OCR
Oxford Cambridge and RSA

Friday 10 May 2024 – Morning

GCSE (9–1) Biology A (Gateway Science)

J247/03 (Higher Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator
- an HB pencil

H

J247703

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Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined page at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **28** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **30 minutes** on this section.

Write your answer to each question in the box provided.

1 Cellulose is a complex carbohydrate.

Which monomers is cellulose made from?

A Amino acids

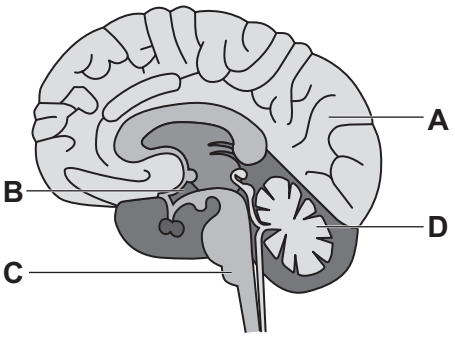
B Fatty acids

C Glycerol

D Simple sugars

Your answer ☐ **[1]**

2 The diagram shows the structure of the human brain.



Which part of the brain is highly folded into two hemispheres and controls language and memory?

Your answer ☐ **[1]**

3 Sensory neurones conduct impulses towards the central nervous system.

Which row is correct about what is included in the structure of a sensory neurone?

	Axon	Dendron
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

Your answer ☐ **[1]**

4 Which statement describes how the body responds to cold temperatures?

A Shivering and vasoconstriction

B Shivering and vasodilation

C Sweating and vasoconstriction

D Sweating and vasodilation

Your answer ☐ **[1]**

5 Which substance in urine does the biuret test identify?

A Glucose

B Ions

C Protein

D Red blood cells

Your answer ☐ **[1]**

6 A section of DNA is analysed to find the percentage of each of the four bases present.
16% of the DNA is guanine.

What is the percentage of the other bases in this section of DNA?

A 16% Adenine, 16% Cytosine, 52% Thymine

B 16% Adenine, 34% Cytosine, 34% Thymine

C 34% Adenine, 16% Cytosine, 34% Thymine

D 34% Adenine, 34% Cytosine, 16% Thymine

Your answer ☐ **[1]**

7 Which statement about DNA is correct?

A DNA codes for the production of amino acids.

B DNA contains specific sequences of amino acids and bases.

C DNA is a polymer made of three different nucleotides.

D DNA nucleotides consist of a base, a sugar and a phosphate.

Your answer ☐ **[1]**

8 What is the correct sequence of events in one cell cycle?

A Growth of the cell, DNA replication, movement of the chromosomes

B Growth of the cell, movement of the chromosomes, DNA replication

C Movement of the chromosomes, DNA replication, growth of the cell

D Movement of the chromosomes, growth of the cell, DNA replication

Your answer ☐ **[1]**

9 Most people have two kidneys.
The two kidneys filter 200 litres of blood every day.

How much blood does **one** kidney filter per hour?

A 0.417 litres

B 8.33 litres

C 4170 millilitres

D 8333 millilitres

Your answer ☐ **[1]**

10 Which hormones are used in the female contraceptive pill?

A FSH and LH

B LH only

C Oestrogen only

D Progesterone and oestrogen

Your answer ☐ **[1]**

11 A person focuses on a distant object.

Which row describes the ciliary muscles and suspensory ligaments in their eye?

	Ciliary muscles	**Suspensory ligaments**
A	contracted	loose
B	contracted	tight
C	relaxed	loose
D	relaxed	tight

Your answer ☐ **[1]**

12 Alcohol reduces the release of ADH.

Which statement describes the effect on urine from drinking alcohol?

A Concentrated urine with a higher volume

B Concentrated urine with a lower volume

C Diluted urine with a higher volume

D Diluted urine with a lower volume

Your answer ☐ **[1]**

13 What is the balanced equation for photosynthesis?

A $3CO_2 + 3H_2O \rightarrow C_6H_{12}O_6 + 3O_2$

B $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

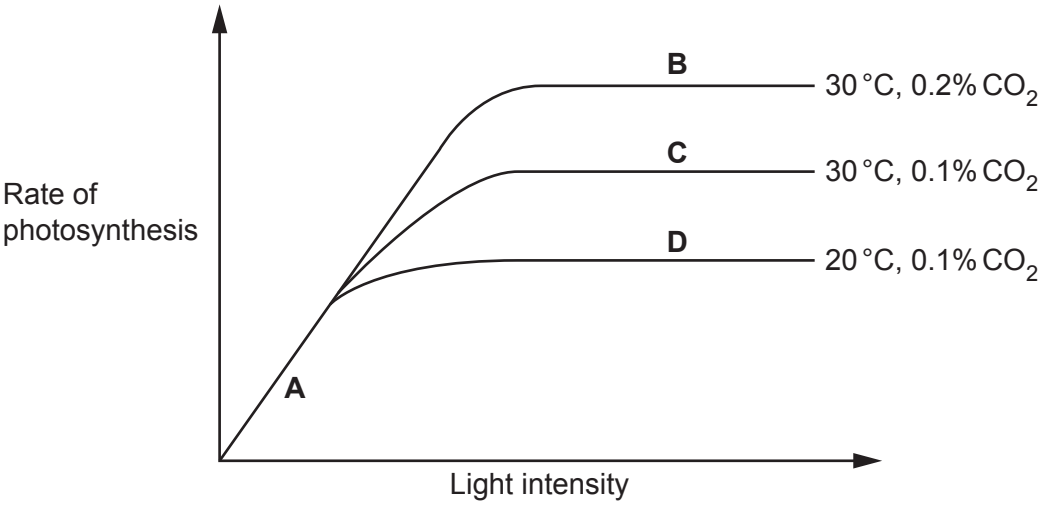
C $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$

D $6H_2O + 6O_2 \rightarrow C_6H_{12}O_6 + 6CO_2$

Your answer ☐ **[1]**

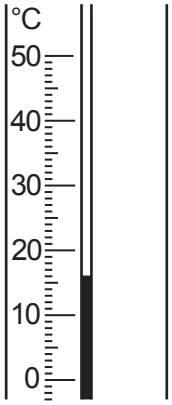
14 The graph shows the effect of light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis.

At which point, **A**, **B**, **C** or **D** is light the limiting factor for photosynthesis?



Your answer ☐ **[1]**

15 In an experiment to investigate the effect of temperature on transpiration, a student measures the air temperature with a thermometer.



They use a thermometer that has a scale with 1 °C divisions.
The student measures the temperature as 16 °C.

What is the degree of uncertainty of the measurement?

A +/– 0.5 °C

B +/– 1 °C

C +/– 2 °C

D +/– 5 °C

Your answer ☐ **[1]**

Section B

16 A student investigates the effect of different concentrations of sugar solution on cubes of beetroot.

This is the method that they use:

Step 1 Cut four cubes of beetroot tissue.

Step 2 Place each beetroot cube in a test tube containing a different concentration of sugar solution.

Step 3 Leave the beetroot cubes in the sugar solutions for 3 hours.

Step 4 Remove the beetroot cubes from the sugar solutions.

(a) The student wants to calculate the percentage change in mass for each beetroot cube.

They want to use the method above to collect the data they need, but have missed some steps from the method.

Describe the **additional** steps needed in the method to find the data.

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.....

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.....

.....

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

(b) State **two** variables that the student should control in this investigation.

1 .....

2 .....

[2]

(c) Describe how the student could find out if their data is both repeatable and reproducible.

Repeatable .....

.....

.....

Reproducible .....

.....

.....

[3]

(d) Two of the beetroot cubes increased in mass.

Explain why some of the beetroot cubes will increase in mass.

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

17 In 2013, scientists researched the use of stem cells to reverse hearing loss.
The scientists used 18 individual rodents for this research.

- They used a chemical to cause deafness in one ear of each rodent.
- They used stem cells to grow nerve cells in the lab.
- They transferred approximately 50 000 nerve cells into each rodent's ear.
- After 10 weeks they tested the rodents' hearing.

(a)

(i) What type of stem cell will the scientists have used?

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

(ii) Why will the scientists have used this type of stem cell?
Tick (✓) **one** box.

Can differentiate into any type of cell ☐

Can differentiate into some types of cells ☐

Easy to collect ☐

[1]

(b) Results from the research showed that the 18 rodents regained an average of 46% of their hearing.

(i) One of the scientists claims 'this research shows that our method will cure people who have a similar hearing problem'.

State **three** reasons why this scientist's claim is **incorrect**.

1 .....

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2 .....

.....

3 .....

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[3]

(ii) Suggest **one** way the scientists could extend their research.

.....

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

(c) The scientists discover that a different technique could one day be used to successfully treat 15% of the 10 million people who have hearing loss.

Calculate how many of the 10 million people with hearing loss could benefit from this technique.

Number of people = ... million **[2]**

18 Organisms use systems to transport substances around their bodies.

(a) The words in the list are processes and parts of transport systems in animals and plants.

Aorta	**Photosynthesis**	**Pulmonary artery**	**Pulmonary vein**
Respiration	**Translocation**	**Transpiration**	**Vena cava**

Answer parts **(i)**, **(ii)** and **(iii)** using words from the list.

(i) Name the blood vessel that transports blood from the left ventricle to the rest of the body.

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

(ii) Name the process that plants use to transport sugars to the roots.

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

(iii) Name the blood vessel that transports blood to the right atrium.

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

(b) The substances transported around the organism enter cells either by active transport, diffusion or osmosis.

For each substance indicate which method of transport is used.

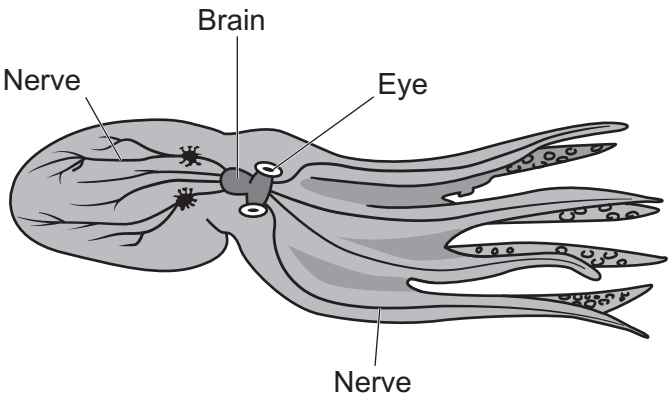
Tick (✓) **one** box in each row.

Substance	**Active transport**	**Diffusion**	**Osmosis**
Water moving into guard cells			
Mineral ions moving into root hair cells against a concentration gradient			
Oxygen entering red blood cells			

[3]

19 **Fig. 19.1** shows the nervous system of an octopus.

Fig. 19.1



(a) Compare the nervous system of the octopus in **Fig. 19.1** to that of a human.

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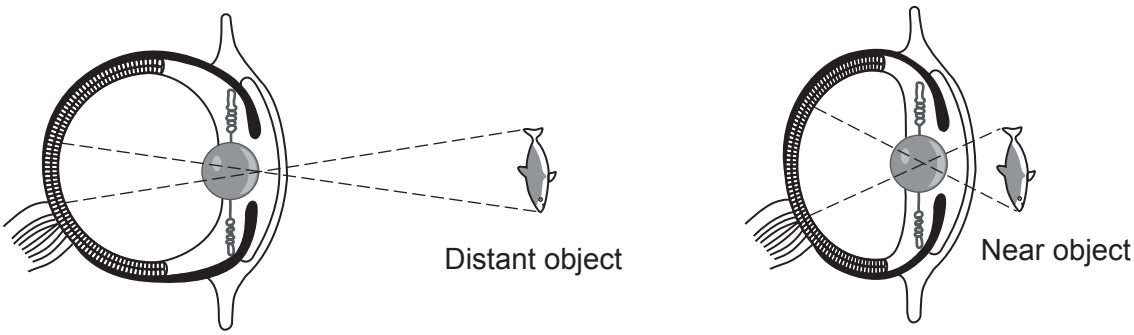
..... **[3]**

(b) **Fig. 19.2** shows changes in an octopus's eye when it adjusts from focusing on a distant object to focusing on a near object.

Fig. 19.2



Give **two** differences, shown on the diagram, between this process in the octopus compared to in a human.

1 .....

.....

2 .....

.....

[2]

(c) The table shows some data from three species.

Species	Eye size (mm)	Body mass (g)	Eye size : body mass ratio
Human	24	64 008	1:2667
Octopus	20	200	
Owl	28	784	1:28

(i) Calculate the eye size : body mass ratio for the octopus.

Ratio = ... **[2]**

(ii) Owls hunt at night.

Explain how their eye size : body mass ratio makes them adapted to hunt at night.

.....

.....

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

20 Plant hormones have a variety of effects on plants.

(a) Plant hormones control many processes in plants.

Complete these sentences by writing the correct plant hormones in the gaps.

Each hormone can be used more than once.

Flowers are sometimes sprayed with ..... to produce fruits without seeds.

After fruits are picked, they can be exposed to ..... to make them ripen.

Flowers are stimulated to open, and seeds made to break dormancy by the hormone

..... .

Selective weedkillers and rooting powders usually contain ..... .

[4]

(b) Plant hormones are also responsible for controlling the growth of stems.

Describe how cells are produced to allow stems to grow.

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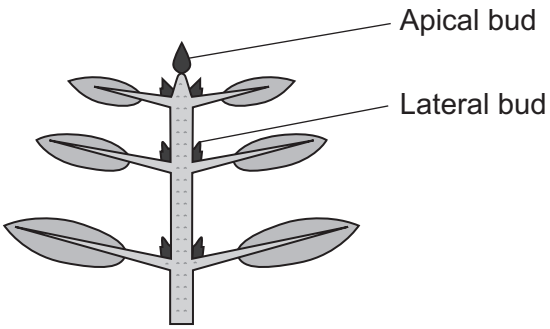
..... **[2]**

(c) **Fig. 20.1** shows buds growing on a plant.

Fig. 20.1

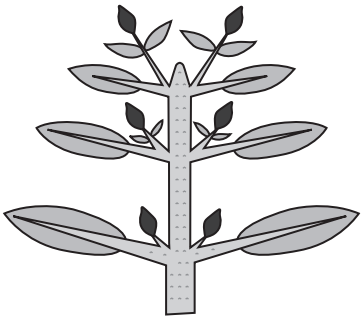


The apical bud affects the growth of the lateral buds. This effect is called apical dominance.

A scientist investigates how auxin produced in the apical bud prevents the growth of the lateral buds.

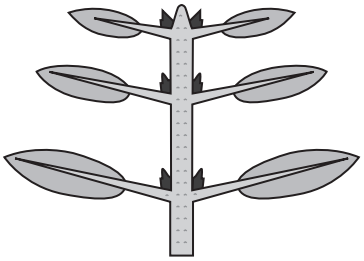
The results of the experiment are shown in **Fig. 20.2** and **Fig. 20.3**.

Fig. 20.2



The apical bud is cut off and the plant is left to grow for two weeks.

Fig. 20.3



The apical bud is cut off and auxin is applied to the top. The plant is left to grow for two weeks.

Explain how the results of the experiment support the theory that auxin from the apical bud prevents the growth of lateral buds.

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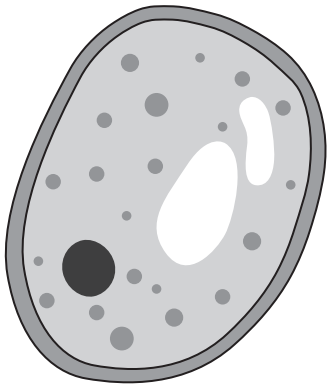
..... **[2]**

21 Yeast is a fungus.

(a) The diagram shows a yeast cell.



(i) Name **two** sub-cellular structures the yeast cell has in common with both animal and plant cells.

1 .....

2 .....

[2]

(ii) Yeast is classified as a fungus and not as a plant or animal.

Explain why fungi are **not** classified as plants or as animals.

Use the diagram.

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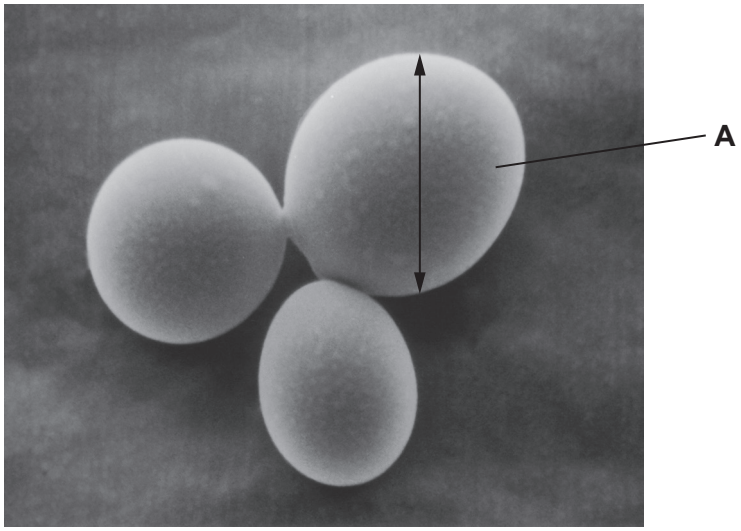
..... **[1]**

(b) The image is of some yeast cells taken using an electron microscope.



The actual diameter of the yeast cell labelled **A** is 2.8 μm.

(1 mm = 1000 μm)

Calculate the magnification used to produce this image.

Give your answer to **3** significant figures.

Magnification = ... **[4]**

(c) The cells in the image are baker's yeast.

Baker's yeast is used to make bread. The yeast respires anaerobically.

Which product of this process will help the bread rise?

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

22 Some people have a condition called varicose veins.

This condition is caused when the valves in veins do not shut properly.

(a) Describe the effect that this condition will have on blood flow.

.....

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

(b) Suggest **one** symptom someone with varicose veins can have.

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

(c) The data in the table shows the results from a study by scientists on varicose veins.

Age group	Number of people with varicose veins	Percentage of people with varicose veins who are male (%)
< 30	3659	37.1
30–39	9691	27.2
40–49	11343	32.1
50–59	9922	39.6
60–69	5671	43.9
70+	3438	33.3

Give **two** conclusions that can be made from the data in the table.

Conclusion 1

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Conclusion 2

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.....

[2]

(d) The study was investigating a potential link between varicose veins and other circulatory conditions.

The study recorded how many of **43 724 people with varicose veins** had three other circulatory conditions. The results are shown in **Table 22.1**.

Table 22.1

Circulatory condition	Number of people with varicose veins
Deep vein thrombosis	458
Heart attack	1434
Stroke	1116

The study also recorded how many of **18 491 people without varicose veins** had the three other circulatory conditions. The results are shown in **Table 22.2**.

Table 22.2

Circulatory condition	Number of people without varicose veins
Deep vein thrombosis	79
Heart attack	638
Stroke	472

(i) The scientists stated this conclusion from the study:

> Individuals with varicose veins were at a greater risk of deep vein thrombosis. However, they were not at a greater risk of the other circulatory conditions.

Explain how they came to this conclusion.

You will need to use calculations to compare the data in **Table 22.1** and **Table 22.2**.

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

(ii) The results of this study were published in a peer reviewed journal.

What are **two** benefits of reading information that has been peer reviewed?

1 .....

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2 .....

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[2]

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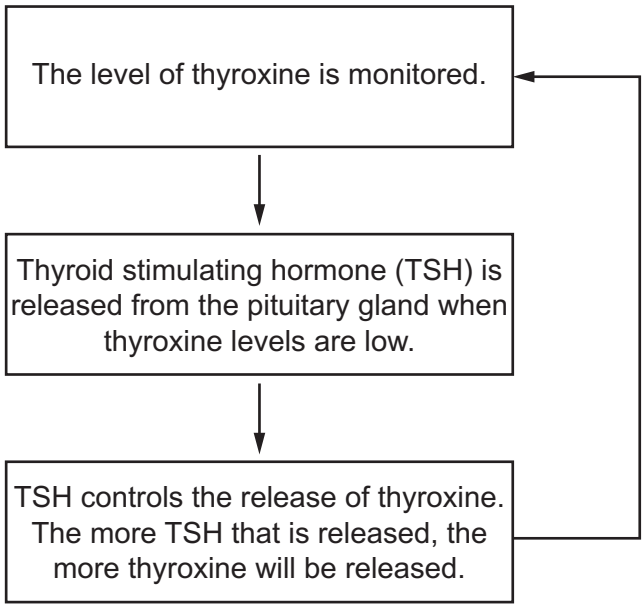
23 Thyroxine is a hormone that regulates metabolism.

The diagram outlines how the release of thyroxine is controlled by the body.



(a) Explain the processes involved in negative feedback and how they are used in the control of thyroxine.

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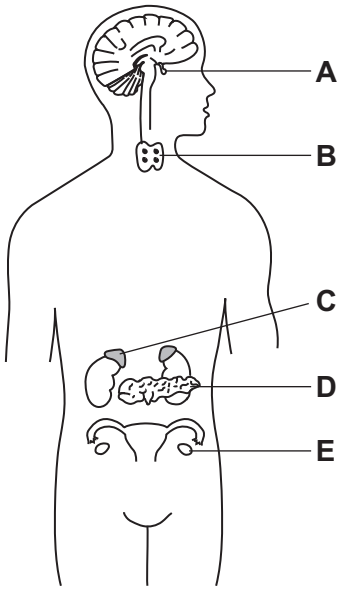
..... **[3]**

(b) This diagram shows the position of different endocrine glands in the body.



Identify the letter on the diagram that shows the position of:

- the pituitary gland .....
- the gland that produces thyroxine ..... .

[2]

(c) Describe how hormones are transported around the body to their targeted organs.

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.....

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

24 Glycogen storage disease is caused by a mutation in the DNA that codes for an enzyme (a protein) that converts glycogen into glucose.

The mutation changes the triplet codes in the DNA.

(a)* Describe how a change to the triplet codes in the DNA can prevent the enzyme working and how this can affect the person's blood glucose level.

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

(b) Glucose is often found in the urine of people who have diabetes.

Benedict's solution is used to detect glucose in the urine.

It is also used to give a measure of the concentration of glucose in a sample.

Describe how the results of the Benedict's test can give a measure of the concentration of glucose in a sample.

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

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.