OCR
RECOGNISING ACHIEVEMENT

# SPECIMEN H

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**GATEWAY SCIENCE**

**BIOLOGY B**

**B731/02**

Unit B731: Biology modules B1, B2, B3 (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 15 minutes

| Candidate Forename | | Candidate Surname | |
|---|---|---|---|

| Centre Number | | | | | | Candidate Number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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**

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- 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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

| Examiner's Use Only: | | | |
|---|---|---|---|
| 1 | | 9 | |
| 2 | | 10 | |
| 3 | | 11 | |
| 4 | | 12 | |
| 5 | | 13 | |
| 6 | | 14 | |
| 7 | | 15 | |
| 8 | | 16 | |
| **Total** | | | |

Answer **all** the questions.

## Section A – Module B1

**1** Deb is thirteen years old.

Her doctor has told her that she must eat enough protein each day.

**(a)** She can calculate her estimated average requirement (EAR) for protein in grams using the formula:

EAR in g = 0.6 × body mass in kg

Deb has a mass of 58 kg.

Look at the information about how much protein Deb eats in one day.

| food | protein content in grams |
|---|---|
| breakfast cereal | 5.0 |
| salad sandwich | 8.0 |
| macaroni cheese pasta | 13.9 |
| rice pudding | 3.0 |
| tinned peaches | 0.5 |

Does Deb meet her EAR for protein and is EAR an accurate measure of her protein requirement?

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

**(b)** The doctor also tells Deb to make a note of which proteins are animal proteins and which are plant proteins.

He says that animal proteins are **first class proteins**.

Why are animal proteins called first class proteins?

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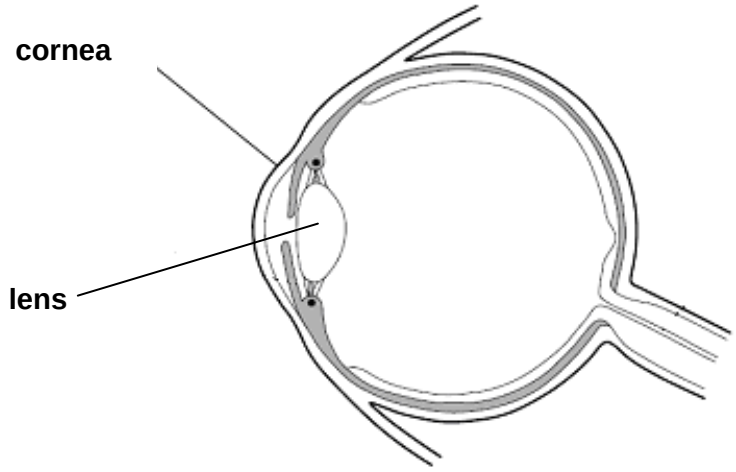
..... **[1]**

**[Total: 4]**

**2** The diagram shows parts of a human eye.




**(a)** Describe the job of the cornea and the lens in vision.

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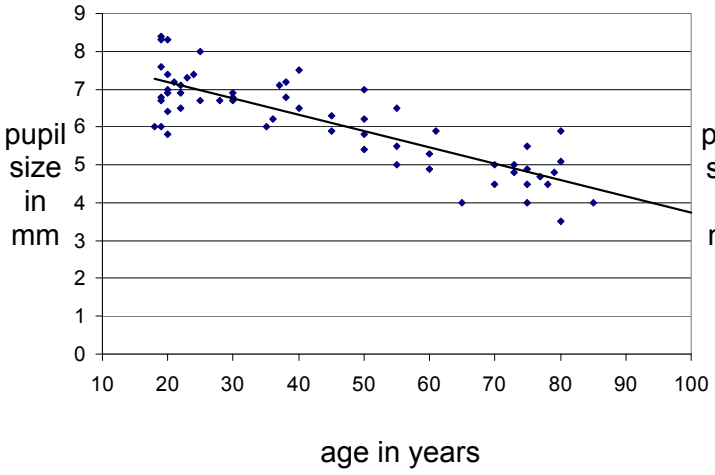
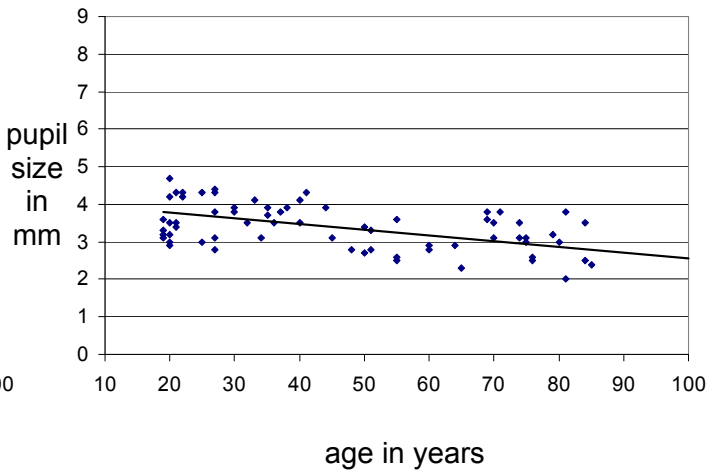
..... **[2]**

**(b)** Look at the graphs. They show how pupil size (diameter) changes with age for two levels of light.

**low light level**




**high light level**




What conclusions can be drawn from these data and what are the implications for elderly people?

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..... **[4]**

**[Total: 6]**

**3** Tobacco smoke can affect many systems in the body.

**(a)** Carbon monoxide in the smoke can cause an increase in blood pressure.

Explain how carbon monoxide can cause an increase in blood pressure.

.....

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

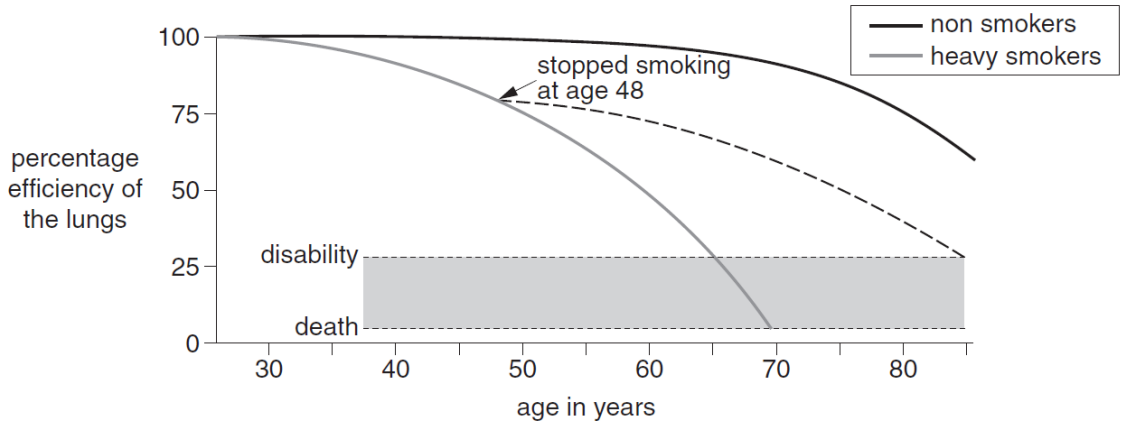
**(b)** Tobacco smoke can also affect the lungs.

The graph shows how well the lungs work at different ages.

This is shown for two groups of people.

One group is heavy smokers. The other group is non-smokers.

The dotted line shows the possible effect of stopping smoking at age 48.



Doug is a 48 year-old heavy smoker.

If Doug decides to give up smoking, the age at which he is likely to become disabled increases by 20 years.

Explain this difference in the age at which Doug would become disabled.

Use your knowledge of the effect of smoking on the lungs in your answer.

.....

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

**(c)** Doug continues to smoke because tobacco contains an addictive drug called nicotine.

This drug is also a stimulant.

Explain how nicotine affects synapses in Doug's body.

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.....

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

**[Total: 4]**

**4** Fred has cystic fibrosis.

He finds it difficult to breathe because there is too much mucus in his lungs.

Cystic fibrosis is an inherited condition.

It is caused by a recessive allele.

**(a)** Neither of Fred's parents has cystic fibrosis.

They want to have another child.

What is the probability of their next child having cystic fibrosis?

Draw a genetic diagram to explain your answer.

probability of next child having cystic fibrosis ..... **[2]**

**(b)** Fred gets a lot of chest infections.

When he gets a bacterial infection, his doctor gives him antibiotics.

Fred's doctor could just give him antibiotics all the time as a precaution.

However, doctors are careful not to use antibiotics more than necessary.

One reason for this is not to waste money.

Write down **one** other reason.

.....

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

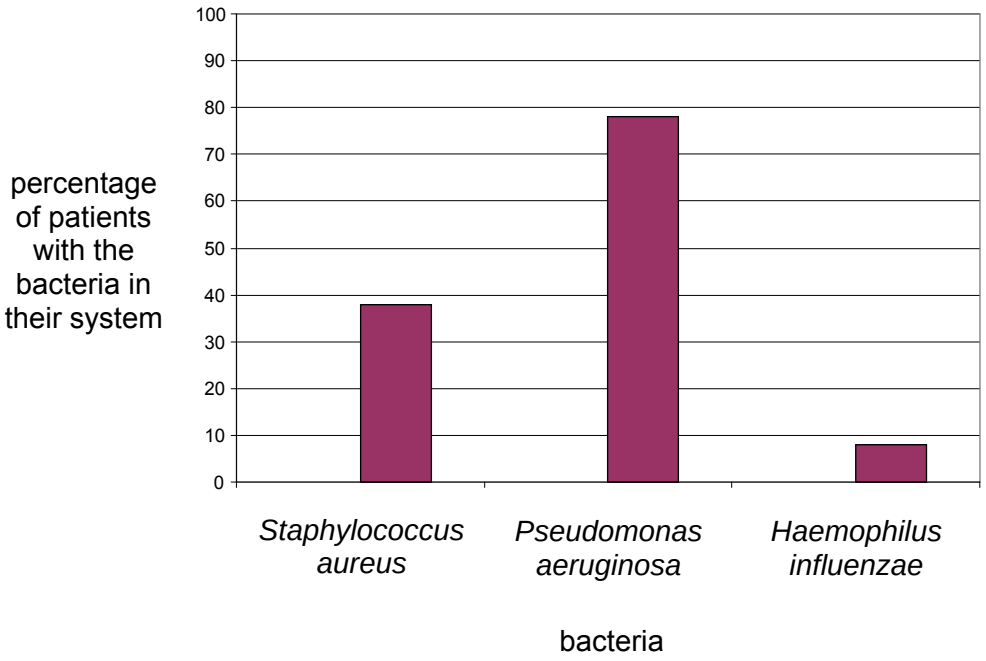
 

**(c)** Chest infections can be caused by different types of bacteria.

Tests were done on 100 patients with cystic fibrosis.

The tests involved taking a sample from each patient and finding which of three types of bacteria were present in their system.

The bar chart shows the results of the tests.




Can you tell from these data how many patients have more than one of these types of bacteria in their system?

Explain your answer.

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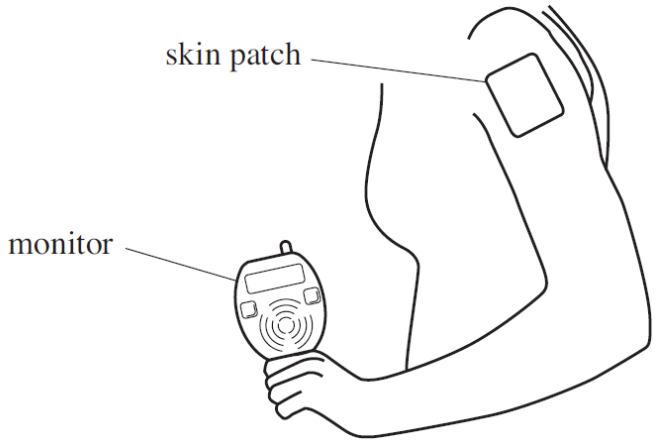
..... **[2]**

**[Total: 5]**

**5** This article appeared in a recent newspaper.

## Patch to test for blood glucose levels




A new skin patch is being developed for people who have type 1 diabetes.

It measures the level of glucose in their blood.

The device measures the level every 60 seconds.

The monitor sounds an alarm if the blood sugar level gets too high or too low.

Mary has type 1 diabetes.

She eats a very large meal.

Explain why using the monitor will help her.

✎ *The quality of written communication will be assessed in your answer to this question.*

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

**[Total: 6]**

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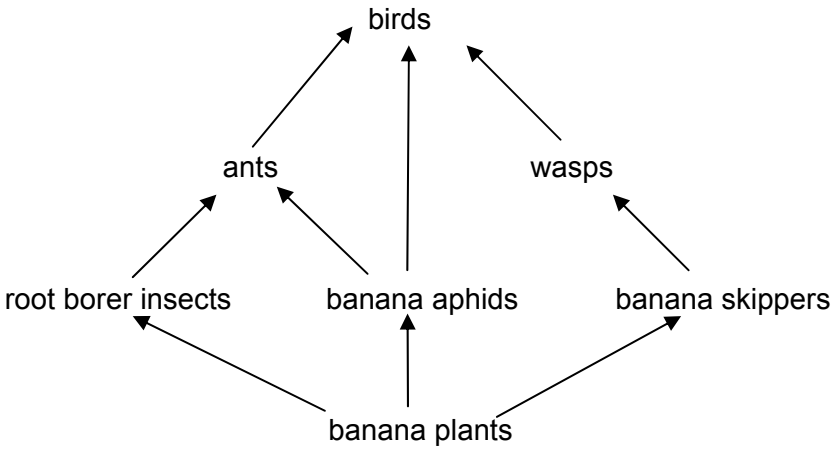
## Section B – Module B2

**6** This question is about bananas.

Banana plants are grown in large fields called plantations.

They are part of a food web.




**(a)** Ecologists studying this food web want to construct a pyramid of biomass for this food web,

Why is it difficult to draw an accurate pyramid of biomass for this food web?

Make reference to organisms in the food web in your answer.

.....

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

**(b)** Energy **enters** this food web from the Sun and **passes** from organism to organism as they feed.

Look at the two food chains from this food web.


Explain which food chain is more efficient and explain how the efficiency of energy transfer impacts on the populations of organisms.

✎ *The quality of written communication will be assessed in your answer to this question*.

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

**[Total: 7]**

**7** This article about the Great Bustard appeared in a newspaper.

Read the article carefully and use it to help you answer the questions.



## Welcome back Big Bird

The Great Bustard was a giant among British birds.

It had a wingspan of nearly two metres and used to be a great sight as it flew over the countryside. However, in the 1870s it became extinct in Britain.

The problem was that the birds need a lot of space around them to mate. If there are too many people, machines or animals near them they are disturbed. They were also widely hunted.

The Great Bustard has now been reintroduced into Britain.

**(a)** The Great Bustard still lives in Turkey.

A group of scientists looked at Great Bustards in three different regions in Turkey.

They measured the area of each region and counted the number of Great Bustards living there.

Their results are shown in the table.

| region | area of the region in $km^2$ | number of birds | | male:female ratio | total number of birds |
|---|---|---|---|---|---|
| | | male | female | | |
| 1 | 898 | 10 | 14 | 5:7 | 24 |
| 2 | 383 | 1 | 30 | 1:30 | 31 |
| 3 | 754 | | 21 | | 35 |

**(i)** Finish the table.

Write the answers in the empty boxes.

**[1]**

**(ii)** Scientists are worried that the bird population in one of the areas will not be able to adapt to changes in the environment.

Which area is this likely to be? Explain your answer.

.....

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

**(b)** Scientists are setting up conservation programs to save the Great Bustard.

Write down **one** reason why people think it is important to conserve endangered organisms preventing extinction.

.....

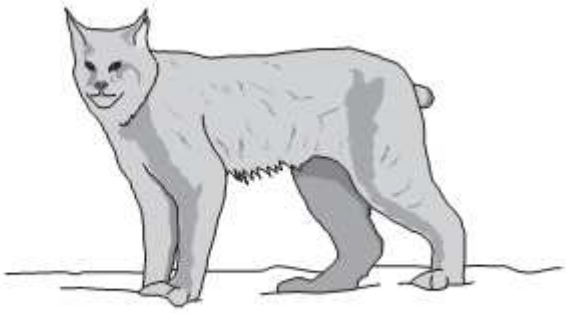
..... **[1]**

**[Total: 4]**

**8** Lynx and snowshoe hares live in northern Canada.

Lynx are the main predators of snowshoe hares.

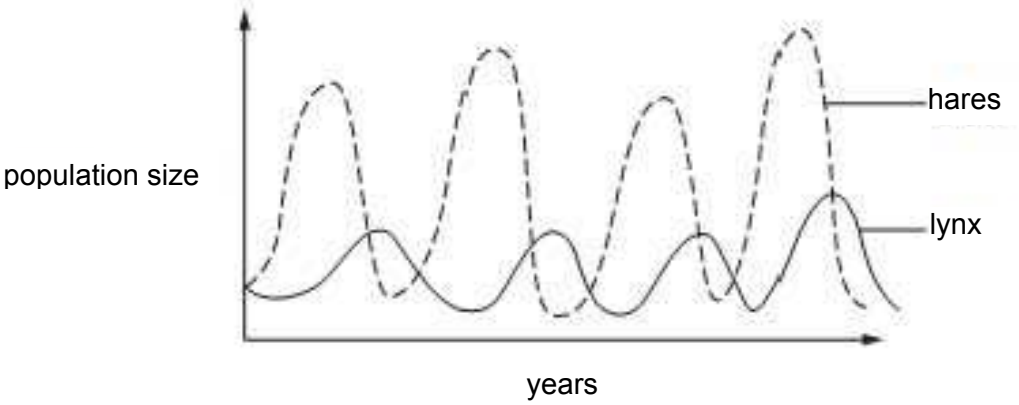
Snowshoe hares are the main prey of lynx.



lynx

snowshoe hare

The graph shows how the lynx and snowshoe hare populations changed over a number of years.




**(a)** Look at the graph.

Explain why the two populations are out of phase.

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

**(b)** Do the snowshoe hare and the lynx occupy the same ecological niche?

Explain your answer.

.....

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

**(c)** Another predator of snowshoe hares is the wolf.

Wolves feed on a wide variety of prey, not just snowshoe hares.

Suggest how the cycle shown on the graph is likely to affect wolf numbers.

Explain your answer.

.....

.....

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

**[Total: 5]**

**9** Both carbon and nitrogen are recycled in nature.

**(a)** The carbon cycle is affected by human activity.

Every person is said to have a **carbon footprint**.

What is meant by the term carbon footprint?

.....

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

**(b)** Both the carbon cycle and the nitrogen cycle involve bacteria acting as decomposers (saprophytes).

The nitrogen cycle also involves three other types of bacteria.

Write down **one** of these other types of bacteria and explain what they do in the cycle.

type of bacteria .....

what they do in the nitrogen cycle .....

.....

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

**[Total: 3]**

**10 (a)** Scientists have been collecting evidence about the size of animals that live on islands. Islands often have a shortage of food and other resources. They are often exposed to wind and have little shelter.

Some scientists report that animals living on these islands are bigger than similar animals living on the mainland.

Other scientists report that animals living on islands should be smaller than similar animals living on the mainland.

Show how Charles Darwin's theory of natural selection can explain **both** sets of evidence.

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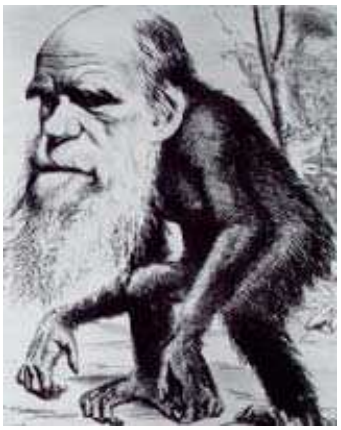
**(b)** Look at the cartoon that was published soon after Darwin put forward his ideas about evolution.



Write about why people wanted to criticise Darwin by publishing this cartoon.

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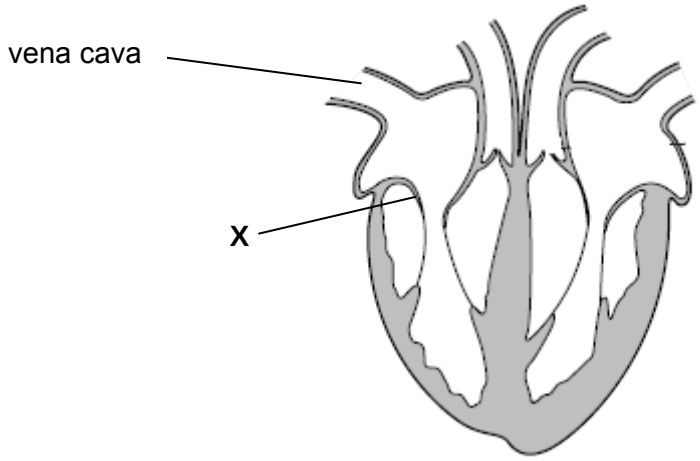
..... **[2]**

**[Total: 6]**

## Section C – Module B3

**11** Look at the diagram of a heart.




**(a)** Write down the **name** of part **X**.

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

**(b)** The vena cava is the main vein entering the right side of the heart.

Veins contain valves, arteries do not.

Explain why arteries do not need valves.

.....

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

**[Total: 3]**

**12** This question is about genes.

Genes code for the production of proteins.

Mutations are changes to genes that can cause them to code for different proteins.

Explain how a gene codes for a protein and how a mutation can lead to a change in the protein for which the gene codes.

*The quality of written communication will be assessed in your answer to this question.*

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

**[Total: 6]**

**13** Look at the picture.

It shows rice being planted in China.



**(a)** Rice belongs to the plant kingdom.

Write down the name of **one** structure found in a plant cell that is **not** found in a bacterial cell.

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

**(b)** **(i)** Scientists have taken the genes that control beta-carotene production and placed them into rice.

This rice is called Golden Rice.

Give **two** reasons why genetic engineering is used in this process and not selective breeding.

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

**(ii)** Some people are opposed to Golden Rice because it may have unexpected harmful effects.

Suggest how scientists could gather evidence to try to overcome this opposition.

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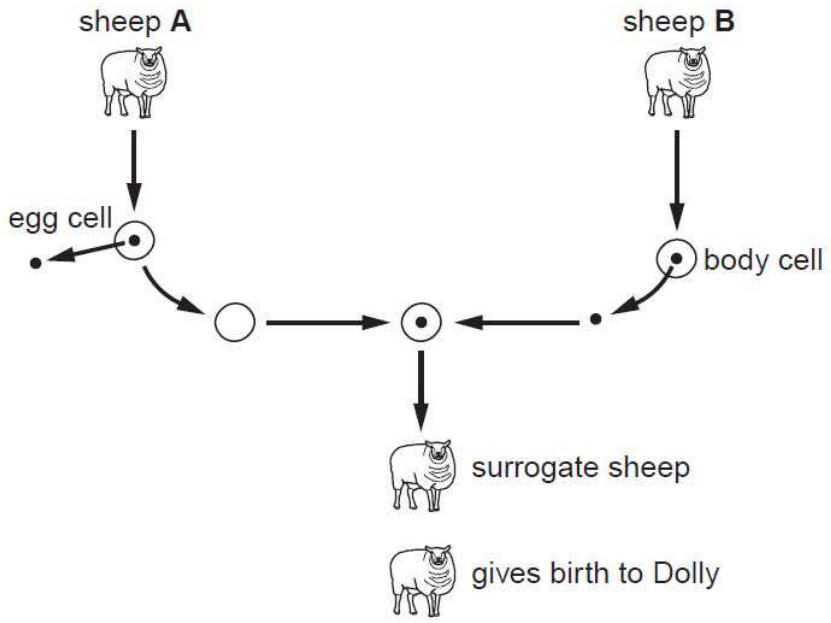
..... **[1]**

**[Total: 4]**

**14** Look at the diagram.

It shows the cloning technique used to produce Dolly the sheep.




**(a)** Is Dolly a clone of sheep **A** or **B**?

Explain your answer.

Dolly is a clone of sheep .....

reason why .....

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

**(b)** Since Dolly was born, many other animals have been cloned.

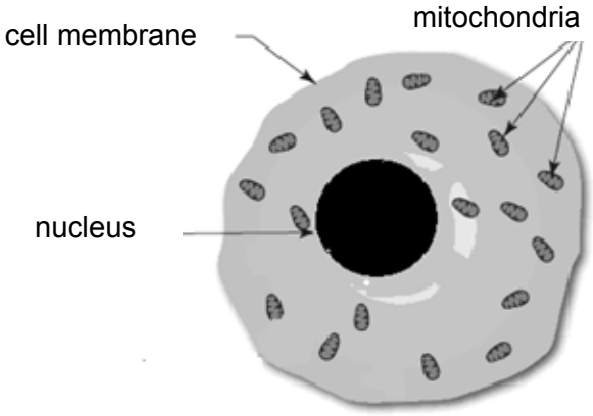
Write down **one** possible use of cloning.

.....

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

**[Total: 2]**

**15** The diagram shows an animal cell.




**(a)** Write down the function of mitochondria in the cell.

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

**(b)** **(i)** It is possible to work out the volume of the cell shown in the diagram.

One millimeter on the diagram equals one micrometer in real life.

Assuming it is a sphere, the volume is $4/3\ \pi\ r^3$, where r is the radius.

So the cell volume = 4/3 x 3.14 x $23^3$ = 50939 micrometers$^3$

Measure the radius of the **nucleus** and work out the volume of the nucleus using the same formula.

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answer = ..... micrometres$^3$ **[2]**

**(ii)** A group of scientists studied the effect of poisoning by the metal cadmium.

They thought that the metal caused the ratio $\frac{\text{volume of nucleus}}{\text{volume of cell}}$ to **decrease**.

The ratio is normally between 0.1 and 0.05 for this type of cell.

Has the cell shown been poisoned with cadmium?

Explain your answer.

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.....

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

**[Total: 5]**

**16** Kara plays basketball for a club every day of the week.

**(a)** Kara finds a way to estimate her basal metabolic rate (BMR).

She uses this formula:

BMR = 655 + (9.6 x body mass in kg) + (1.8 x height in cm) - (4.7 x age in years)

What effect does getting older have on BMR?

Describe how you can tell this from the formula.

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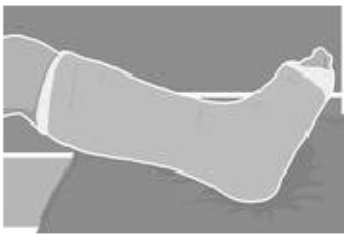
..... **[1]**

**(b)** Kara gets injured and cannot do any sport.



Kara knows her total energy requirement is dependent on her BMR and her activity.

Now that she is not exercising she does not want to eat too much and put on weight.

Kara calculates her BMR as 6000kJ per day.

The table gives a measure of activity called an **activity factor**.

| level of activity | activity factor |
|---|---|
| little or no exercise | 1.20 |
| light exercise / plays sport 1-3 times a week | 1.40 |
| moderate exercise / plays sport 3-5 times a week | 1.55 |
| very active / plays sport 6-7 times a week | 1.75 |

The total energy Kara needs is found by multiplying her BMR by her activity factor.

The energy Kara needs is released by respiration.

During aerobic respiration 6.6 kJ is released per gram of glucose.

**(i)** Calculate how much less glucose Kara needs to take in per day now she has stopped doing sport.

.....

.....

answer = .....g of glucose **[3]**

**(ii)** Kara wants to calculate how much glucose she needs to play a game of basketball.

Suggest why Kara should **not** use a figure of 6.6 kJ per gram of glucose to do this calculation.

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

**[Total: 5]**

**[Paper Total: 75]**

**END OF QUESTION PAPER**

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