

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

3400U20-1



TUESDAY, 16 MAY 2023 – MORNING

**BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms
FOUNDATION TIER**

1 hour 45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	6	
3.	9	
4.	10	
5.	6	
6.	14	
7.	8	
8.	11	
9.	9	
Total	80	

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 or correction fluid.

You may use pencil for graphs and diagrams only.

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 page 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 7(b) is a quality of extended response (QER) question where your writing skills will be assessed.



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Answer **all** questions.

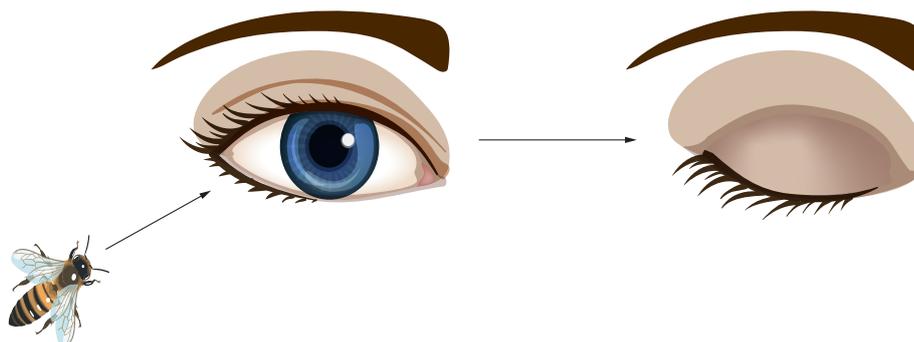
1. (a) Use some of the words from the box to **complete the sentences** about the nervous system. [4]

cornea	light	chemical	retina	electrical	receptor
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Sense organs contain groups of cells which respond to stimuli.

In the eye, cells in the respond to the stimulus of
and send impulses to the brain along neurones.

- (b) The diagram shows how the eye closes automatically (blinks) when something which may be harmful approaches.



Select the scientific term (**A**, **B** or **C**) for this type of action from the list below. [1]

- A** a release action
- B** a relax action
- C** a reflex action

Answer

- (c) Apart from happening automatically, state **two** other properties of actions such as blinking. [2]

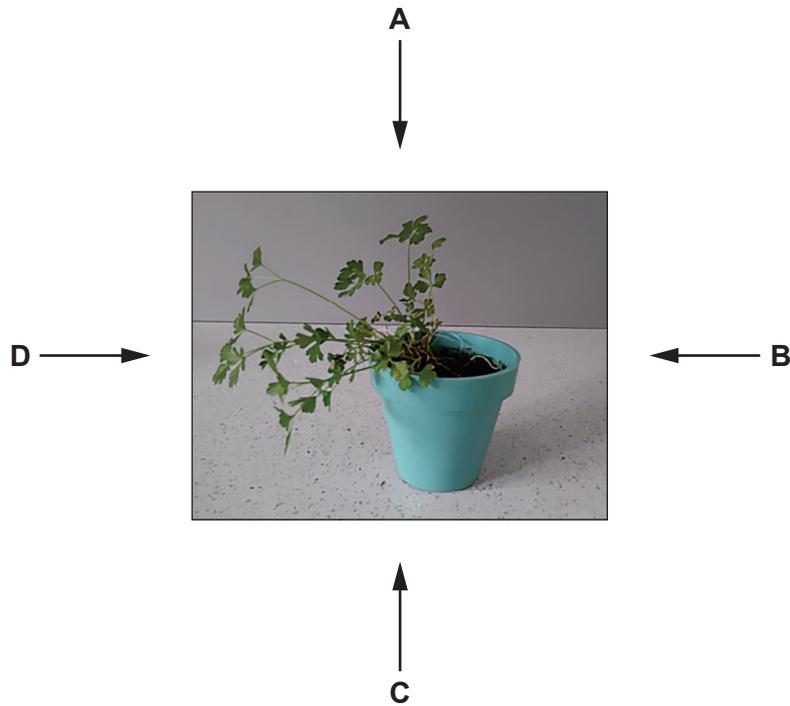
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2. **Image 2.1** shows a parsley plant (*Petroselinum sp.*) growing on a windowsill.

Image 2.1



The plant is showing a response to light called positive phototropism.

- (a) (i) State which **one** of arrows **A**, **B**, **C** or **D** on **Image 2.1** shows the main direction of light. [1]

Answer

- (ii) Underline the name of the plant hormone involved in the response. [1]

insulin

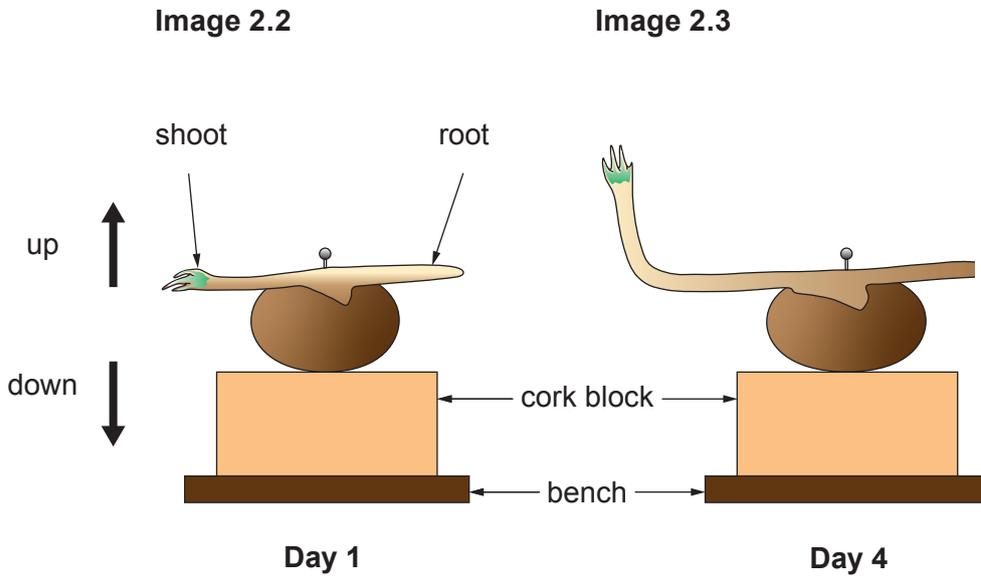
amylase

auxin



(b) **Images 2.2 and 2.3** show an investigation into the effect of gravity on the growth of a seedling which has been placed horizontally on a laboratory bench.

(i) **Complete Image 2.3** by drawing **the root** as you would expect to see it at **day 4**. [2]



(ii) I. State the name of the response of the root to gravity. [1]

.....

II. Explain why this response is important to the seedling. [1]

.....
.....

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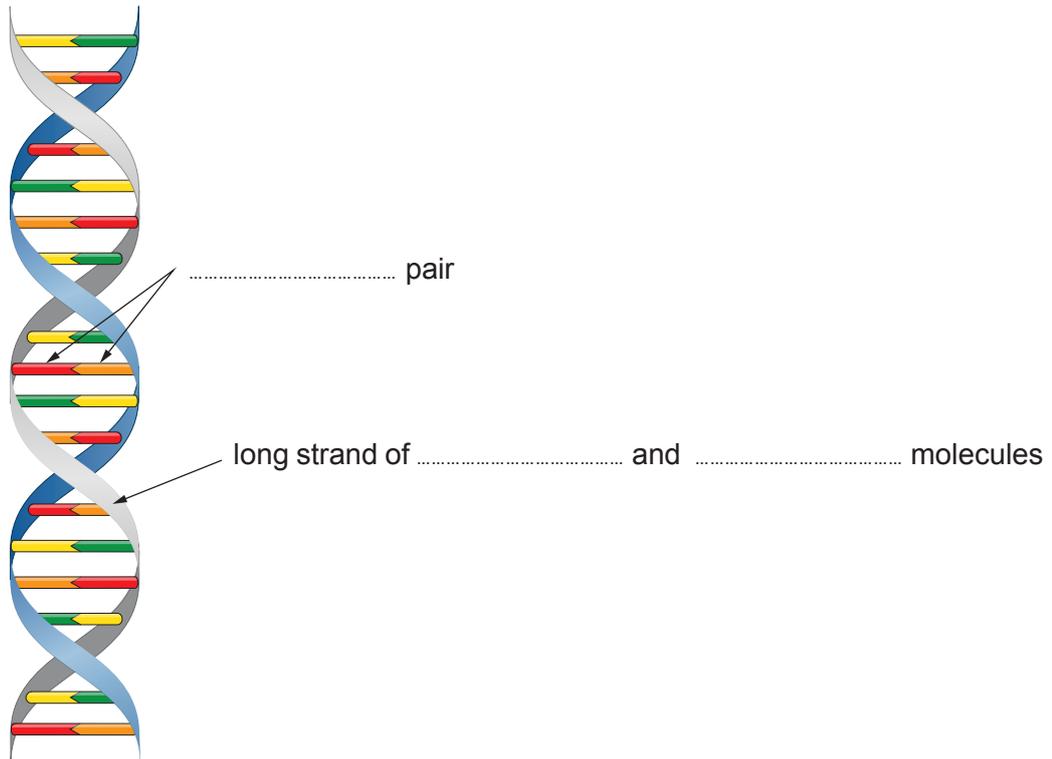


3. (a) **Image 3.1** shows part of a DNA molecule.

(i) **Complete the labels on Image 3.1** by choosing words from the box. [3]

phosphate	salt	base	sugar	amino acid
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Image 3.1



(ii) The shape of DNA is described as a twisted ladder. State the scientific term for this shape. [1]

.....

(b) The DNA of an individual can be analysed as a genetic profile.

Underline which **one** of the following correctly states how the DNA must first be treated in order to produce the bands in a genetic profile. [1]

Cut it into small pieces.

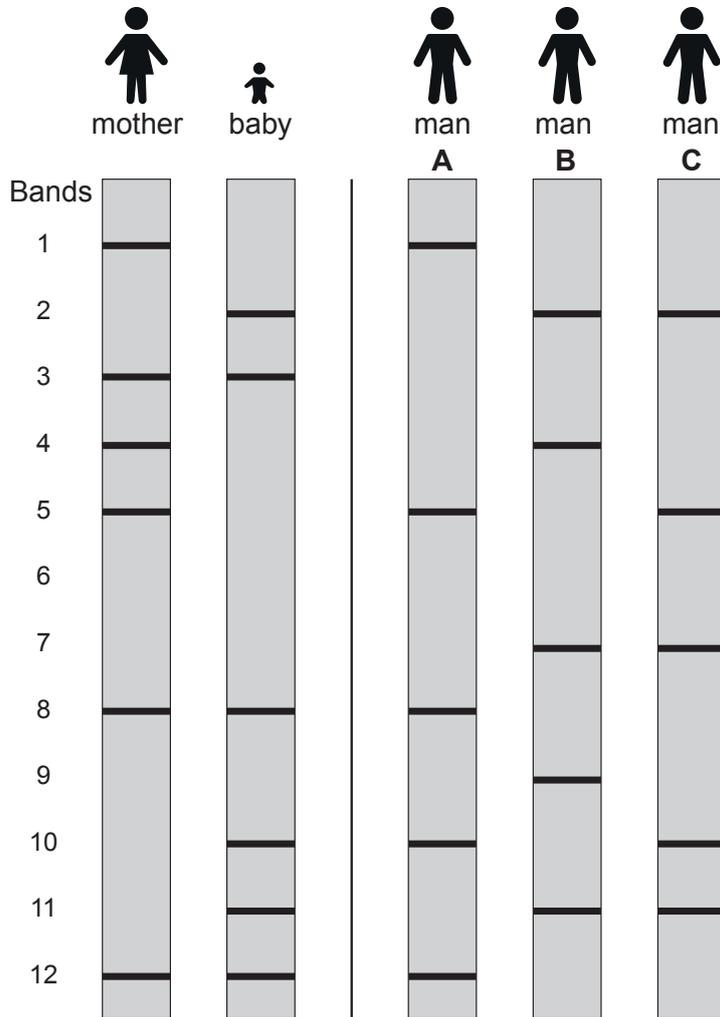
Place it in acid conditions.

Expose it to very low temperatures.



(c) **Image 3.2** shows the DNA profiles of people involved in a paternity test.

Image 3.2



- (i) In this baby's profile, three of the bands have come from the mother and three from the father.

Draw circles around the **three bands** in the **baby's profile** in **Image 3.2** which have come from the **mother**. [1]

- (ii) Use the DNA profiles to conclude which man (**A, B or C**) is the baby's father. Explain how you obtained your answer. [2]

.....

.....

.....

- (iii) Apart from paternity testing state **one** other use for DNA profiling. [1]

.....



4. In the 1980s young terrapins (*Trachemys scripta*) from North America were sold in pet shops throughout the UK. When the terrapins became adults, many people no longer wanted them and released them into local ponds. The animals can live for up to 50 years.



Young terrapin



Adult terrapin

Table 4.1

Terrapin age	Body length (mm)
3 months	25
2 years	50
12 years	300

After release, adult terrapins eat native animals including invertebrates and vertebrates such as frogs and fish. In some ponds, native species have been reduced or lost completely. Since 1992 a law has banned the import of terrapins into the UK.

Use the information to answer the questions.

- (a) Complete the classification of the terrapin.

[3]

Kingdom

Phylum Chordates (Vertebrates)

Class Reptiles

Genus

Species



- (b) (i) Calculate the increase in body length **per year** for an adult terrapin in the **ten years** between 2 years old and 12 years old. [2]

Increase in body length = mm/year

- (ii) Suggest **one** reason why some people did not want to keep the terrapins when they became too big. [1]

.....

.....

- (c) **Complete Table 4.2** by writing true or false for each of the statements. One row has been done for you. [3]

Table 4.2

Statement about terrapins in the UK	True / False
They can live for over 60 years.	False
They do not eat animals with backbones.
They have reduced the biodiversity in ponds.
They cannot be brought into the country legally.
They are an alien species.

- (d) In the USA, these terrapins are called red-eared sliders and in Welsh they are called terapin clustgoch.

State how scientists from different countries ensure that they are all talking about the same species. [1]

.....

.....

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5. The photograph shows a koala (*Phascolarctos cinereus*). These animals live in trees in Australia. Their chromosome number is 16.



- (a) (i) **Complete Table 5** about cell division in the koala.

[3]

Table 5

	Number
Number of chromosomes in one body cell.	16
Number of cells produced from one cell by mitosis .	
Number of chromosomes in each new cell produced by mitosis .	
Number of chromosomes in each new cell produced by meiosis .	

- (ii) State:

I. **one** function of mitosis;

[1]

.....

II. the scientific name for the daughter cells produced by meiosis.

[1]

.....



- (b) Another Australian animal, the grey kangaroo (*Macropus giganteus*) also has 16 chromosomes but its appearance is very different from the koala.



Underline which **one** of the following statements explains what causes the appearance of these two species to be different. [1]

They live in different habitats.

The genes on their chromosomes are different.

Their diet consists of different types of plants.



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6. Mair investigated four antibiotics (**A**, **B**, **C** and **D**) to compare how effective they were at killing bacteria.
- She set up four agar plates with bacteria growing on them.
 - She placed a filter paper disc containing a different antibiotic in the centre of each plate.
 - She put the plates in an incubator.
 - After three days, she measured the diameter of the clear zone where bacteria had been killed.
 - She calculated the area of the clear zone.

Image 6.1

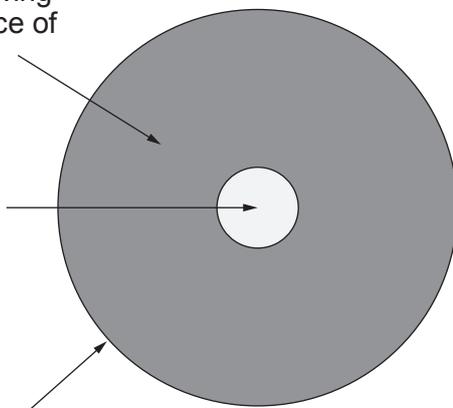
Agar plate at start of the investigation

Agar plate at three days

bacteria growing on the surface of the agar

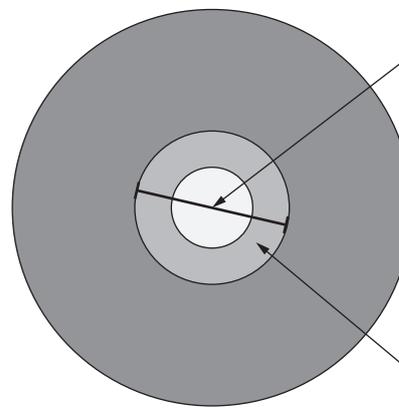
filter paper disc containing antibiotic

agar plate



diameter of clear zone

clear zone where bacteria have been killed



(a) Mair used aseptic techniques to set up the agar plates.

- (i) Explain why it was necessary for her to use **sterilised** forceps to place the filter paper discs on the agar. [1]

.....

.....

- (ii) Describe how she would have made sure that no bacteria from the environment could enter the agar plates after the filter paper discs were placed on the agar. [1]

.....

.....

(b) **Circle** the most suitable temperature for the incubator in a **school** laboratory from the choice below. [1]

10 °C 25 °C 37 °C 60 °C



(c) **Table 6.2** shows Mair's results.

Table 6.2

	Antibiotic A	Antibiotic B	Antibiotic C	Antibiotic D
Area of clear zone on agar plate (mm ²)	270	360	450

(i) The **radius** of the clear zone for antibiotic **C** was 11 mm.

Complete Table 6.2 by calculating the area of the clear zone for antibiotic **C**, using the formula below, where r = radius.

$$\text{Area of circle} = \pi r^2 \quad (\pi = 3.14)$$

Give your answer to the **nearest whole number**.
Space for working

[3]

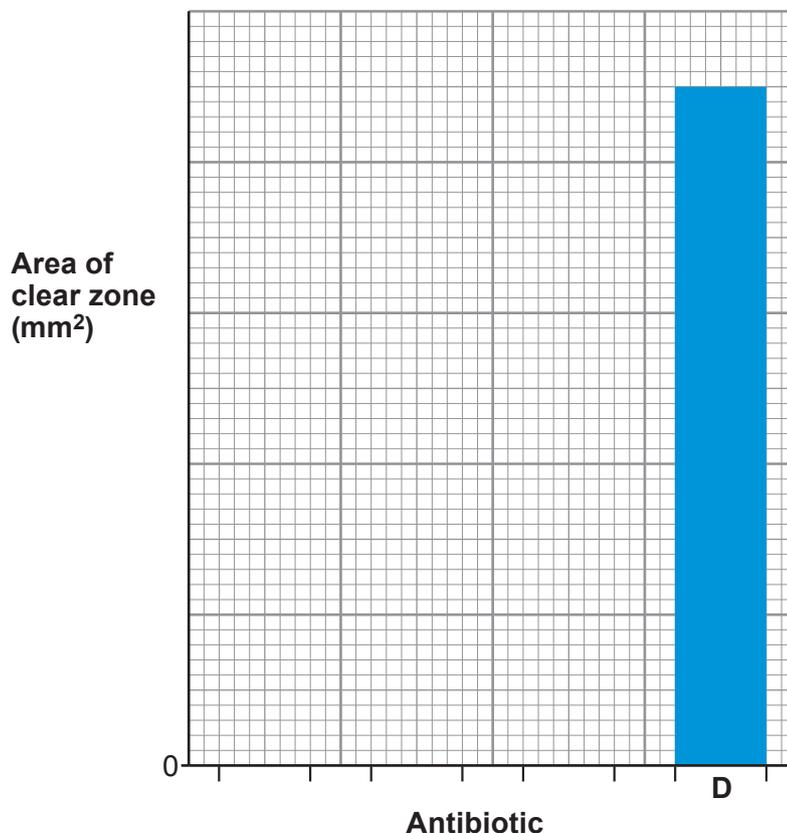
(ii) Use the data in **Table 6.2** to complete **Bar chart 6.3** by:

[3]

- I. adding the scale for the area of the clear zone .
- II. drawing bars for antibiotics **A**, **B** and **C** and labelling your bars.



Bar chart 6.3



(iii) From Bar chart 6.3, state which **one** of the antibiotics was the most effective and explain the reason for your choice. [3]

Antibiotic

Reason

.....

(d) (i) State how Mair could check that her results were reproducible. [1]

.....

(ii) Suggest **one** way in which the investigation could be extended to give more information about the effects of antibiotics on the growth of bacteria. [1]

.....

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7. **Image 7.1** shows a section through the skin.

(a) Complete labels **A** and **B** on **Image 7.1**.

[2]

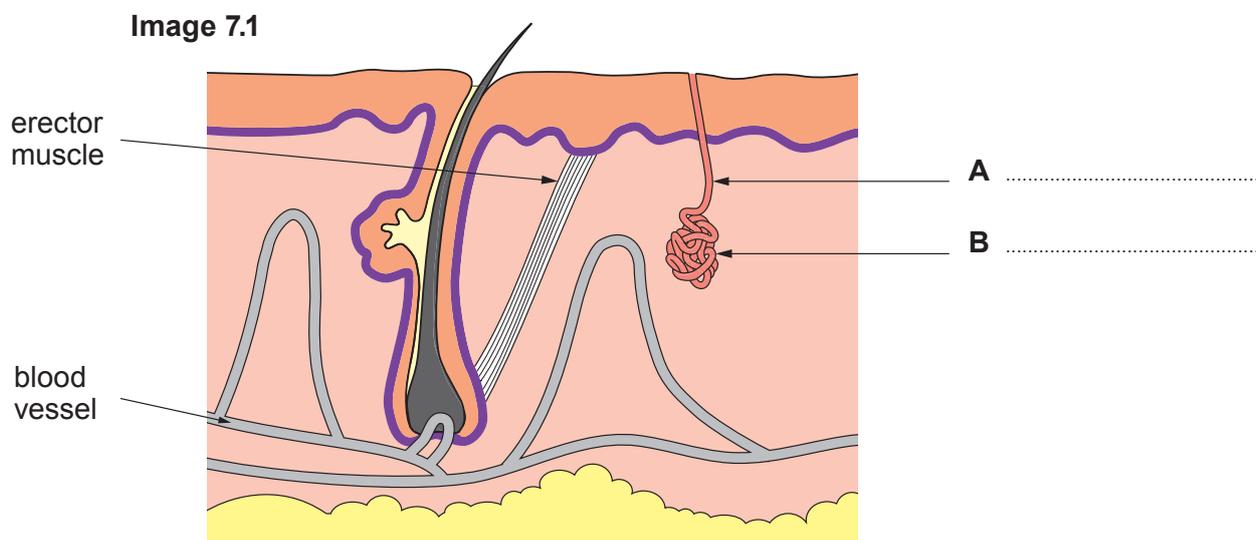


Table 7.2 shows some features of the skin at two air temperatures.

Table 7.2

	Air temperature	
	8 °C	28 °C
Volume of sweat produced per day (cm ³)	800	1600
Diameter of blood vessel (mm)	0.005	0.1
Erector muscle	contracted	relaxed

(b) Using the information in **Table 7.2**, describe the changes in the skin which occur as the air temperature increases. Explain how each of these changes helps to cool the body.

[6 QER]

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Examiner
only

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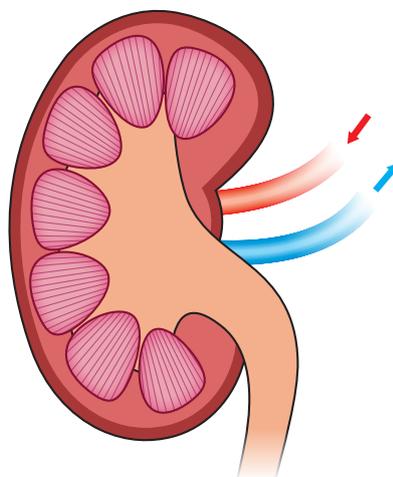
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8. **Image 8.1** shows a section through a human kidney.

Image 8.1



(a) **Draw arrows on Image 8.1** to label the following parts: [2]

- (i) the medulla;
- (ii) the renal artery.

(b) **Table 8.2** shows the results of an investigation on a patient in a hospital.

Table 8.2

Substance	Concentration in blood entering kidney (au)	Concentration in blood leaving kidney (au)	Present in urine (✓ or ✗)
glucose	145	32	✓
protein	120	120
urea	93	0

- (i) I. **Complete Table 8.2** to show which substance(s) would be present in the urine of this patient. One row has been done for you. [1]
- II. State which **one** of the substances is a waste product. [1]
.....
- III. Doctors suggested that this patient had diabetes. From **Table 8.2**, state the evidence to support this suggestion. [1]
.....
.....



(ii) Describe the chemical tests which could be carried out to confirm whether or not the urine contained glucose and protein. For each test state the colours you would expect **for the results shown in Table 8.2.**

I. glucose test [3]

.....

.....

.....

II. protein test [2]

.....

.....

(iii) **Complete the risk assessment** below which shows one hazard linked to these tests. [1]

Hazard	Risk	Control measure
Chemical reagent is an irritant

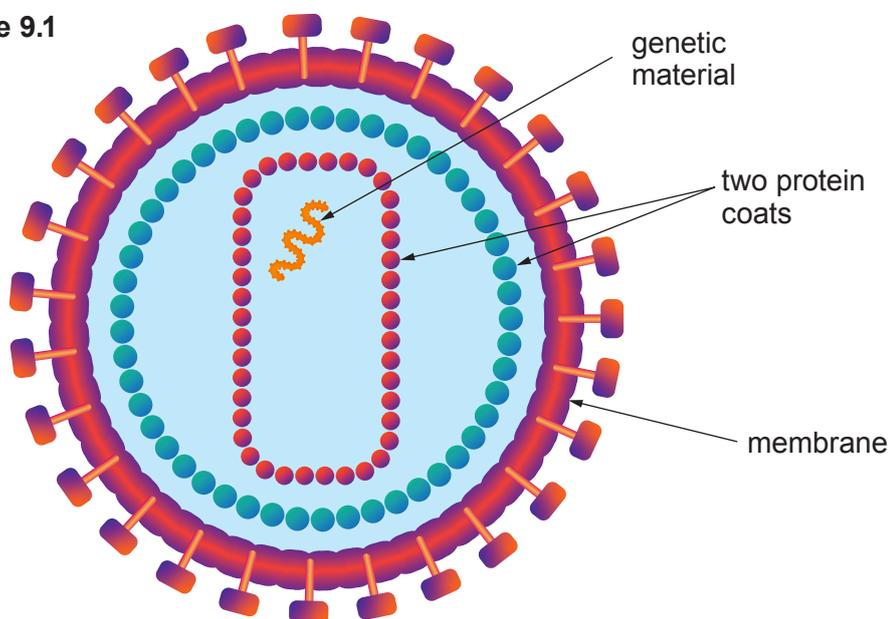
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9. **Image 9.1** shows the structure of the human immuno-deficiency virus (HIV).

In some of the people who have an HIV infection, the virus can lead to the disease AIDS, which can be fatal.

Image 9.1



(a) State **two** ways, visible in **Image 9.1**, in which the structure of HIV is different from other viruses. [1]

1.

2.

(b) State how HIV is spread from one person to another and **one** measure which can be taken to reduce the spread. [2]

.....

.....

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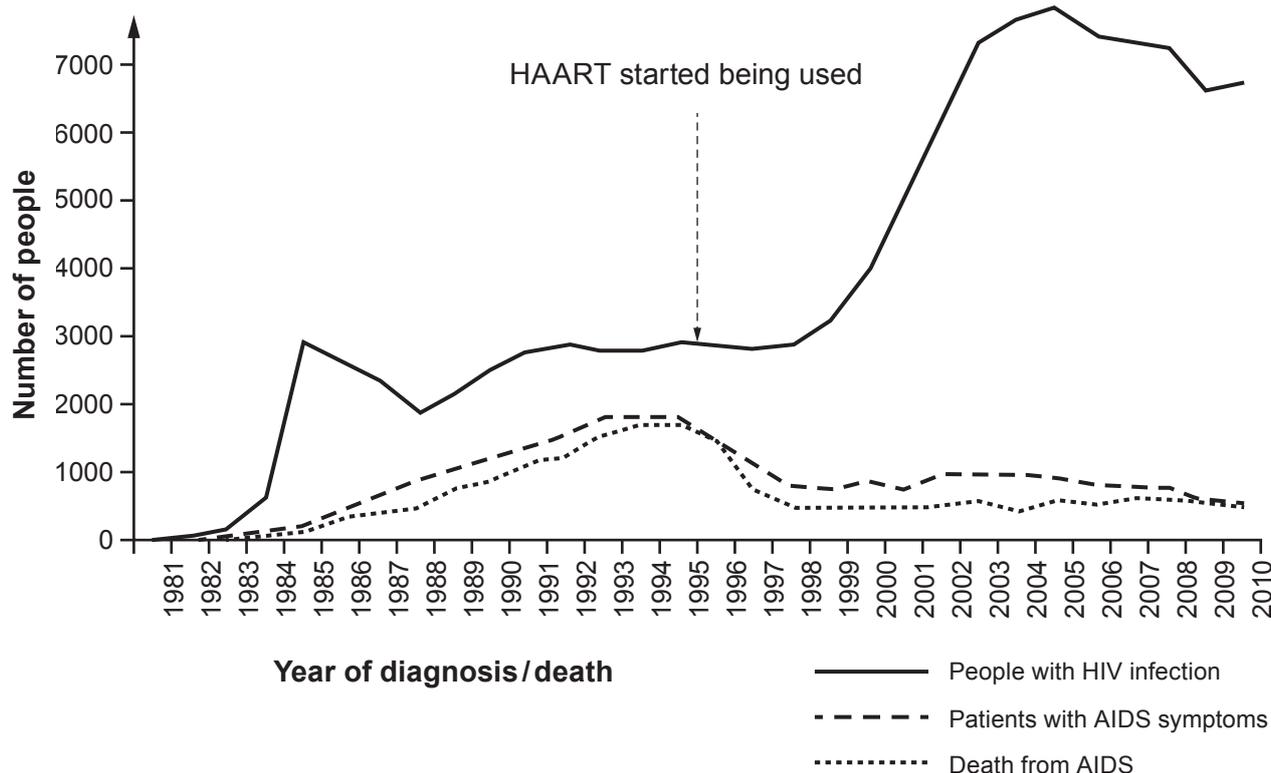


- (c) In 2000, the United Nations set a target that 90% of people with HIV should be receiving treatment. This treatment should be effective at reducing the number of people developing AIDS.

By 2010, 97% of people with HIV in the UK were being treated with the anti-viral drug, HAART.

Graph 9.2 shows the results from investigations on the effectiveness of HAART.

Graph 9.2



Using the information provided on this page, give the evidence that by 2010 the UK had met the UN target by

- (i) providing treatment to enough people; [1]

.....

- (ii) providing treatment which was effective. [1]

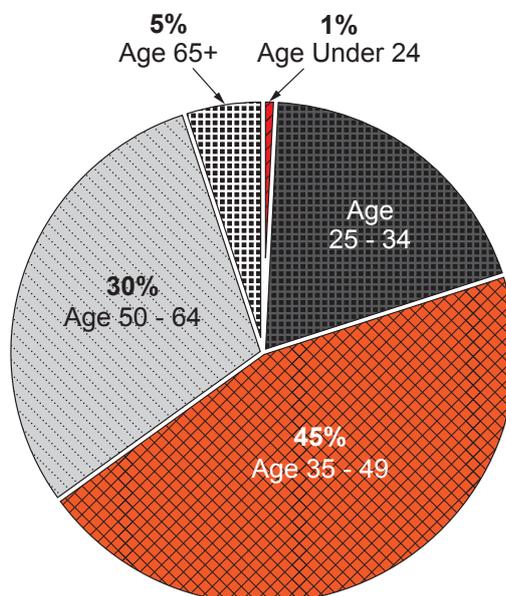
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- (d) **Graph 9.3** shows the percentages of people in different age groups in the UK who were known to be infected with HIV in 2017. The total number of infected people was 101 610.

Graph 9.3



People infected with HIV in the UK

From the information given above calculate

- (i) **the percentage** of people in the 25–34 age group, [1]

..... %

- (ii) **the number** of people in the 35–49 age group. [2]

..... people.

- (iii) Most campaigns which encourage people to take treatment for HIV infections are targeted at those under 35. Some charities, however, say it would be more effective to target campaigns at older age groups.

Using the information in **Graph 9.3**, state **one** piece of evidence which supports the point of view of some charities. [1]

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END OF PAPER



