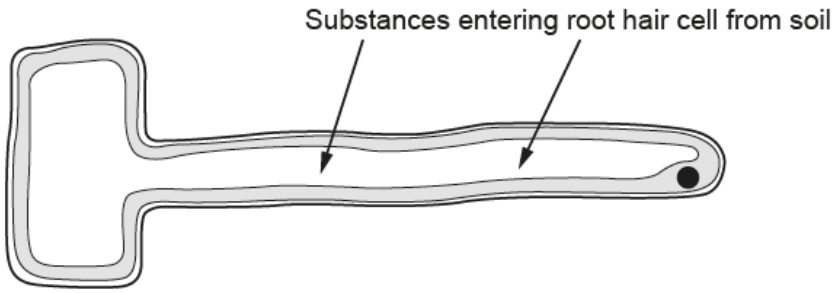
Scaling up – 2021/20 GCSE Gateway Biology A

1. Nov 2020/Paper_J247/01/No.3

Which substances are absorbed from the soil by the root hair cell?



A Carbohydrates and proteins

B Carbon dioxide and nitrogen

C Proteins and vitamins

D Water and mineral ions

Your answer ☐ **[1]**

2. Nov 2020/Paper_J247/01/No.5

Which type of cell can divide to produce a range of different cell types?

A Heart cell

B Neurone cell

C Sperm cell

D Stem cell

Your answer ☐ **[1]**

3. Nov 2020/Paper_J247/01/No.6

Which process moves food around in plants?

A Osmosis

B Respiration

C Translocation

D Transpiration

Your answer ☐ **[1]**

4. Nov 2020/Paper_J247/01/No.7

Some plants can wilt if they lose more water than they take up.

Which conditions make a plant **most** likely to wilt?

A Higher wind speed and lower temperature

B Lower wind speed and lower temperature

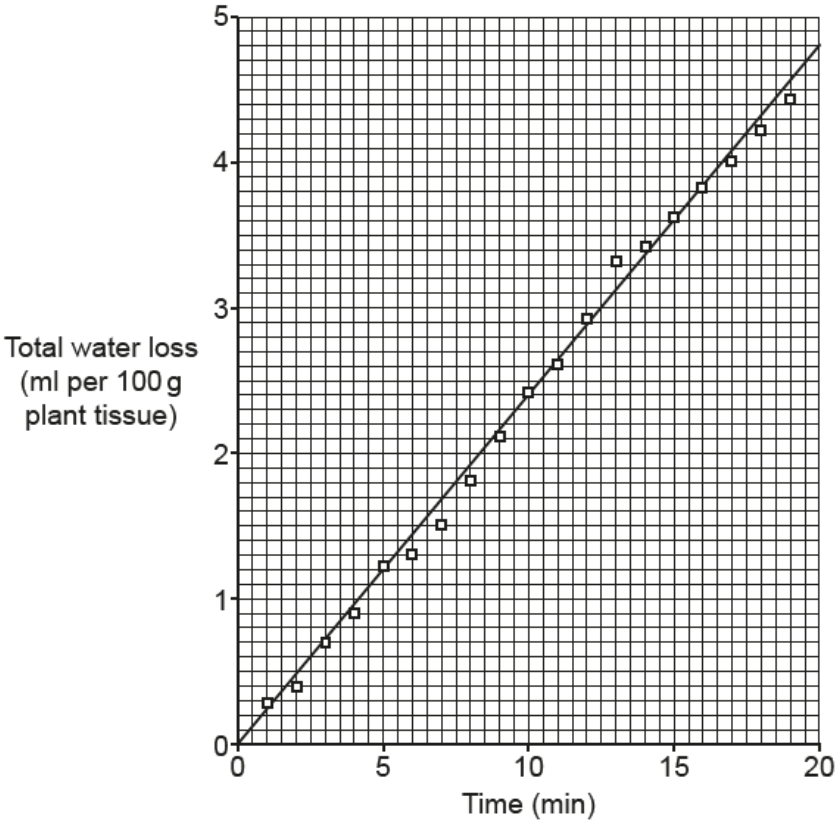
C Lower wind speed and higher temperature

D Higher wind speed and higher temperature

Your answer ☐ **[1]**

5. Nov 2020/Paper_J247/01/No.8

The graph shows total water loss from a plant.



Calculate the water lost between 5 and 15 minutes using the line of best fit.

A 2.2 ml per 100 g

B 2.4 ml per 100 g

C 2.6 ml per 100 g

D 2.8 ml per 100 g

Your answer ☐ **[1]**

6. Nov 2020/Paper_J247/01/No.11

Plants growing in swamps have special roots that grow **upwards** through waterlogged soil to get oxygen from air.

What type of response do these roots show?

A Negative germination

B Negative gravitropism

C Positive germination

D Positive gravitropism

Your answer ☐ **[1]**

7. Nov 2020/Paper_J247/01/No.21

Some students investigate the effect of the surface area : volume ratio on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 21.1 shows the apparatus they use.

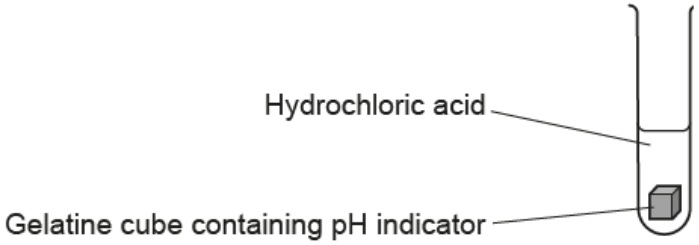


Fig. 21.1

The table shows the students' results.

Length of each side of the cube (mm)	surface area : volume ratio	Time to completely change colour (seconds)
2	.....	32
4	3 : 2	61
6	1 : 1	170

(a) (i) Calculate the surface area : volume ratio for the cube with sides of 2 mm.

surface area : volume ratio = ... **[2]**

(ii) What conclusion can be made about the effect of surface area : volume ratio on the rate of diffusion?

.....

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

(iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

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

(b) In a condition called sickle cell anaemia, the red blood cells can change shape. This reduces the amount of oxygen getting to cells in the body.

Fig. 21.2 shows a red blood cell and a sickled red blood cell.

Red blood cell **Sickled red blood cell**

Fig. 21.2

Explain why sickle cell anaemia reduces the amount of oxygen getting to cells in the body.

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

(c) Red blood cells burst when they are placed in a solution with a much higher water potential than the red blood cells. This is called lysis.

Explain why lysis happens.

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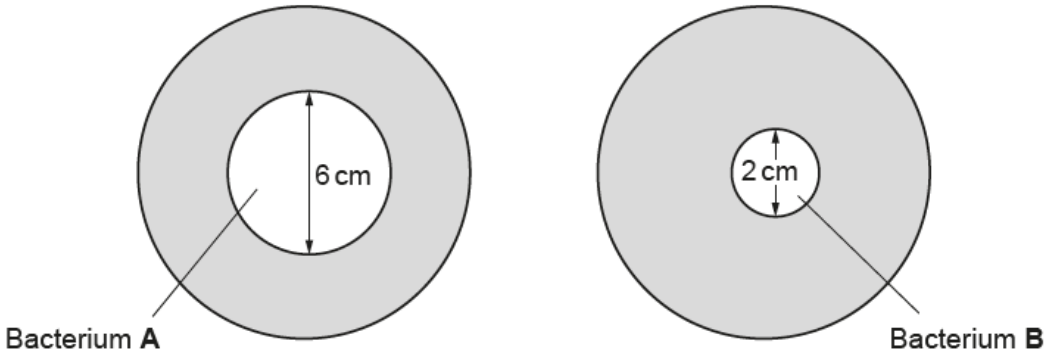
..... **[3]**

8. Nov 2021/Paper_J247/04/No.6

The diagram shows colonies of bacteria growing on two agar plates.



What is the ratio of the area covered by bacterium **A** compared to the area covered by bacterium **B**? (The area of a circle = πr^2)

A 1:3

B 1:9

C 3:1

D 9:1

Your answer ☐ **[1]**

9. Nov 2020/Paper_J247/04/No.19

Fanconi anaemia is a genetic disorder. It results in the bone marrow being destroyed. This causes a decrease in the numbers of red blood cells, white blood cells and platelets.

(a) Explain **two** possible symptoms of Fanconi anaemia.

1 .....

.....

2 .....

.....

[2]

(b) **Table 19.1** shows normal ranges for blood components in people **without** Fanconi anaemia.

Blood component	Number per mm^3
red blood cell	$4.5–6.5 \times 10^6$
white blood cell	$6.0–16.0 \times 10^3$
platelet	$1.5–4.0 \times 10^5$

Table 19.1

(i) Suggest why there is such a wide range of white blood cell numbers.

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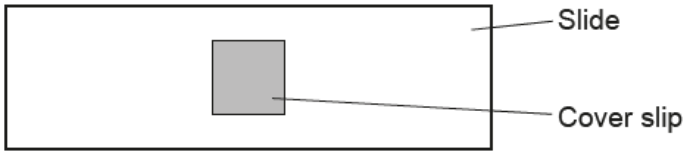
..... **[2]**

(ii) The diagram shows a microscope slide containing blood from a patient.



The square cover slip is 10 mm wide and the thickness of the blood underneath is 0.001 mm.

Calculate the volume of blood under the cover slip.

Volume of blood = ... mm^3 **[1]**

(iii) Under the cover slip are 1000 white blood cells.

Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use **Table 19.1** and your answer to part **(b)(ii)** to justify your answer.

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

(c) There are many different genetic disorders that can affect blood cells. Details of three of these are found in **Table 19.2**.

Name of disorder	Cause of disorder	Symptom
D-B anaemia	dominant allele	low red blood cell numbers
S-D syndrome	recessive allele	low white blood cell numbers
Fanconi anaemia	recessive allele	small numbers of all blood cells

Table 19.2

A blood smear from another patient shows that he has 3×10^6 red blood cells per mm^3 of blood. Neither of his parents have a blood disorder.

Use **Table 19.1** and **Table 19.2** to explain which blood disorder the patient could have.

Name of disorder .....

Explanation .....

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

10. Nov 2020/Paper_J247/04/No.20

Fig. 20.1 is a diagram of an antibody molecule. Antibodies are protein molecules. The ends of the antibody molecule bind with a particular antigen molecule.

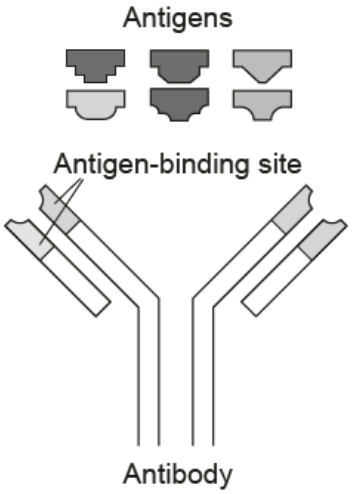

Fig. 20.1

(a) Explain why a different antibody molecule is needed for each antigen.

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

(b) Large quantities of one type of antibody can be made by the process shown in **Fig. 20.2**.

These antibodies are called monoclonal antibodies.

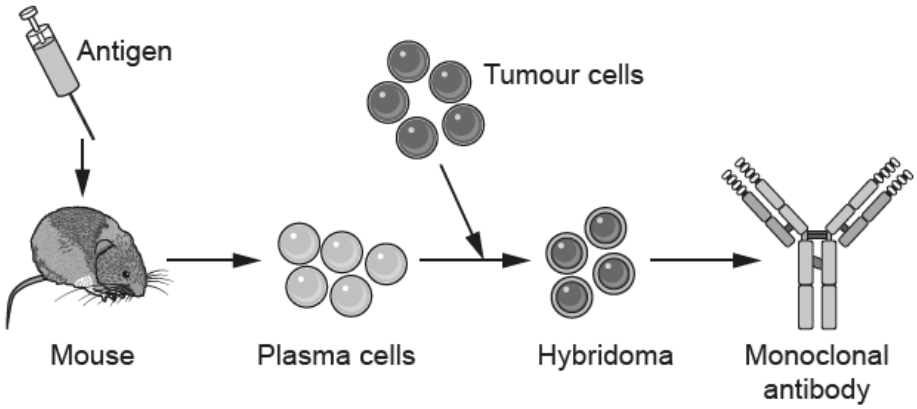

Fig. 20.2

(i) Give **two** uses of monoclonal antibodies.

1 .....

2 .....

[2]

(ii) Why are tumour cells used in this process?

.....

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

(c) Two scientists discovered a different method of making monoclonal antibodies.

They put genes that code for many different antibodies into viruses. The viruses then make the antibodies on their surfaces.

If an antigen attaches to an antibody, the scientists use the gene for this antibody to genetically engineer bacteria. The bacteria are then used to make large quantities of the antibody.

(i) Describe how scientists could use the antibody gene to genetically engineer bacteria to make many copies of the antibody.

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

(ii) Many people would prefer to use antibodies made using bacteria and viruses, rather than the method shown in **Fig. 20.2**.

Suggest an explanation for this.

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

(iii) In 2018, the scientists were awarded the Nobel Prize for their work.

Explain why their work had to be peer reviewed before they were awarded the prize.

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