

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

M5 GEOMETRY AND TRIGONOMETRY

SCORE

/34

PERCENTAGE

%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Gateway Biology A (9-1)

Maths 5: Geometry and trigonometry

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 **34**.
- The total number of marks may take into account some 'either/or' question choices.

1(a) Zebras (Fig. 23.1) have evolved to live in hot grassland in Africa.

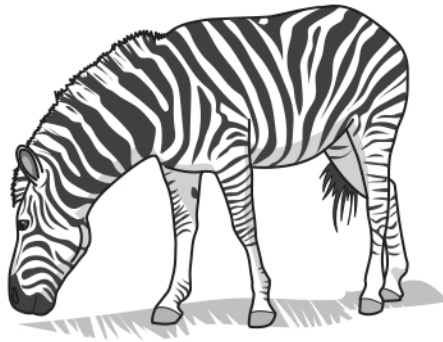
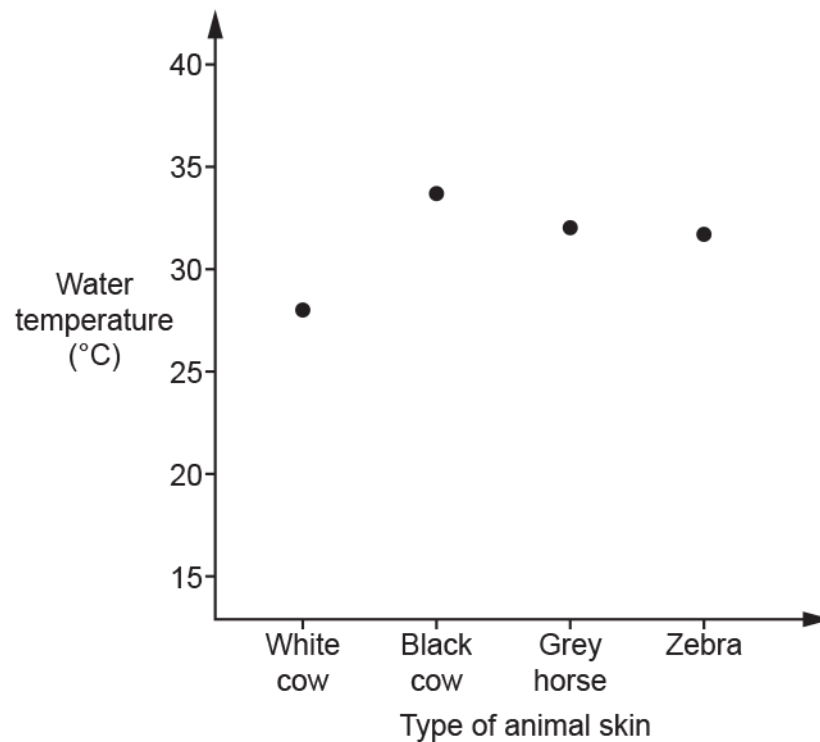


Fig. 23.1

Scientists have tried to find out why zebras have evolved stripes on their body.

One theory is that the stripes help to keep the zebra cooler than other colours. Scientists did an experiment to test this theory. They covered barrels of cold water with the skin of different animals. Then they measured the temperature of the water several hours later.

The results are shown in Fig. 23.2.



- (i) Do the results in Fig. 23.2 support the theory that stripes keep zebras cool?
Explain your answer.

----- [1]

- (ii) The scientists were aiming to investigate if it was **only** the colour of the skin that affected temperature regulation.

Suggest **one** improvement the scientists could make to ensure they **only** investigate the **colour** of the skin.
Explain your answer.

----- [1]

- (b) Another theory says that the stripes make a zebra less likely to be bitten by insects.

To test this theory scientists made models of zebras and covered them with sticky tape. One model was black. The other models had different widths of stripes.

Fig. 23.3 shows the number of insects that stuck to the tape.

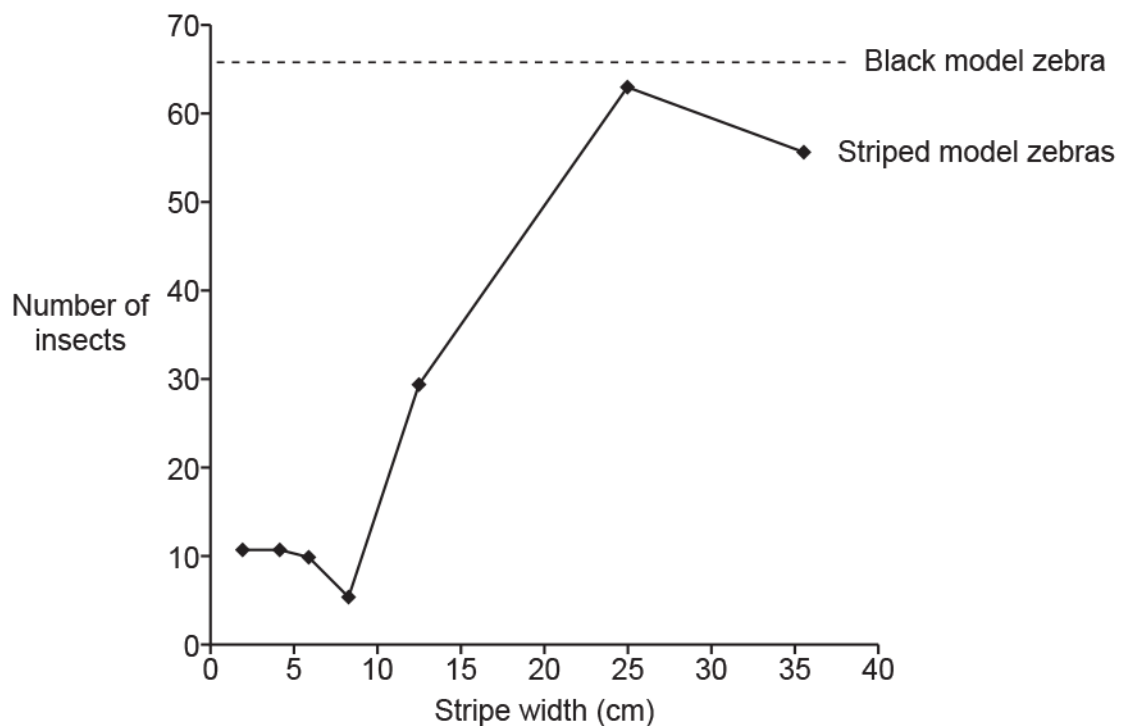


Fig. 23.3

- (i) Describe what Fig. 23.3 shows about the link between zebra stripes and protection from insects.

[2]

- (ii) Horse blankets are used to cover horses when they are outside. Companies have started to produce horse blankets with zebra stripes.

Use the information in Fig. 23.3 to suggest what width of stripe should be used to reduce insect bites.

Explain your answer.

[1]

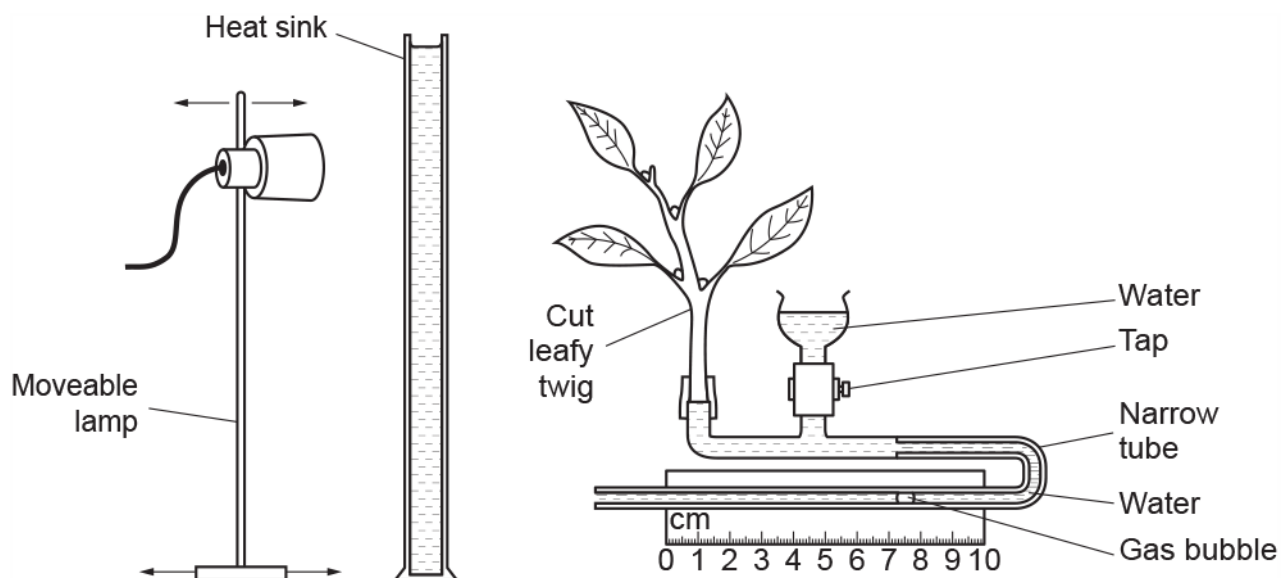
(iii) Biting insects can spread pathogens between animals.

Use the theory of natural selection to explain how zebra stripes could have developed.

[3]

2(a) The diagram shows a simple potometer.

The apparatus can be used to investigate the effect of light intensity on transpiration rates.



(i) Describe what happens during transpiration.

[2]

(ii) Describe how the apparatus can be used to investigate the effect of light on transpiration rates.

[3]

(iii) The heat sink is a transparent tube of cold water.

Explain why a heat sink is used in this experiment.

[2]

(b) The table shows the results from using the potometer.

Distance of potometer from the light (cm)	Distance gas bubble moved in one minute (mm)		
	Trial 1	Trial 2	Trial 3
10	70	74	72
20	73	75	71
30	52	49	51
40	42	30	31
50	12	14	13

(i) The mean distance the gas bubble moved along the tube at 10 cm from the light was 72 mm.

The diameter of the narrow tube was 1 mm.

Calculate the volume of water taken up by the plant.

Use the equation: $\text{volume} = \pi r^2 l$

where r is the radius of the tube and l is the distance the bubble moves

$\pi = 3.14$

Give your answer to 2 significant figures.

Volume of water = ... mm³ / minute [3]

(ii) Identify the anomalous reading in their recorded results and suggest a possible reason for this.

[2]

(iii) How should the scientists deal with this anomalous reading when they process the data?

[1]

- (iv) The scientists described their results for 20 cm as 73 ± 2 .
Explain why they did this.

[2]

- 3(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]

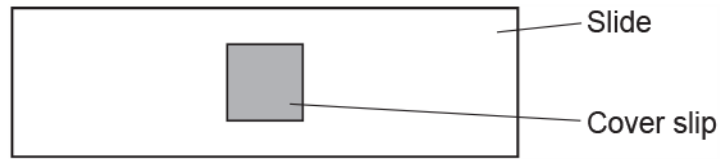
- (b) Table 19.1 shows normal ranges for blood components in people **without** Fanconi anaemia.

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.

- (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 = ... mm³ [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.

(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]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
	b	i	Any two from: zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2 x 3.1a)	ALLOW insect bites for insects IGNORE length of stripe ALLOW width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	ALLOW width tolerance between 7-9cm and least number of insects (on tape)

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Any three from: stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	ALLOW some more striped than others ALLOW offspring produced / breed together IGNORE selective breeding ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on IGNORE over time
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
2	a	i	water evaporates (on surface of spongy mesophyll) ✓ water (vapour) passes/diffuses through the stomata/pores ✓	2 (AO1.1)	Need evaporate or a description of the process
		ii	measure distance gas bubble moves ✓ over certain time / specified time ✓ vary distance of lamp from potometer ✓	3 (AO1.2)	ALLOW measure position of bubble before and after time taken for bubble to move a certain distance = 2 marks
		iii	absorbs heat/thermal energy (from lamp) / keeps (plants at) constant temperature ✓ heat/temperature would affect transpiration ✓	2 (AO2.2)	IGNORE references to photosynthesis
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 57 (mm ³) award 3 marks $\pi \times 0.5^2 \times 72$ ✓ = 56.52 ✓ = 57 (mm ³) ✓	3 (AO3 x 2.2)	ALLOW one mark for an answer of 226.08 and 2 marks for an answer of 230 (1.0 has been used as r) ALLOW one mark for clear evidence of incorrect answer correctly rounded to two sig figs.
		ii	42 (mm) / Trial 1 at 40cm ✓ reading taken too quickly after moving the lamp / error in measurement (distance bubble moved/time) / heat sink not in the way/radiating heat / change in room temp/air movements / potometer/light not at correct distance ✓	2 (AO2 x 2.2)	
		iii	Idea that they should remove/ignore the anomalous result (before processing) ✓	1 (AO1.2)	ALLOW repeat that reading
		iv	the mean is 73 mm ✓ the range of values is 71 to 75 / range is 4 mm / 2mm is half the range ✓	2 (AO2 x 1.2)	ALLOW adding or subtracting 2 from 73 covers all the readings this is the mean $\pm$ half the range = 2 marks
			Total	15	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3	a		Any two from: anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2 (AO2 x 1.1)	DO NOT ALLOW incorrectly matched symptom to blood cell type ALLOW less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC ALLOW (recurring) nosebleeds / bruise easily due to lack of platelets
	b	i	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ OR weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2 (AO2 x 2.1)	IGNORE fighting(off) pathogens
		ii	Area = $10 \times 10 = 100(\text{mm}^2)$ Volume = $100 \times 0.001 = 0.1 (\text{mm}^3)$ ✓	1 (AO2.2)	
		iii	No (no mark) $1000 \div 0.1$ OR 1000×10 ✓ number of white blood cells/mm^3 is 10×10^3 / 1.0×10^4 / 10000 ✓ within the range of $6.0 - 16.0 \times 10^3$ ✓	3 (AO2 x 2.2) (AO3.2b)	ALLOW ECF from (ii) ALLOW number of white blood cells /mm^3 = 10 000 ALLOW within the normal white blood cell range/ 6000 – 16000

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		(Fanconi anaemia) (no mark) (3×10^6 is a) low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ OR cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓	3 (AO3x3.2 b)	if incorrect disorder then no marks IGNORE low numbers of all cells
			Total	11	