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GCSE

3430U40-1

SCIENCE (Double Award)

Unit 4 – BIOLOGY 2
FOUNDATION TIER

TUESDAY, 14 MAY 2019 – AFTERNOON

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	5	
2.	7	
3.	6	
4.	10	
5.	11	
6.	6	
7.	8	
8.	7	
Total	60	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **6** is a quality of extended response (QER) question where your writing skills will be assessed.

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*Answer **all** questions.*

1. The diagram shows a plant called camelthorn *(Alhagi sparsifolia).*
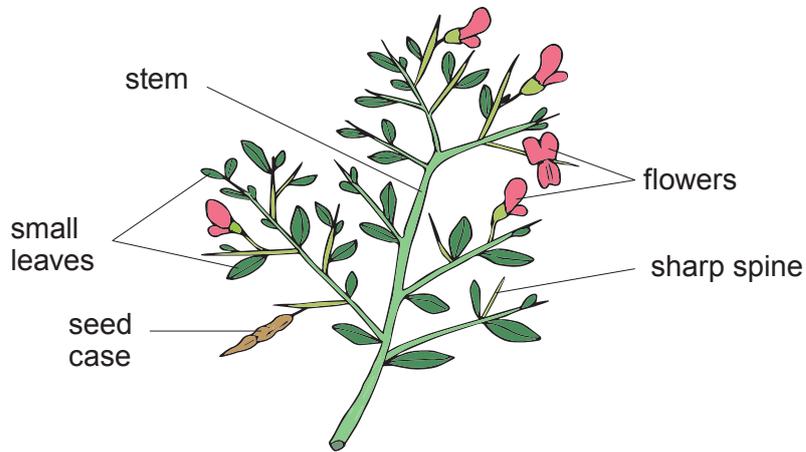
(a) State the genus name for camelthorn. [1]

....

(b) Camelthorn lives in dry, desert areas, where there are herbivores.

Choose **two** labelled features shown on the diagram and explain how each is an adaptation for camelthorn to survive in deserts. [2]

1. ....

....

2. ....

....

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(c) Megan investigated growth in camelthorn plants in two different conditions.

Plant A was given 250 cm³ of water each day. **Plant B**, was watered once only at the start of the investigation. The diagram shows the appearance of the two plants at seven days.

Plant A　　　　　　**Plant B**

soil surface
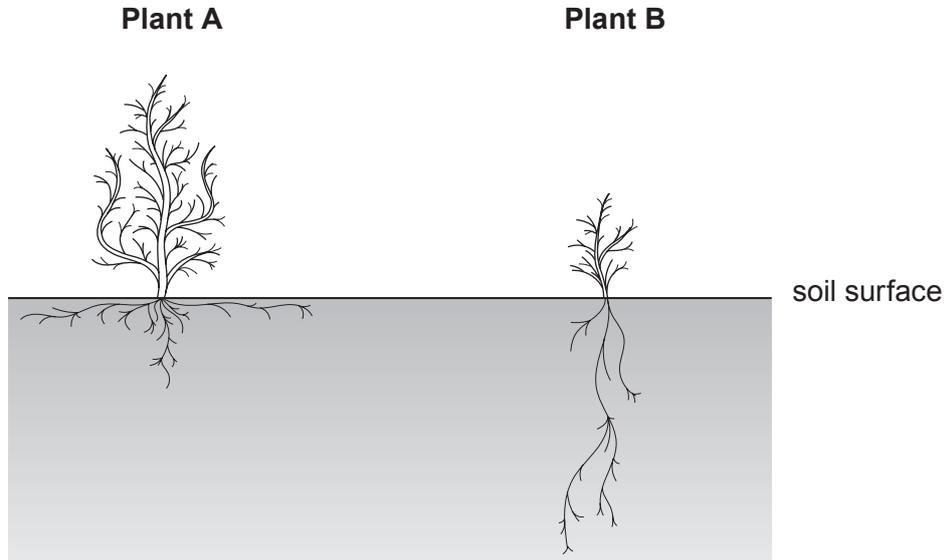
Compare the root growth in the two plants and suggest how root growth in **plant B** is an adaptation to dry soil. [2]

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5

2. The poster is about some uses of stem cells.

Human Stem Cell Differentiation
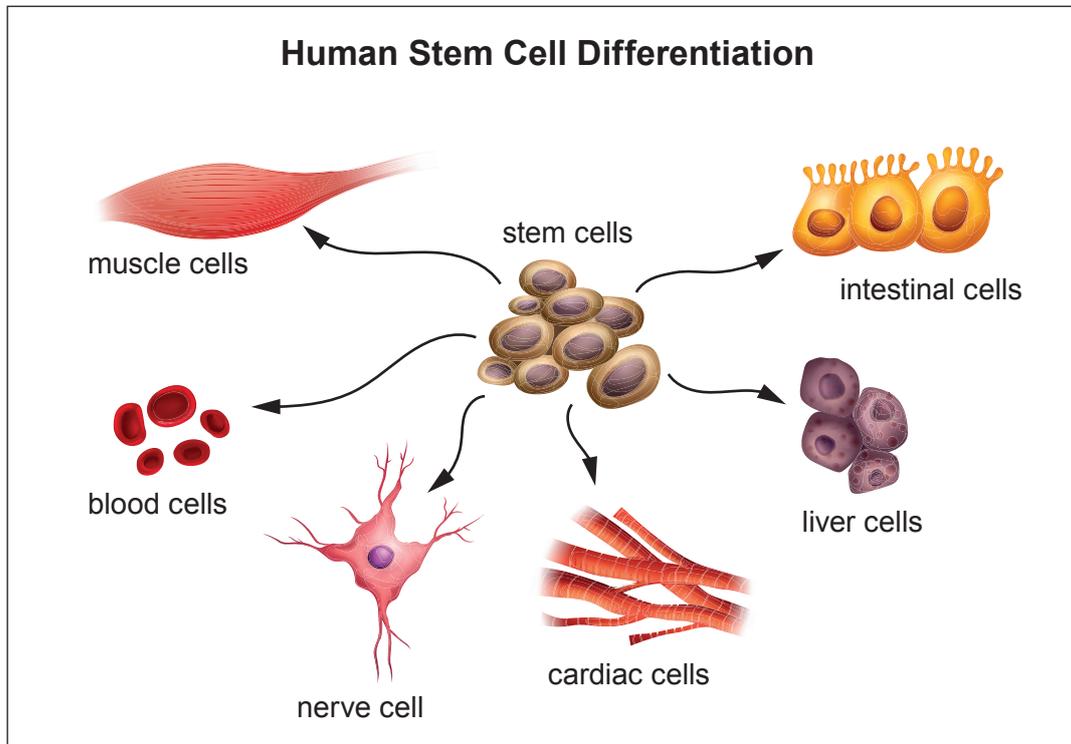
(a) Stem cells can differentiate.
Using **one** example from the poster, explain the meaning of differentiate. [1]

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(b) Stem cells undergo rapid mitosis.
The table gives five features of cell division. Some features relate to mitosis and some relate to meiosis.
Complete the table by writing **true** or **false** in each row to show the features that relate only to **mitosis**. [3]

Feature of cell division	**True** or **False**
daughter cells are genetically identical	....
produces four daughter cells	....
daughter cells retain the original chromosome number	....
daughter cells have chromosomes in pairs	....
produces gametes	....

(c) A patient receiving stem cell therapy may be treated with cells taken from their own body or from embryos.
Give **three** advantages of the use of stem cells taken from a patient compared with those from an embryo. [3]

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3. *(a)* The diagram shows a pathogen that causes an infectious disease.

genes

antigens

protein coat
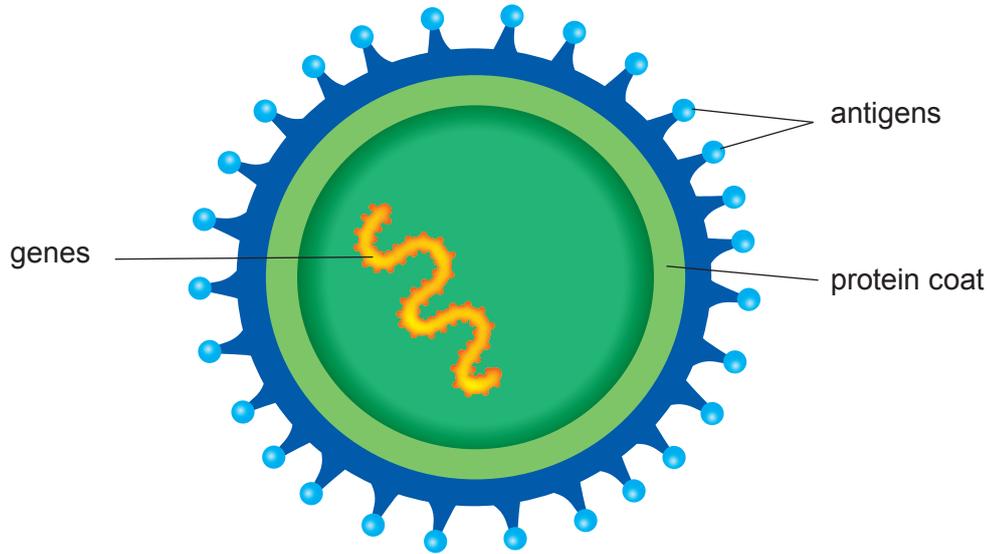
(i) State the type of pathogen shown above. [1]

....

(ii) Sudden changes to a gene cause changes to the antigens on the coat of the pathogen.

State the term for a sudden change to a gene. [1]

....

(b) State **one** way by which pathogens are spread between people. [1]

....

(c) The following statements (**1 – 6**) describe how the body responds when it is invaded by pathogens. The statements are not in the correct order.

1 the pathogens have foreign antigens

2 pathogens enter the blood

3 they respond by releasing antibodies to the antigens

4 the antibodies attach to the pathogen

5 the antigens are recognised as foreign by lymphocytes

6 the attached antibodies help phagocytes destroy the pathogen

Complete the sequence to put the statements in the correct order. [3]

....**1**...... ....**3**...... ....

6

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4. *(a)* The diagram shows a section through the skin.
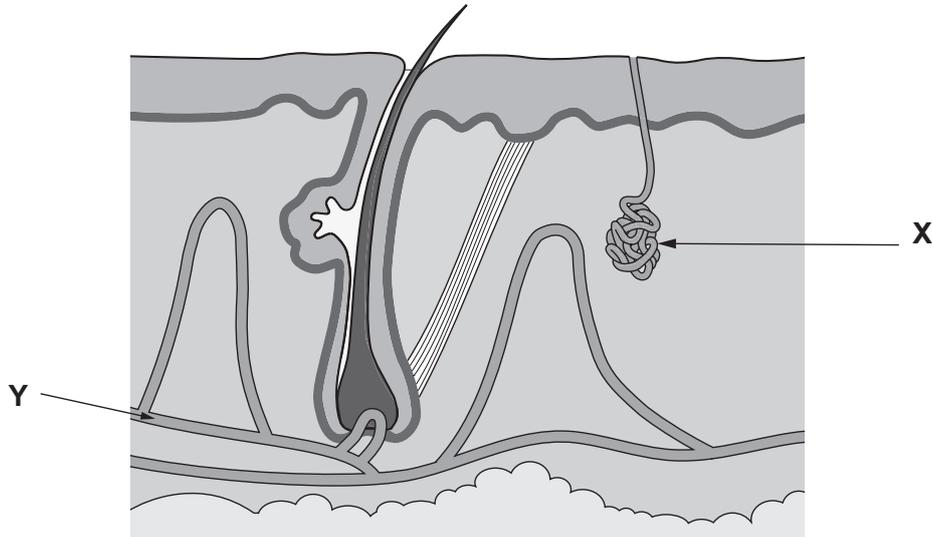
State the name of structures:

(i) **X** .... [1]

(ii) **Y** .... [1]

(b) Carwyn investigated the control of body temperature.
He set up a model to demonstrate the action of sweat using the apparatus shown below.

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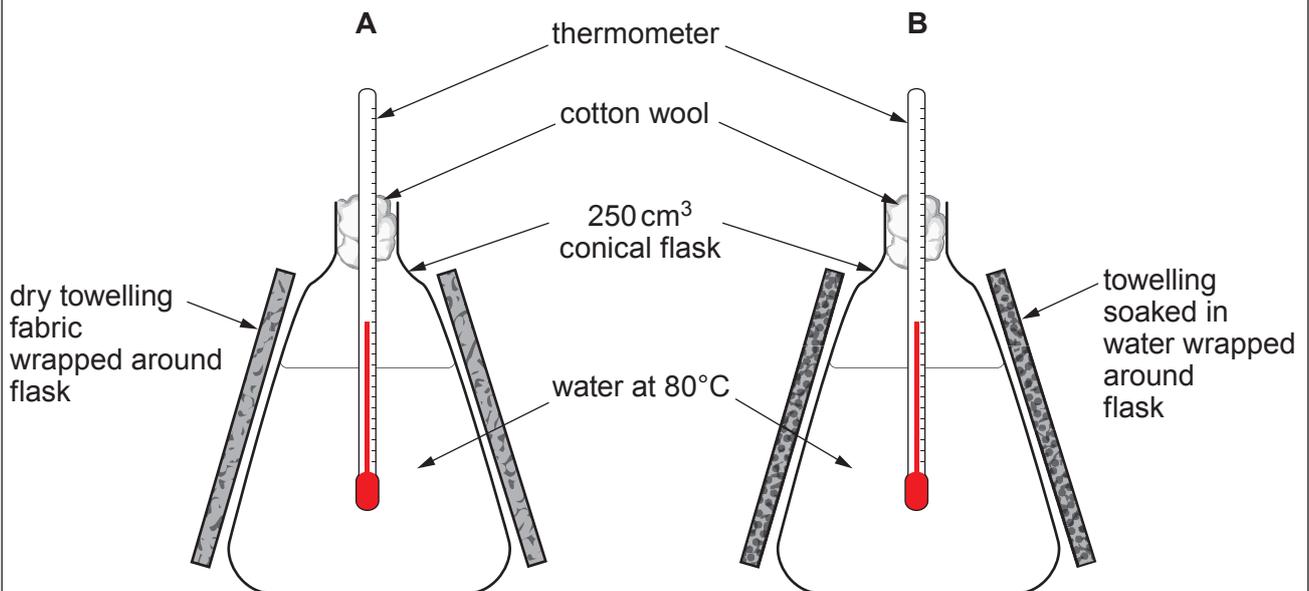
At the start of the investigation, Carwyn added 250 cm³ of water at 80 °C to each flask. He then recorded the temperature of the water in both flasks at two minute intervals for ten minutes, as shown in the results table.

Time (minutes)	Temperature of water in flask (°C)	
	A – dry towelling	**B** – wet towelling
0	80	80
2	79	73
4	78	65
6	77	58
8	76	54
10	75	51

(i) **Complete the graph** of the results by: [3]

   I. plotting the points for flask **B**

   II. using a ruler to join your plots.

Temperature of flask (°C)

Time (min)

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Turn over.

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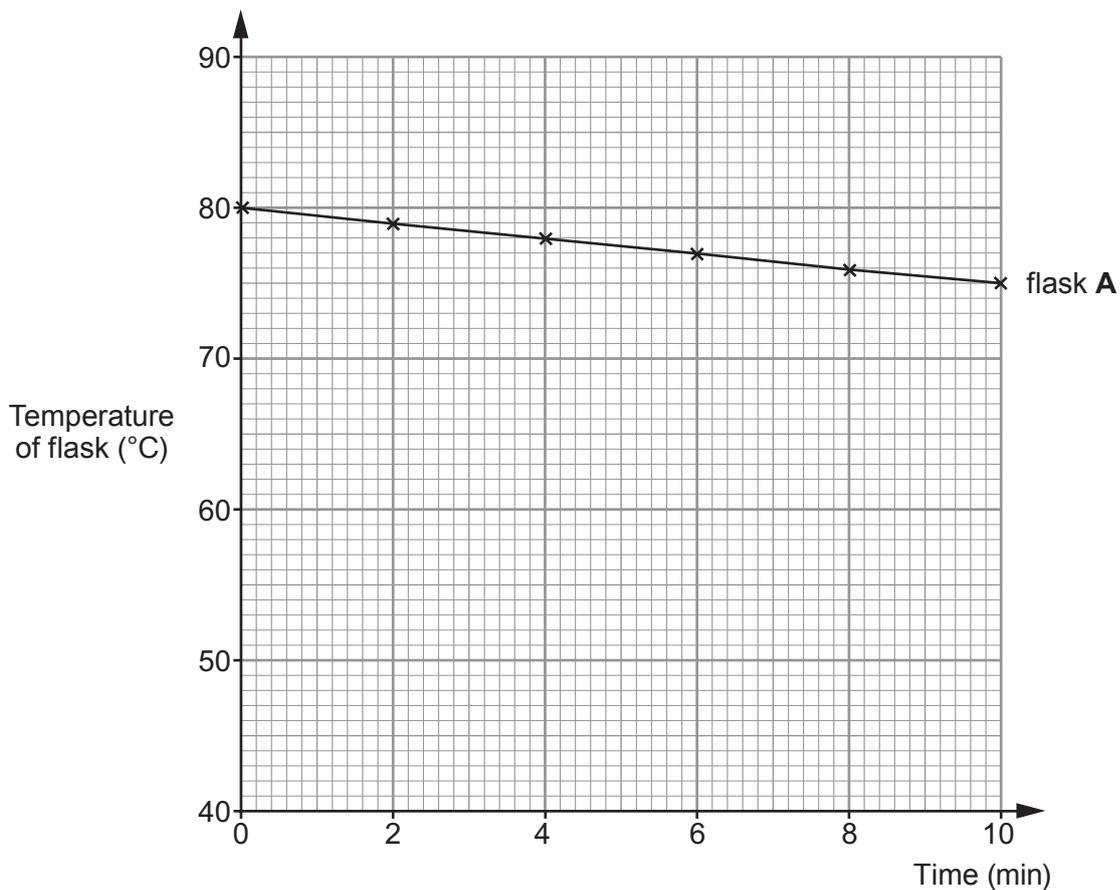
(ii) In Carwyn's model, the towelling represents the skin surface.
Using the results from flask **B**, explain the effect of sweat on human body temperature. [3]

....

....

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(iii) Heat stroke is a condition in which body temperature becomes dangerously high.
Use the results from flask **A** to conclude why people who do not drink enough water during very hot weather may suffer heat stroke. [2]

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10

5. The photograph shows an adult North Sea cod *(Gadus morhua).*
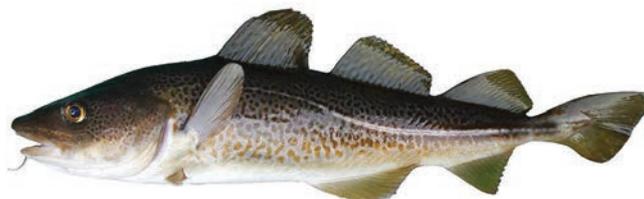
(a) Cod are important in maintaining biodiversity in the North Sea.
Choose the letter (**A - C**) from the list which defines biodiversity for an area. [1]

A The total number of species

B The variety of species and the number of organisms within those species

C The variety of species and their feeding relationships

Answer

(b) Read the following information about cod.

- Overfishing in the second half of the 20th century had a serious effect on the stocks of adult cod in the North Sea.

- The **total** stock of adult cod is estimated annually.

- The **safe** stock is the minimum mass of the adult cod population that should be left in the sea each year to ensure that the cod remains at sustainable levels.

- In 1996, scientists predicted that without action there would be no adult cod in the North Sea by 2015.

- In 2005, the European Commission put an annual limit (quota) on the mass of cod that could be taken by each vessel fishing in the area.

(3430U40-1) **Turn over.**

The graph shows the total annual catch of cod and the stock of adult fish remaining in the North Sea from 1965 to 2015.

North Sea cod
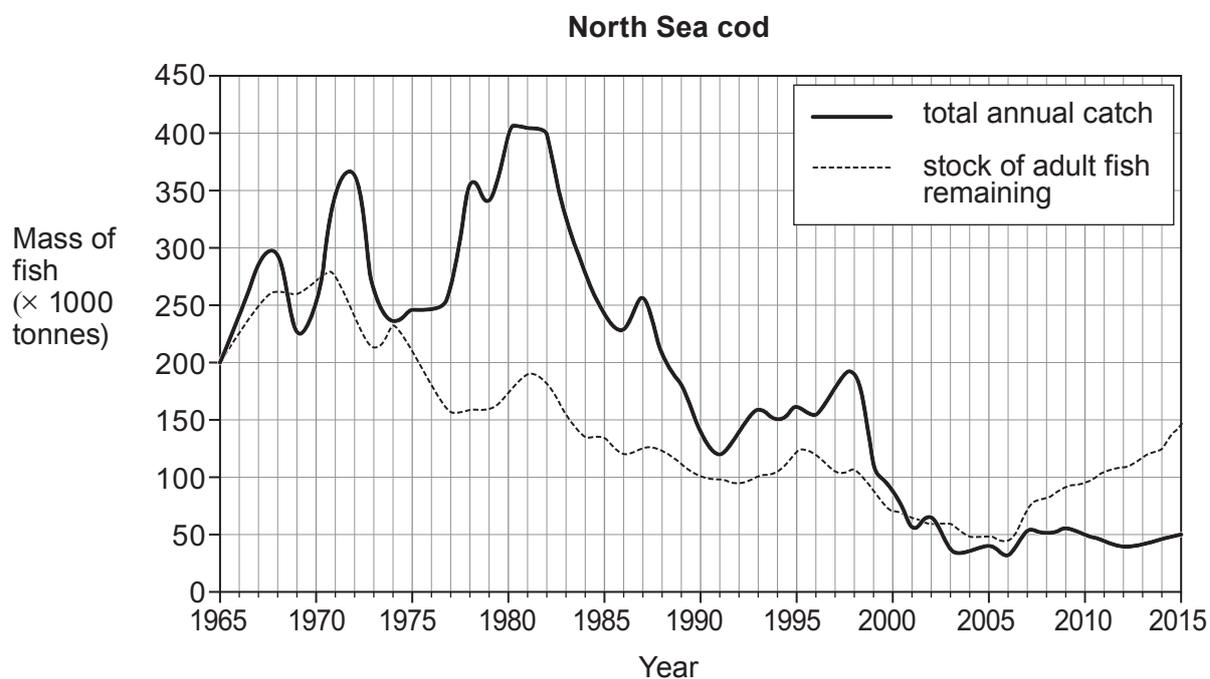
(i)   The safe stock is 150 000 tonnes.

Use a ruler to draw a straight line on the grid to show the safe stock, from 1965 to 2015.   [1]

(ii)   Use the data in the graph to answer the following questions.

I.   Calculate the **difference in mass** between the total catch in 1982 and the safe stock.   [2]

Difference in mass = ... thousand tonnes

II.   One tonne contains 120 adult cod.
Calculate the number of adult cod in the safe stock.   [2]

Number of adult cod in the safe stock = ...

(iii)   Describe the evidence that:

I.   shows overfishing beyond a sustainable level took place between 1971 and 2005; [2]

....

....

....

....

II.   supports the prediction made by scientists in 1996, that '*without action there would be no adult cod in the North Sea by 2015*'; [1]

....

....

III.   shows the fishing quota of 2005 had an effect on the cod population. [1]

....

....

(c)   Maintaining biodiversity ensures a continued food supply for humans.
Give **one** *other* benefit to humans of maintaining biodiversity. [1]

....

....

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6. Reaction time can be measured using the following method.

experimenter
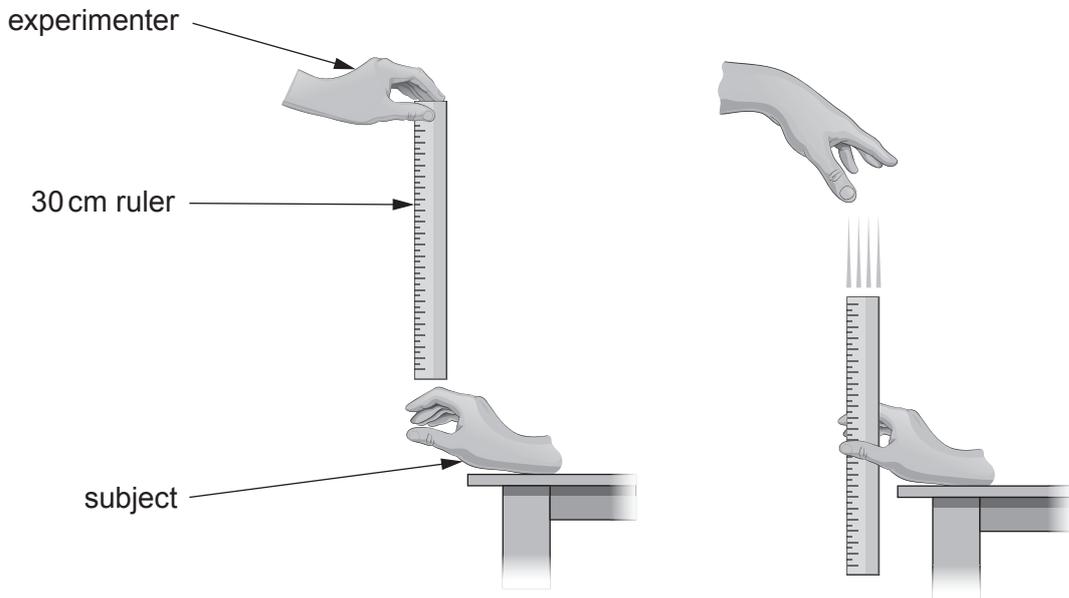
30 cm ruler

subject

1. The experimenter holds a 30 cm ruler just above the hand of the subject.
2. The ruler is dropped.
3. The subject then catches the ruler as quickly as possible.
4. The distance travelled by the ruler between steps 2 and 3 gives a measure of reaction time.

You have two solutions of coffee, one with caffeine and one without (decaffeinated coffee).

Describe how you would test the effect of drinking coffee with caffeine on the reaction time of a class of 20 Year 11 students. Include at least **two** variables which should be kept the same in order to make it a fair test.

[You are **not** required to write out steps 1 - 4 above in your answer.]　　　　　　[6 QER]

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7. *(a)* State what is meant by the following terms:

(i) gene; [1]

....

....

(ii) allele. [1]

....

...

(b) Cystic fibrosis is an inherited condition. The allele that causes this condition is recessive. The family tree below shows how cystic fibrosis is passed on in families.

Key

Unaffected female

Unaffected male

Affected male

Affected female

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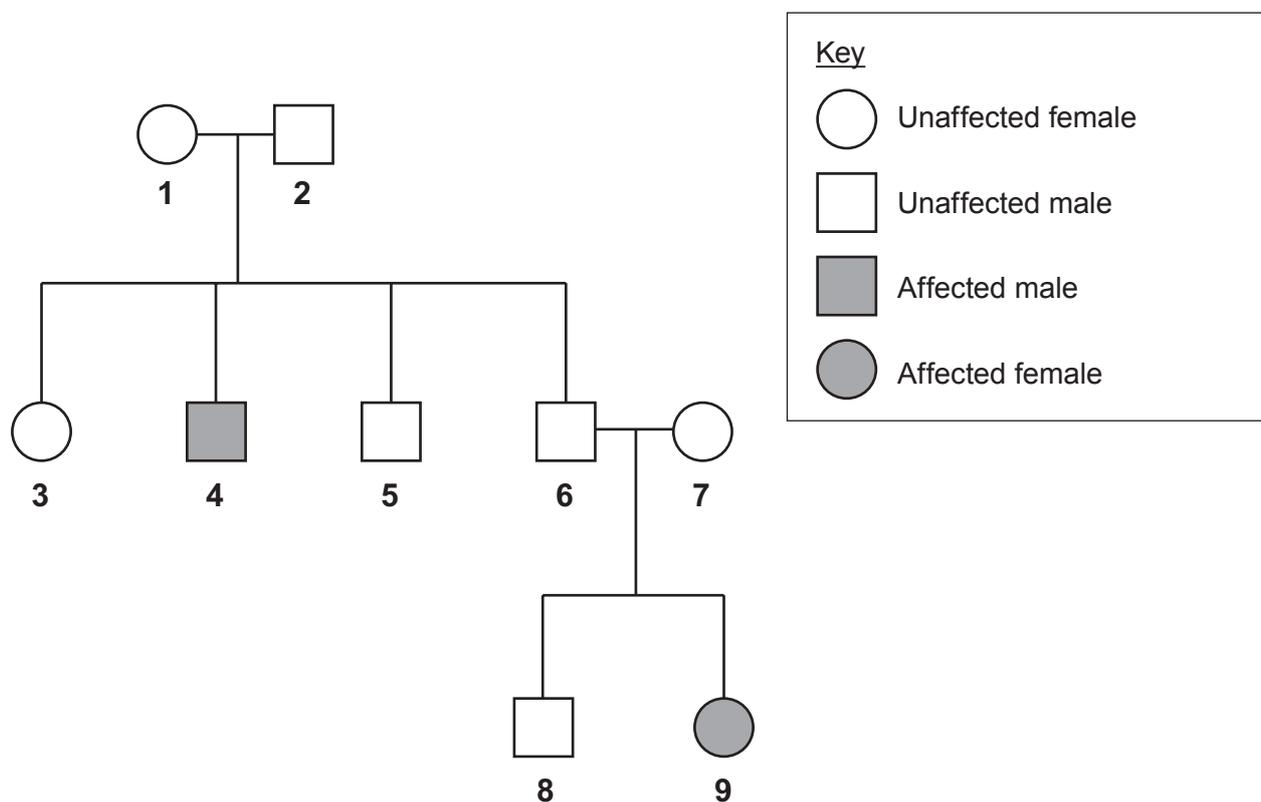
(i) Use letters **N** and **n** to complete the Punnett square to show how parents **1** and **2** could produce offspring number **4**. [2]

Gametes		

(ii) State the genotype of individual **9**. Explain your answer. [2]

....

....

(iii) State the possible genotypes of individual **5**. [1]

....

(c) Our understanding of how characteristics are inherited comes from the principles proposed by Gregor Mendel in the 19th century. In his experiments on pea plants *(Pisum sativum)* Mendel studied characteristics controlled by a single gene. State why this is not representative of most phenotypes. [1]

....

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8. The diagram shows a bacterial cell.

A ....

B ....

C ....
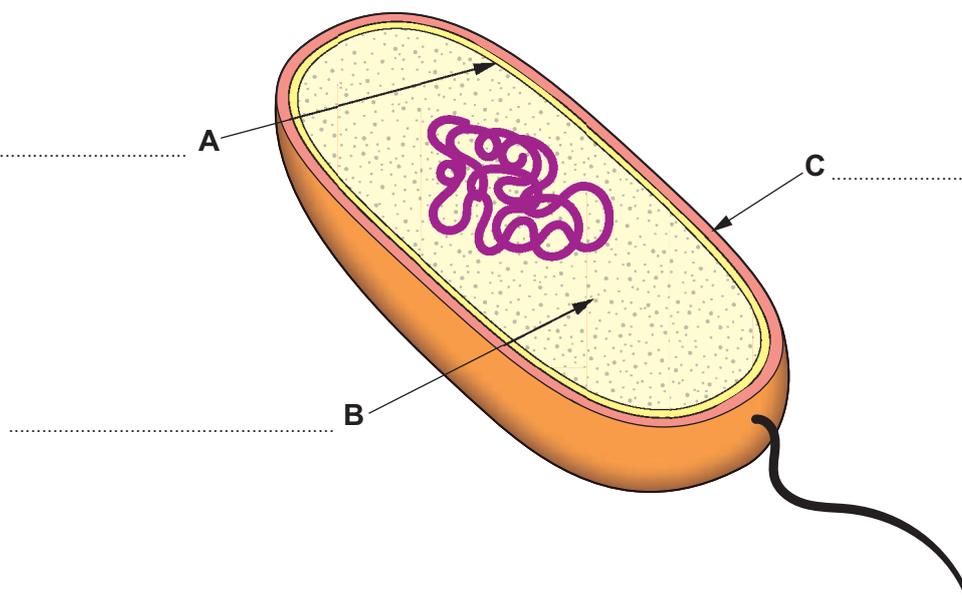
(a) Label structures **A**, **B** and **C** on the diagram above. [3]

(b) Carys wanted to investigate the effect of an antibiotic on bacterial growth. She set up the experiment shown below with test tubes containing increasing concentrations of an antibiotic and inoculated each test tube with a fixed volume of nutrient broth containing a known concentration of bacteria.

The tubes were incubated at 25 °C for two days. The cloudier the solution becomes the more bacteria present. A clear sample means there is no bacterial growth.

cloudy
solution

clear
solution
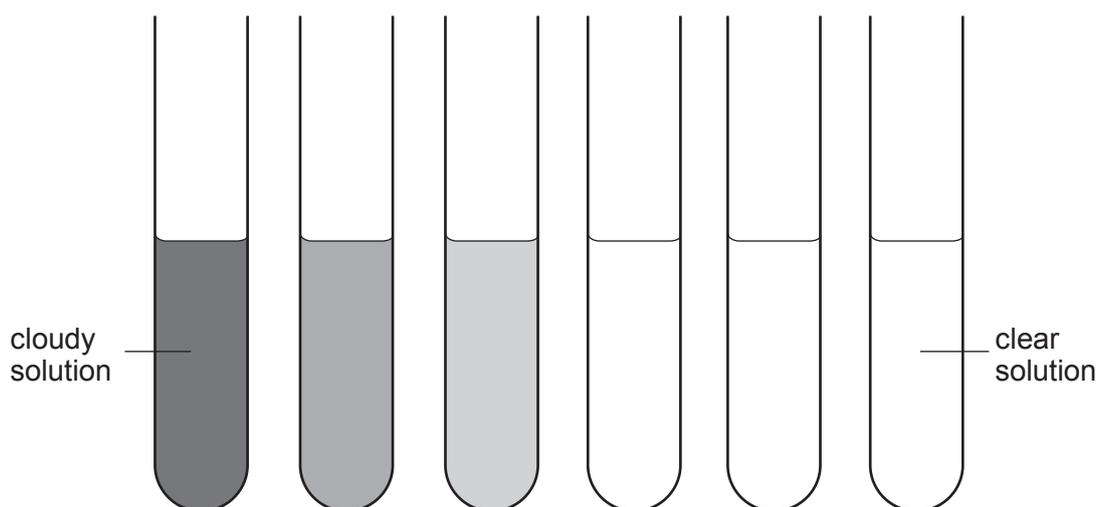
Tube number	1	2	3	4	5	6
Concentration of antibiotic (μg/cm^3)	0.25	0.50	1.00	2.00	4.00	8.00

(i) Explain the result observed in tubes **4–6**. [1]

....

....

(ii) Suggest the minimum concentration of antibiotic that would be effective against the bacterium. [1]

minimum concentration = ... µg/cm^3

(iii) Suggest how Carys could improve her experiment so that she could obtain a more accurate value for the minimum concentration of antibiotic needed to be effective against the bacterium. [2]

....

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....

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