.4	52.9
Netherlands	935.0	0.3	52.5	39.6
Spain	2047.9	4.3	37.6	50.7
UK	2674.3	1.6	42.4	46.8
Mean	**2604.3**		**41.7**	**47.5**

(i) Which of the following statements about the data are true?

Put a tick (✓) in the boxes next the **two** correct statements.

In all countries the greatest amount of nitrogen added to the soil is through the use of inorganic fertilisers. ☐

France adds 10 times more nitrogen to the soil through biological fixation than the Netherlands. ☐

France adds more tonnes of nitrogen compounds to the soil through the use of manure than Spain. ☐

The mean percentage of nitrogen compounds entering the soil through biological fixation is 2.3%. ☐

Only one country adds a higher amount of nitrogen compounds to the soil than the mean value. ☐

[2]

(ii) The UK adds 1251.6 tonnes of nitrogen as inorganic fertiliser to the soil each year.

A student concludes that the UK adds more tonnes of inorganic fertiliser to the soil than Spain.

Use the data to work out if the student's conclusion is correct.

Use calculations to support your answer.

Show your working.

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

(iii) Inorganic fertilisers can harm the environment.

The statements **A**, **B**, **C**, **D**, and **E** describe the process of eutrophication. They are not in the correct order.

A algae prevents light reaching plants found growing on the lake or river bed

B algae and other plants die

C inorganic fertilisers cause rapid growth of algae

D inorganic fertilisers can wash off fields and enter lakes and rivers

E bacterial respiration increases reducing oxygen levels

Write down the statements in the correct order to describe the process of eutrophication. The first one has been done for you.

D				

[1]

(iv) Despite the possible damage to natural ecosystems, farmers in Europe use more than ten times more inorganic fertiliser now than they did 50 years ago.

Explain how using inorganic fertilisers benefits local communities.

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

(c) (i) Agriculture uses sustainable and unsustainable sources of energy.

What is the sustainable source of energy used in natural ecosystems and sustainable agriculture?

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

(ii) Crude oil is used in the production of inorganic fertilisers.

Use ideas about how crude oil is formed to explain why the use of crude oil does not fulfil the requirements of a closed loop system.

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

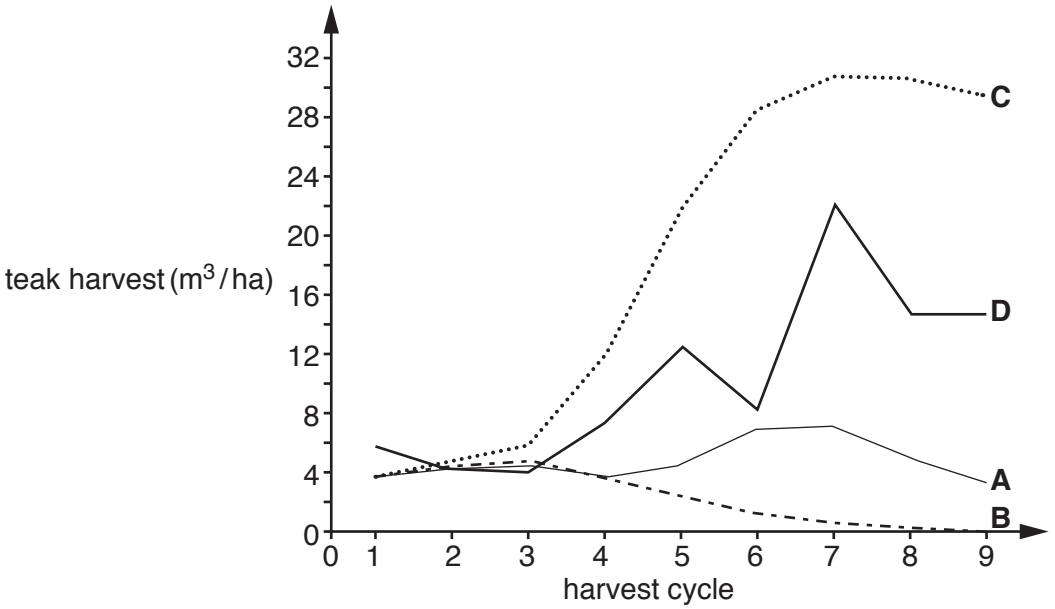
[Total: 13]

6 Teak is a wood harvested from forests.

Scientists used a computer to model four different methods **A**, **B**, **C** and **D** that can be used to harvest teak.

The scientists are looking for the most sustainable harvesting method.

The graph shows the predictions made by the model.



Use the graph to comment on how sustainable each harvesting method is and describe the environmental impact of unsustainable timber harvesting.

The quality of written communication will be assessed in your answer.

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[Total: 6]

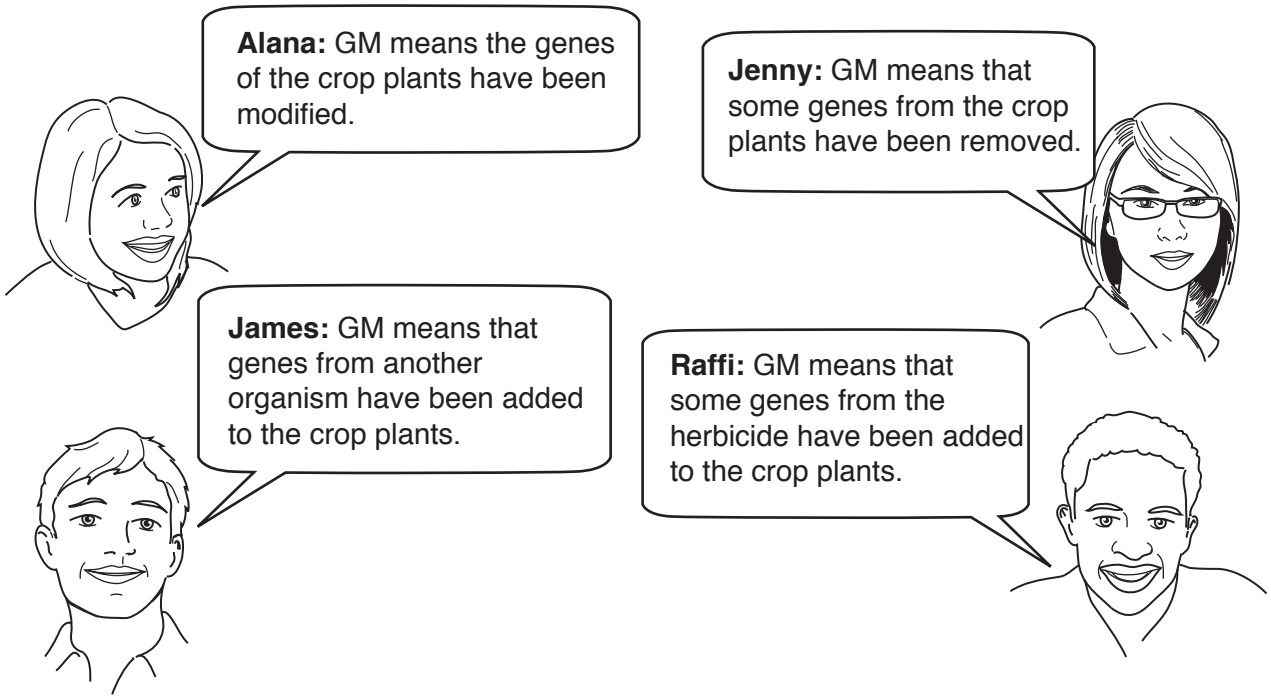
7 Read the article about herbicide resistant crops.

Herbicide resistant crops

Herbicides are chemicals used by farmers to kill weeds. Some herbicides are non-selective and can kill crop plants as well as weeds. Crop plants have been genetically modified so they are resistant to herbicides. These crop plants will not be killed by the herbicides used by farmers.

GM crops are widely grown in North and South America.
GM crops are not currently grown in the UK.

Four students are discussing what is meant by genetic modification (GM).



(a) Who has given the correct definition of genetic modification?

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

Alana ☐

Jenny ☐

James ☐

Raffi ☐

[1]

(b) The four students suggest some possible advantages and disadvantages of growing GM crops.

Put a tick (✓) in the boxes to show which suggestions are:

- an advantage for farmers
- an advantage for a seed company
- a disadvantage of using GM crops

Suggestion	Advantage for farmers	Advantage for a seed company	Disadvantage of using GM crops
Farmers will buy new GM seed every year.			
Less herbicide will need to be used.			
GM crops can lead to the evolution of super-weeds.			
GM seeds can be patented so those buying the seeds have to pay more money.			
Less competition can lead to a bigger yield.			
Herbicide may remain on crop plants, this could affect human health.			

[3]

(c) GM herbicide resistant crops are widely grown in North and South America but are not grown in the UK.

Suggest why.

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

[Total: 6]

8 **(a)** Nanoparticles are used in the food industry.

They can be added to the plastic packaging used to seal food in containers.

They change colour when the amount of oxygen in the packet increases.

Suggest why this may be useful.

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

(b) Nanoparticles are small particles.

Which of the below are the most similar in size to a nanoparticle?

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

some cells	☐
some molecules	☐
some nuclei	☐
some viruses	☐

[1]

(c) The food industry grow bacteria and fungi on a large scale in fermenters to make products. Write down two products made in this way.

1 .....

2 .....

[2]

[Total: 5]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).