OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



EXAM QUESTION PACK

M1 ARITHMETIC AND NUMERICAL COMPUTATION

SCORE	PERCENTAGE
/55	%

STEMUP

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Gateway Biology A (9-1)

Maths 1: Arithmetic and numerical computation

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **55**.
- The total number of marks may take into account some 'either/or' question choices.

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1 A student uses a light microscope to see cheek cells.

One cell is shown in **Fig. 16.1**.

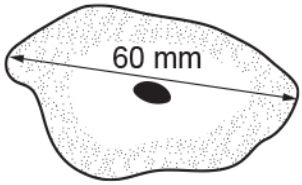


Fig. 16.1

(i) The actual size of the cheek cell is 0.03 mm.

Calculate the magnification of the drawing.

Use the equation: magnification = measured size ÷ actual size

Magnification = × ..... **[2]**

(ii) Which type of substance is used to make structures inside the cell easier to see when using a light microscope?

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

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2 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.

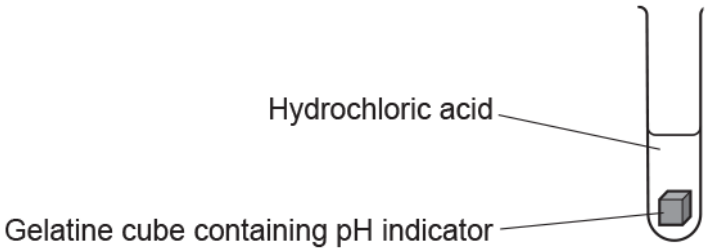


Fig. 21.1

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

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

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

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(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.

[2]

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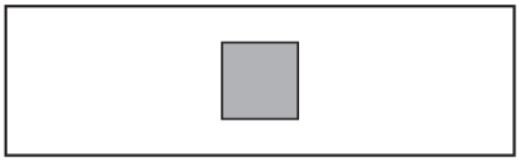
3 Fanconi anaemia is a genetic disorder. The disorder causes a decrease in the number of platelets in the blood.

Fanconi anaemia also causes a decrease in white blood cells and red blood cells.

The table shows ranges for blood components in people **without** Fanconi anaemia.

Blood component	Number per mm^3
red blood cell	4.5 million – 6.5 million
white blood cell	6.0 thousand – 16.0 thousand
platelet	0.15 million – 0.40 million

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



The volume of blood under the slide is 0.1 mm^3 and it contains 1000 white blood cells.

Calculate the number of white blood cells per mm^3 of blood.

Number = ... per mm^3 **[2]**

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

Use the table and your answer to part **(i)** to justify your answer.

---

[1]

4 Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

Number of people = ... **[1]**

5 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. 16.1 shows the apparatus they use.

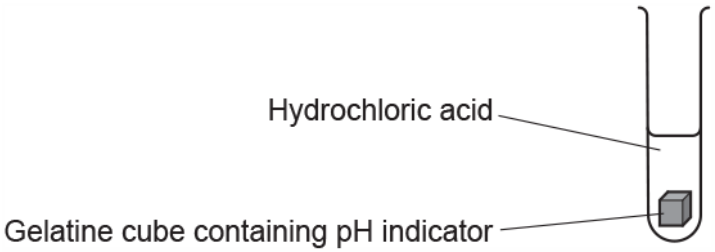


Fig. 16.1

The table shows the students' results.

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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.

---

[2]

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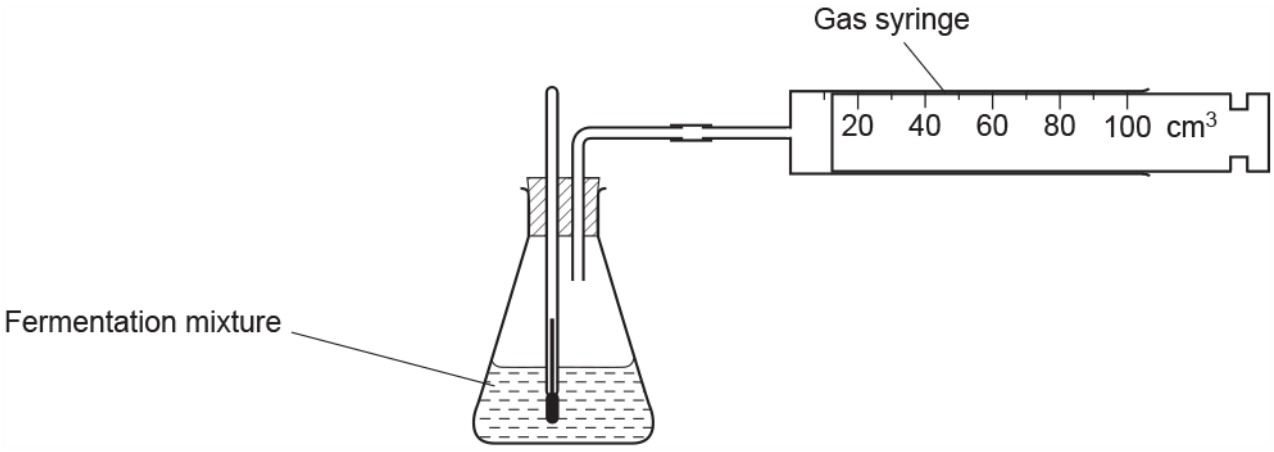
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6 Fermentation involves enzymes that break down sugar releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.
She measures the volume of carbon dioxide released in 10 minutes.
The diagram shows the apparatus she uses.



The student's results are shown in the table.

Temperature (°C)	Volume of carbon dioxide gas (cm^3) released in 10 minutes		
	Trial 1	Trial 2	Trial 3
25	23	25	22
30	34	27	33

(i) Calculate the **mean** rate of gas produced at **25 °C** in cm^3 / minute.

Give your answer to **1** decimal place.

Mean rate of gas produced at 25 °C = ... cm^3 / minute **[3]**

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(ii) The rate of gas produced at 30 °C is greater than at 25 °C.

Use ideas about enzymes to explain why.

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[3]

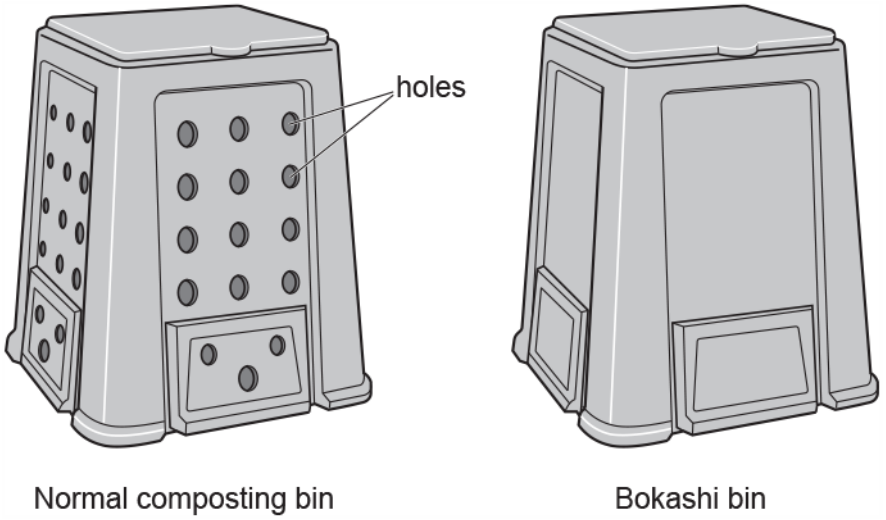
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7(a) Gardeners often turn dead plant material from their garden into compost. They then add this compost to the soil where they are growing plants.

Compost can be made in a composting bin. In the bin **aerobic bacteria** turn dead plant material into compost.

Some people use a different way of making compost, called bokashi. In this process the compost is made **anaerobically.**

The drawings show a normal composting bin and a bokashi bin.



Explain the difference in the design of the two composting bins.

---

[2]

(b) Scientists investigate the two methods of making compost.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Write down **one** way that the scientists make sure that they can draw valid conclusions.

---

[1]

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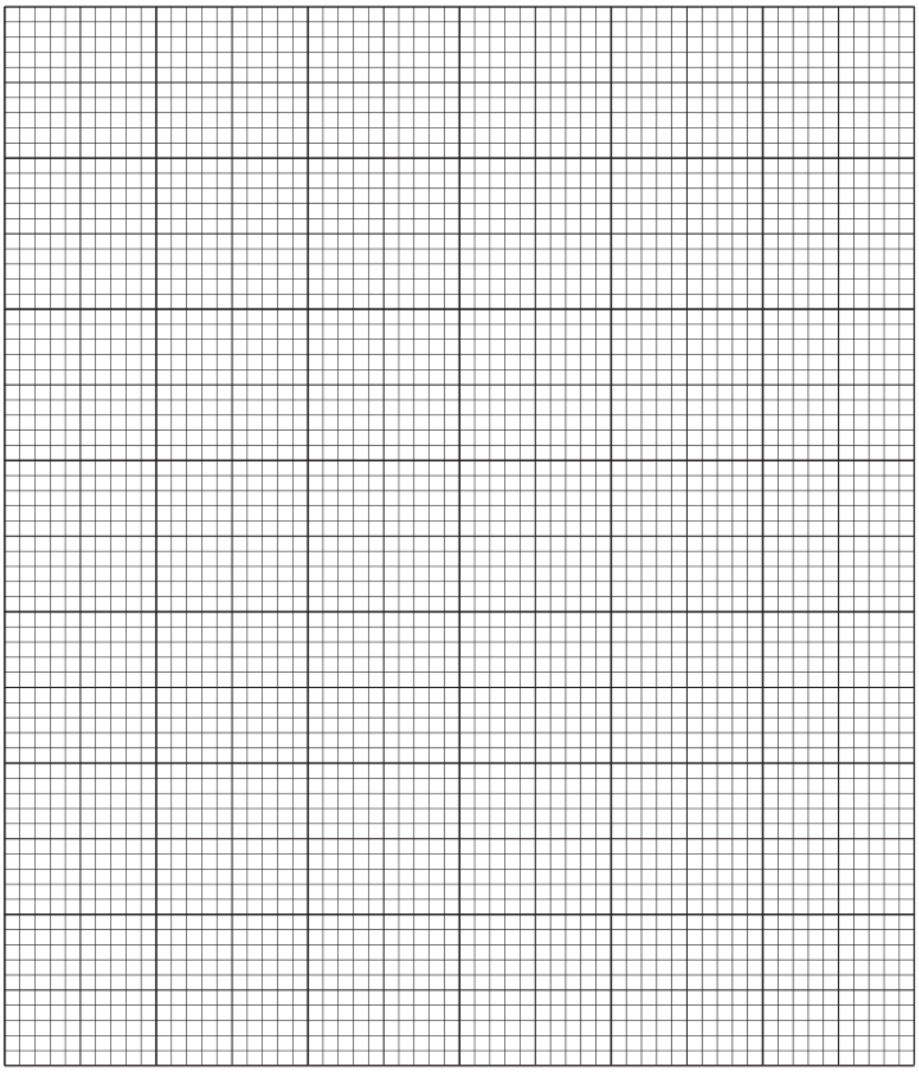
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(c) **Table 18.1** shows the scientists' temperature readings.

	Temperature of the compost (°C)	
Time (days)	normal compost	bokashi compost
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 18.1

(i) Plot the scientists' results on the grid for normal and bokashi compost, and draw **two** curves of best fit.



[5]

(ii) Explain why the temperature of the compost in the **normal** bin changed as shown in the graph.

[2]

(iii) Explain the difference in the temperature changes between the aerobic normal compost and the anaerobic bokashi compost.

[2]

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(d) **Table 18.2** shows the scientists' results for the mass of the compost.

	Normal compost	Bokashi compost
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	750	1100

Table 18.2

A gas is given off in the formation of the compost. This causes most of the decrease in mass.

(i) The percentage decrease in the mass of the normal compost is 50%.

Calculate the percentage decrease in the mass of the bokashi compost.

Give your answer to **2** significant figures.

Percentage decrease = ... % **[3]**

(ii) The scientists concluded that the bokashi method of composting might be better for the environment.

Use your answer from part **(i)** to justify the scientists' conclusion.

---

[2]

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8(a) 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.

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	$1.5 – 4.0 \times 10^5$

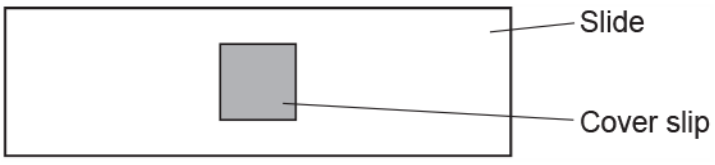
Table 19.1

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

---

[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 **(ii)** to justify your answer.

---

[3]

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(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 _____

_____

_____

_____

[3]

9(a) Hypercholesterolemia (HC) is the result of a mutation in the genome. It is caused by a dominant allele on chromosome 19. The mutation involved causes a change in the DNA nucleotides.

Write the words **allele, chromosome, genome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

Smallest feature

Largest feature

[1]

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(b) One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

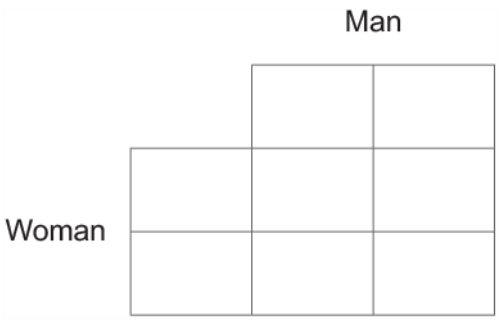
Number of people = ... **[1]**

(c) A woman who does not have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

Complete the genetic diagram to explain your answer.

Use **D** for the dominant HC allele and **d** for the recessive allele.



Probability = ... **[2]**

END OF QUESTION PAPER