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EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Cells and Control (2)

GCSE Biology (Foundation) Topic 2

13 questions · 141 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

13 questions · 141 marks · lowest tariff first



8-MARK QUESTIONS

3 questions in this booklet



2 Figure 3 shows a cell from an onion root tip.

This cell is dividing by mitosis.

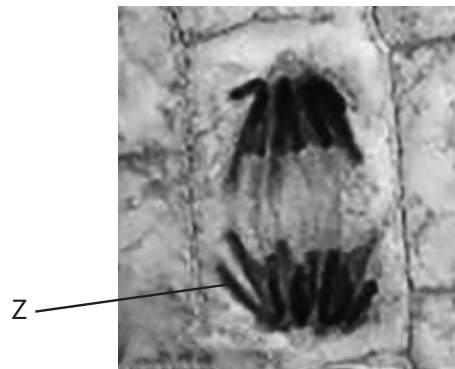


Figure 3

(a) (i) Which structure is labelled Z?

(1)

- ☐ A allele
- ☐ B chromosome
- ☐ C spindle
- ☐ D nuclear membrane

(ii) Mitosis produces new cells.

Give **two** reasons why mitosis is important in living things.

(2)

- 1
- 2

(iii) Draw **one** straight line from each stage of the cell cycle to its description.

(2)

stage of cell cycle

description

interphase

the nuclear membrane
breaks down

two nuclei are formed

the cell divides in two

cytokinesis

a spindle is formed

DNA is copied

(b) A student is preparing a microscope slide of plant cells.

(i) State what can be added to the slide to make the plant cells more visible.

(1)

(ii) The microscope has two lenses:

- an eyepiece lens with $\times 10$ magnification
- an objective lens with $\times 40$ magnification

Which is the **total** magnification of this microscope?

(1)

- ☐ **A** $\times 4$
- ☐ **B** $\times 30$
- ☐ **C** $\times 50$
- ☐ **D** $\times 400$

(c) Name **one** part of a light microscope that can be moved to obtain a clear image of plant cells.

(1)

(Total for Question 2 = 8 marks)



3 Figure 4 shows a cross-section of a human eye.

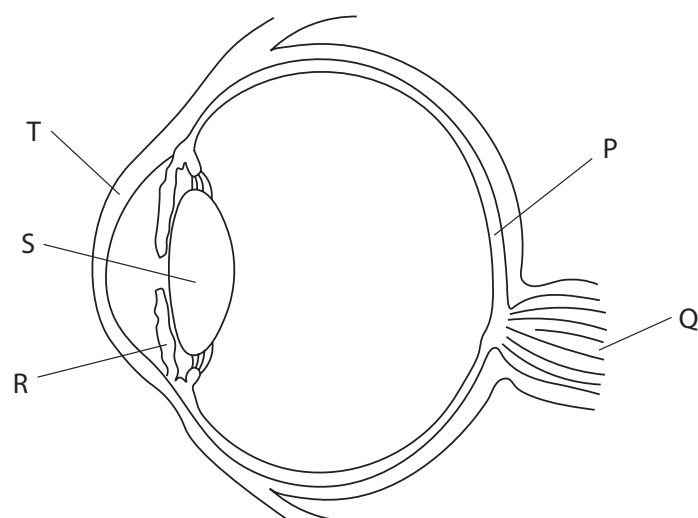


Figure 4

(a) (i) Which structure is the retina?

(1)

- ☐ A P
- ☐ B Q
- ☐ C R
- ☐ D S

(ii) Name the structure labelled T.

(1)

.....

(iii) Explain how structure R controls the amount of light entering the eye.

(2)

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(b) Figure 5 shows a diagram of light entering an eye.

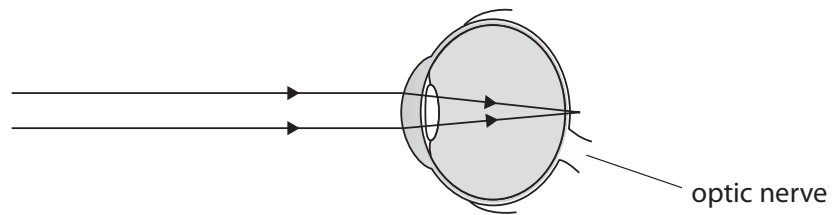


Figure 5

Explain why this person cannot see near objects clearly.

(2)

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.....

(c) Long-sightedness and short-sightedness are defects of the eye.

(i) Draw, in the box, the shape of the lens needed to correct long-sightedness.

(1)



(ii) Name **one** other defect of the eye.

(1)

.....

.....

(Total for Question 3 = 8 marks)

3 Figure 5 shows a human brain.

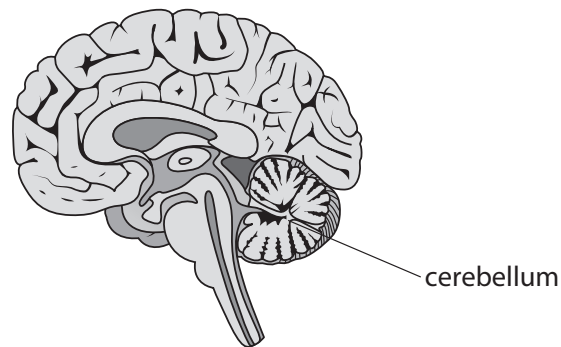


Figure 5

(a) Which is a function of the cerebellum?

(1)

- ☒ A to control balance
- ☒ B to control breathing rate
- ☒ C to control heart rate
- ☒ D to control blood pressure

(b) (i) Label the cerebral hemisphere on Figure 5.

(1)

(ii) State **two** functions of the cerebral hemispheres.

(2)

1

2

(c) The brain sends information to the muscles in the iris of the eye.

(i) Name the type of neurone that transmits nerve impulses from the brain to the muscles in the iris of the eye.

(1)

.....

(ii) Figure 6 shows a human eye.

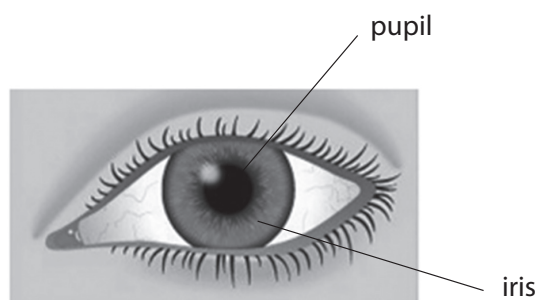


Figure 6

Explain how the pupil changes size.

(2)

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.....

.....

.....

.....

(iii) Short-sightedness is a defect of the eye.

State **one** cause of short-sightedness.

(1)

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(Total for Question 3 = 8 marks)

9-MARK QUESTIONS

1 question in this booklet



- 4 Figure 4 shows a picture seen through healthy eyes and the same picture seen through eyes affected by cataracts.



picture seen through healthy eyes



picture seen through eyes with cataracts

Figure 4

- (a) (i) In which part of the eye do cataracts form?

(1)

- ☐ A retina
- ☐ B iris
- ☐ C cornea
- ☐ D lens

- (ii) Explain why the picture seen through eyes with cataracts is less clear.

(2)

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(b) Figure 5 shows the estimated number of people with cataracts in the world between 1980 and 2020.

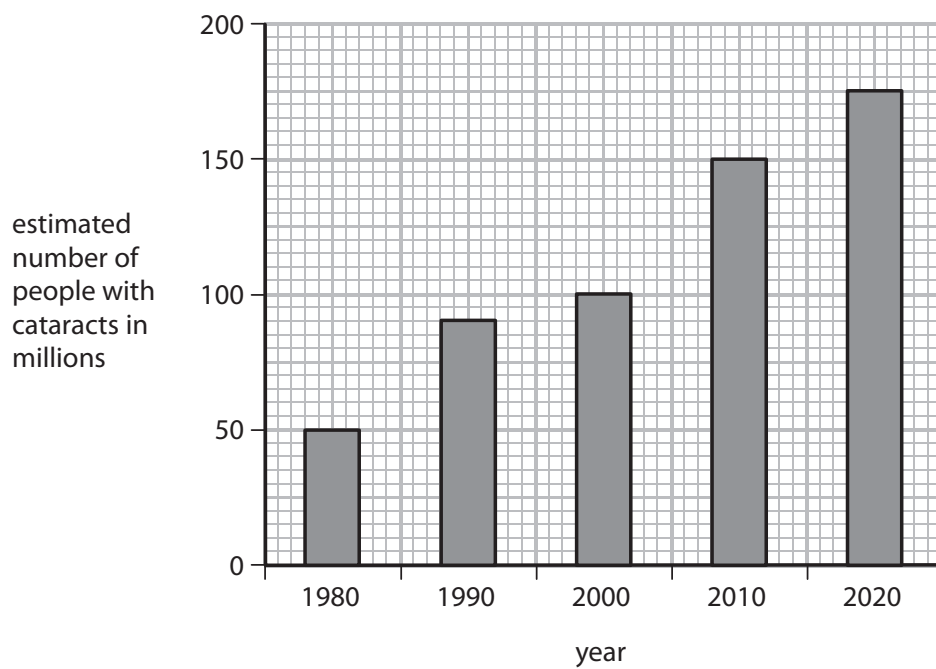


Figure 5

Describe the change in the estimated number of people with cataracts between 1980 and 2020.

(2)

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.....

(c) (i) Explain how cataracts are currently treated.

(2)

(ii) Scientists are developing a new treatment using eye drops for cataracts.

Describe the advantages of using eye drops to treat cataracts rather than the current treatment.

(2)

(Total for Question 4 = 9 marks)

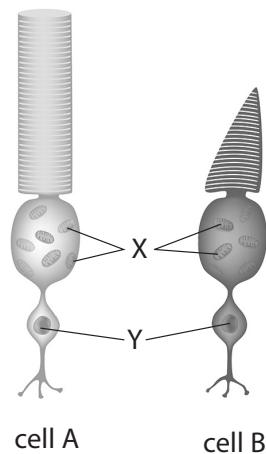


11-MARK QUESTIONS

2 questions in this booklet



10 (a) Figure 18 shows two light receptor cells from the human eye.



(Source: © Kokhanchikov/Shutterstock)

Figure 18

(i) Which part of the eye contains light receptor cells?

(1)

- ☒ **A** cornea
- ☒ **B** iris
- ☒ **C** lens
- ☒ **D** retina

(ii) These cells require energy.

The cell organelles labelled X release energy during respiration.

Name the organelles labelled X.

(1)

(iii) The cell organelle labelled Y contains chromosomes.

Name the organelle labelled Y.

(1)

(iv) Cell A responds to dim light and is responsible for night vision.

Name cell A.

(1)

- (v) Describe how the role of light receptor cell B is different from the role of light receptor cell A.

(2)

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.....

- (b) The optic nerve carries information from the back of the eye to the brain.

The optic nerve is 47 mm in length.

Nerve impulses travel at 75 metres per second.

- (i) Calculate the time an impulse takes to travel the length of the optic nerve.

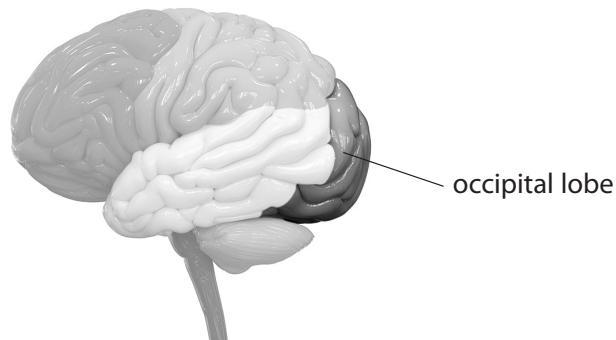
Use the equation: $\text{speed} = \frac{\text{distance}}{\text{time}}$

(3)

..... seconds



- (ii) The impulse travels to the occipital lobe of the brain.
The occipital lobe is labelled in Figure 19.



(Source: © Magic mine/Shutterstock)

Figure 19

Which part of the brain contains the occipital lobe?

(1)

- ☐ **A** cerebral hemispheres
- ☐ **B** medulla oblongata
- ☐ **C** cerebellum
- ☐ **D** hypothalamus

- (iii) State the sense most likely to be affected if the occipital lobe is damaged.

(1)

(Total for Question 10 = 11 marks)

10 Figure 19 shows a chart used by opticians to test a person's vision.

The person's vision is judged by the lowest row of letters they can read.

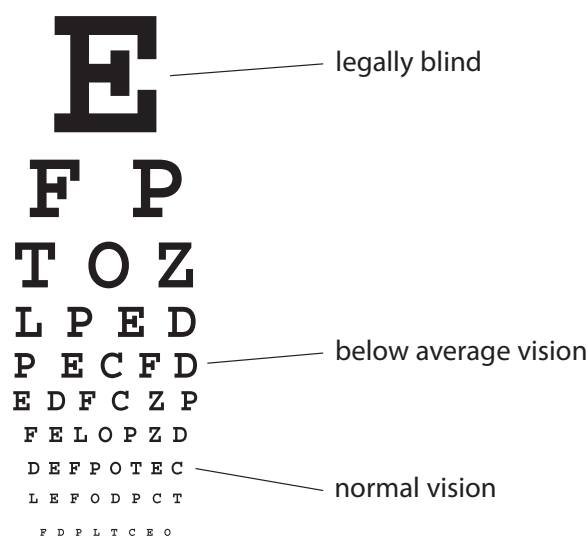


Figure 19

(a) (i) An optician tested the eyesight of 240 people.

35% of these people could read the normal vision row without wearing glasses.

The rest of the people need glasses to correct their vision.

Calculate the number of people who need glasses to correct their vision.

(3)

..... people

(ii) An optician can use the chart to diagnose short-sightedness.

Give **one** reason why people are short-sighted.

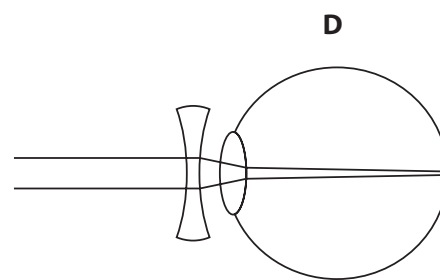
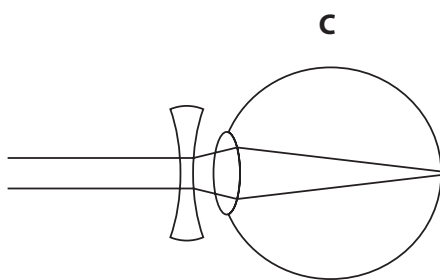
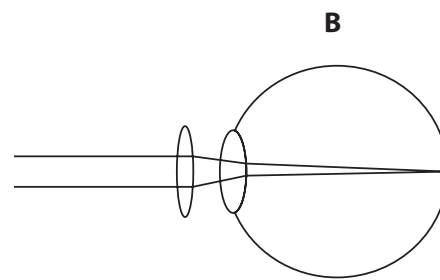
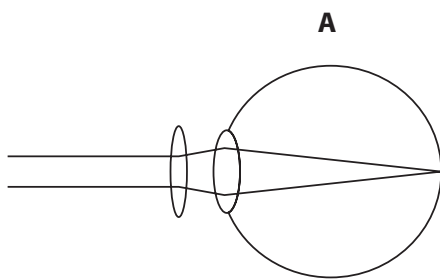
(1)

.....

.....

(iii) Which diagram shows how short-sightedness can be corrected?

(1)



- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

- (b) Cataracts can affect a person's vision.

Figure 20 shows what a person with normal vision and a person with cataracts can see for the top letter on the optician's chart.



person with normal vision



person with cataracts

Figure 20

- (i) Describe why a person with cataracts would see the image shown in Figure 20.

(2)

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- (ii) State the treatment for cataracts.

(1)

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(c) Figure 21 shows the structure of the brain.

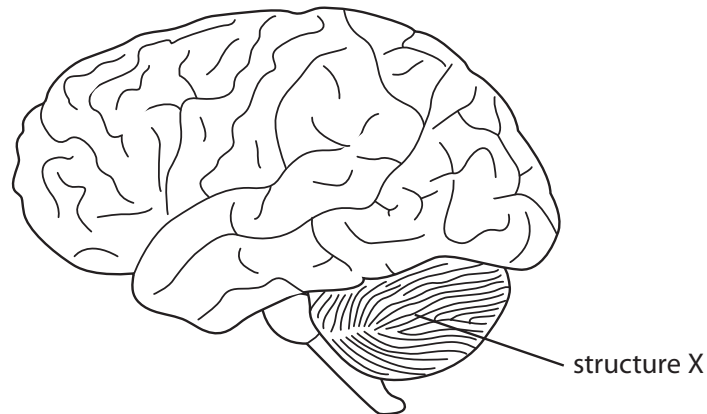


Figure 21

(i) Which region of the brain is labelled structure X?

(1)

- ☐ **A** cerebellum
- ☐ **B** cerebral hemisphere
- ☐ **C** medulla oblongata
- ☐ **D** spinal cord

(ii) When a person reacts to a stimulus, messages from the brain are sent to their muscles.

Describe how messages are sent from the brain to muscles.

(2)

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(Total for Question 10 = 11 marks)

12-MARK QUESTIONS

5 questions in this booklet



- 8 (a) Motor neurones are found in the nervous system.

Figure 16 shows a motor neurone.

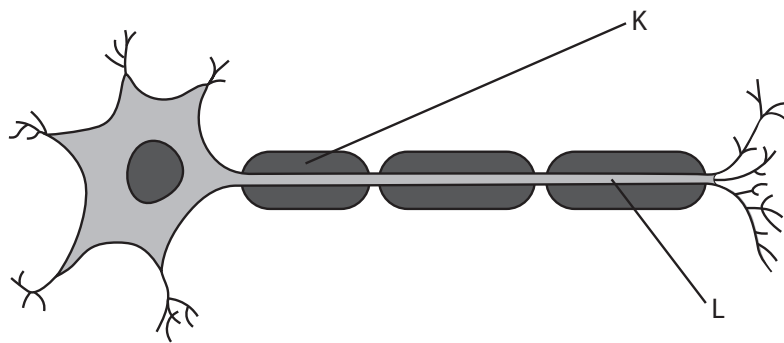


Figure 16

- (i) Draw an arrow on Figure 16 to show the direction of travel of an electrical impulse along the motor neurone.

(1)

- (ii) Name both structure **K** and structure **L**.

(2)

K

L

(b) Figure 17 shows part of a reflex arc in the spinal cord.

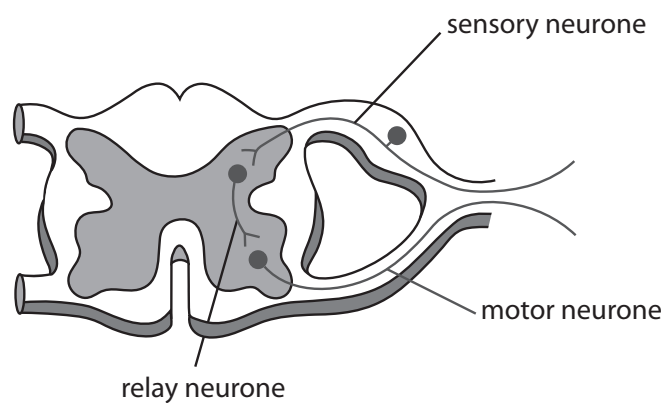


Figure 17

(i) Describe how an impulse passes from the relay neurone to the motor neurone.

(3)

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.....

.....

(ii) Explain the function of a reflex arc.

(2)

.....

.....

.....

.....

.....

- (c) A scientist investigated the reaction times of five students using a computer program.

The computer screen showed a blue square at the start.

As soon as the blue square turned yellow, each student had to press a key on the keyboard as fast as possible.

Figure 18 shows the results for the five students.

student	reaction time in milliseconds
1	245
2	200
3	210
4	215
5	225

Figure 18

- (i) Which is the median result for these students?

(1)

- ☐ **A** 200 milliseconds
- ☐ **B** 210 milliseconds
- ☐ **C** 215 milliseconds
- ☐ **D** 225 milliseconds

- (ii) The scientist wanted to investigate if the colours of the squares used on the computer program affected reaction time.

The computer program started with blue squares that turned into yellow squares.

Describe how the scientist could compare the reaction times of these students when they respond to red squares turning into yellow squares.

(3)

(Total for Question 8 = 12 marks)



6 (a) Figure 12 shows a height percentile chart for boys.

The numbers on the right-hand side of the graph show the percentiles of the population for each growth curve.

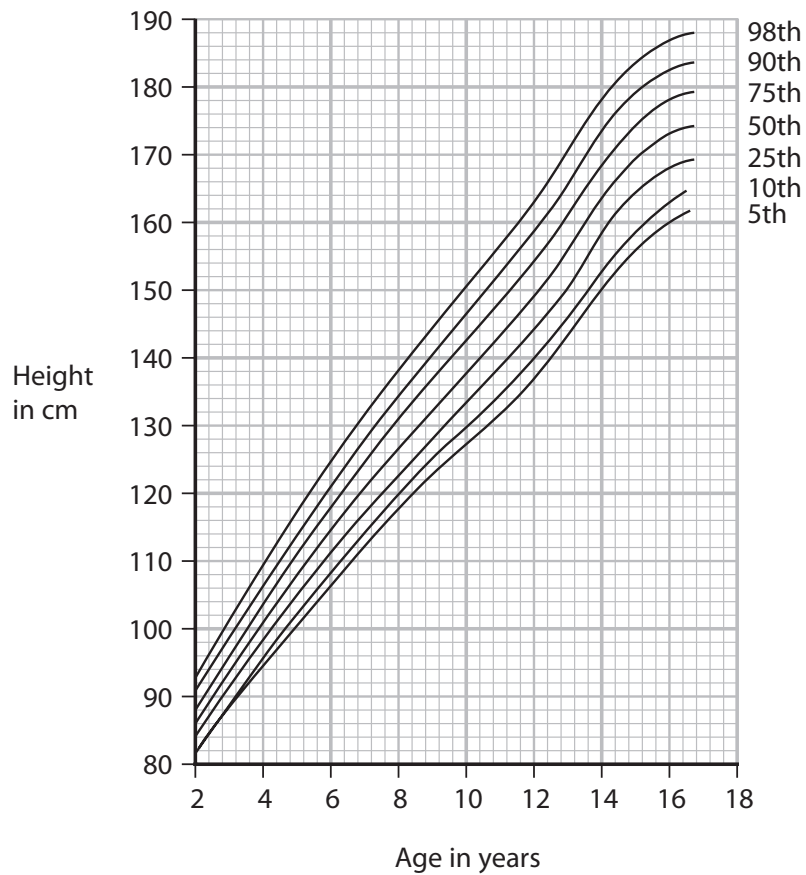


Figure 12

(i) A 10-year-old boy has a height of 140 cm.

Which is the percentile range for height for this boy?

(1)

- ☐ **A** 10th to 25th
- ☐ **B** 25th to 50th
- ☐ **C** 50th to 75th
- ☐ **D** 75th to 90th

(ii) State how percentile charts are used.

(1)

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(b) As we grow, we make new cells by mitosis and meiosis.

(i) The cells that are made can become specialised.

Figure 13 shows a diagram of a sperm cell.

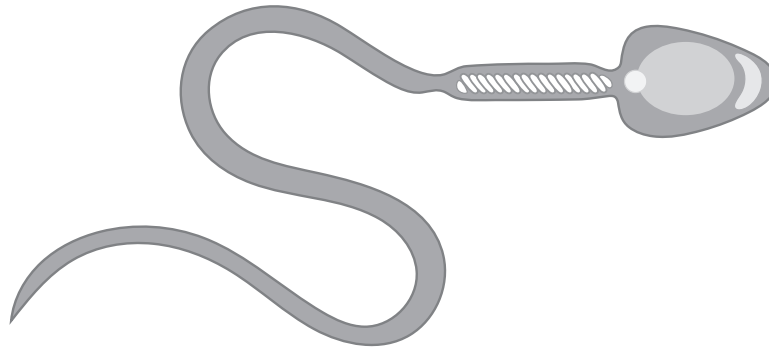


Figure 13

Describe **two** ways that the sperm cell is specialised.

(2)

- 1
- 2

(ii) Complete the table to show the results when a cell divides by mitosis or meiosis in humans.

Human body cells, except gametes, have 23 pairs of chromosomes.

(4)

	mitosis	meiosis
number of daughter cells produced		
number of chromosomes in each daughter cell		

(c) The tips of plant roots are where many cells are dividing by mitosis.

(i) Which term describes the area of a root where many cells are dividing by mitosis?

(1)

- ☐ A meristem
- ☐ B root hair cell
- ☐ C xylem
- ☐ D phloem

(ii) Plant root cells contain an enzyme that joins glucose molecules together to make starch.

Devise a plan to investigate the effect of pH on the activity of this enzyme.

(3)

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(Total for Question 6 = 12 marks)

7 Figure 14 shows a cross-section of a human eye.

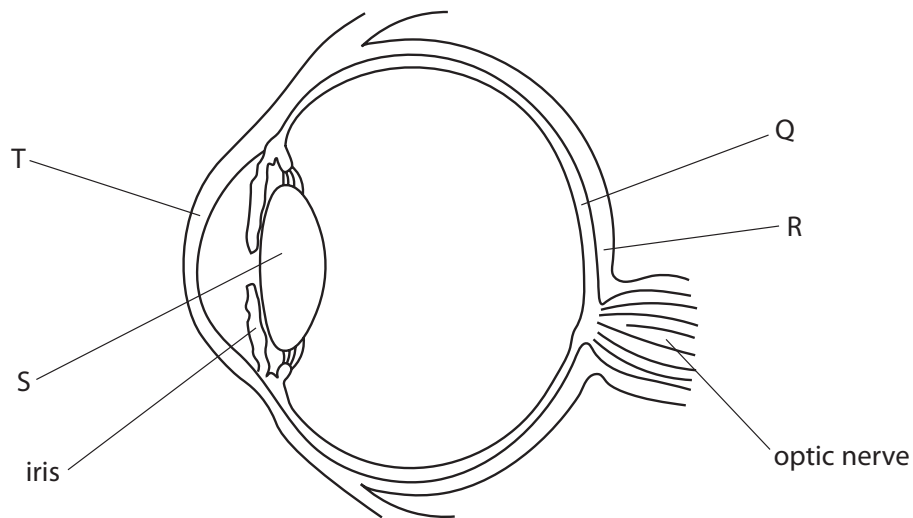


Figure 14

(a) Cataracts can develop in the eye causing people to have blurred vision.

(i) Which structure of the eye can develop cataracts?

(1)

- ☐ A structure Q
- ☐ B structure R
- ☐ C structure S
- ☐ D structure T

(ii) Describe how cataracts are corrected by surgery.

(2)

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- (b) (i) Explain how the size of the pupil of the eye changes when a torch is shone into the eye of a person.

(3)



7 Tissue culture can be used to grow cells.

(a) (i) State **one** difference between normal body cells and cancer cells.

(1)

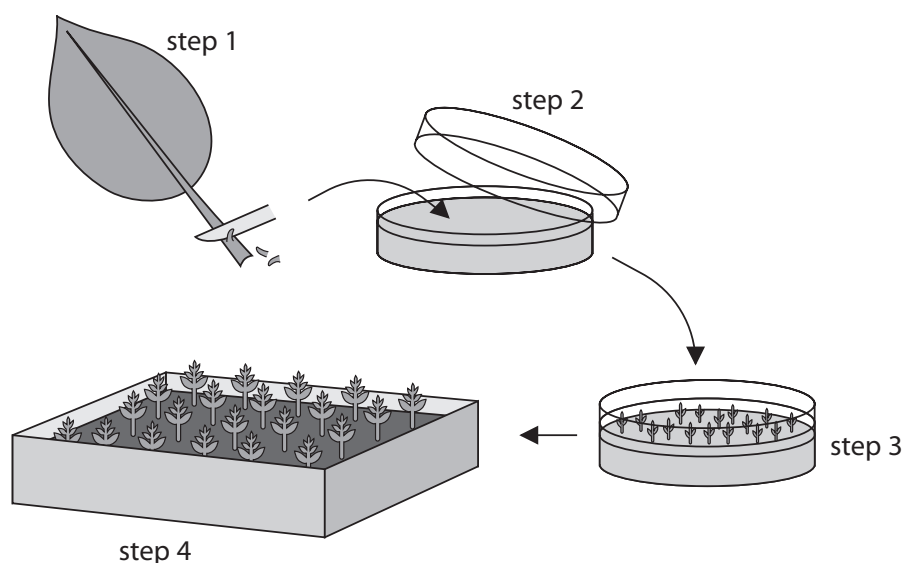
(ii) Cancer cells can be grown in tissue culture.

Give **one** disadvantage of testing drugs on these cancer cells.

(1)

(b) Tissue culture can be used to conserve rare plants.

Figure 13 shows some of the stages involved.



Step 1: Cells are taken from a rare plant.

Step 2: The cells are placed on sterile growth medium.

Step 3: The cells develop into small plantlets with roots and stems.

Step 4: The plantlets are grown in compost.

Figure 13

(i) State **one** way the growth medium can be sterilised.

(1)

(ii) Explain **one** reason why the growth medium must be sterilised.

(2)

(iii) Suggest **one** advantage of using tissue culture to conserve rare plants.

(1)



*(c) Figure 14 shows some plant structures that protect plants from attack by pests and pathogens.

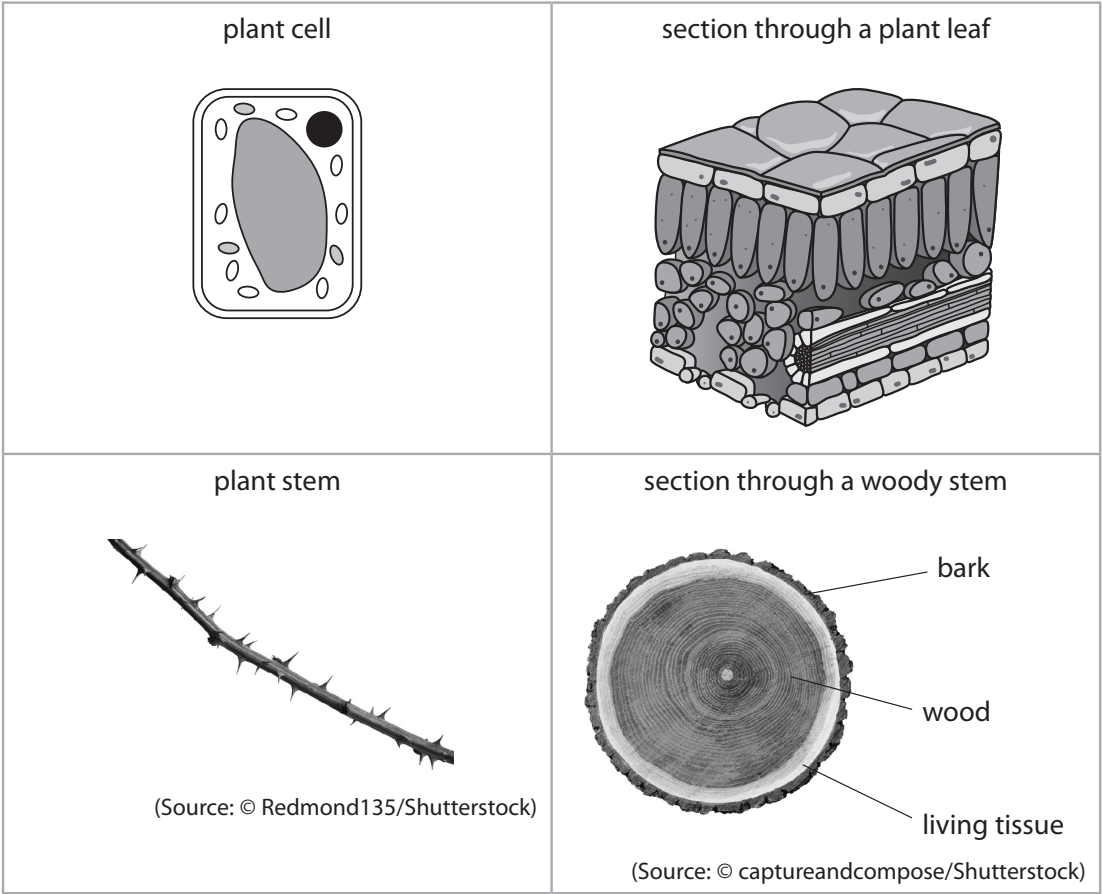


Figure 14

Describe how physical barriers protect plants from attack by pests and pathogens.

Use information from Figure 14 in your answer.

(6)

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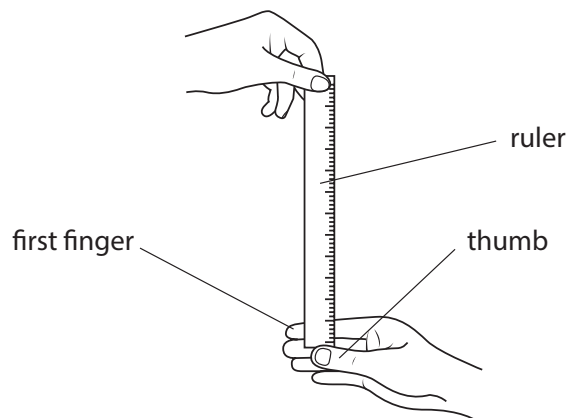
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(Total for Question 7 = 12 marks)



- 6 (a) A scientist uses the method shown in Figure 11 to investigate the reaction times of some students.



Method

The scientist

- holds the ruler as shown
- suddenly lets the ruler fall

The student

- catches the ruler between their first finger and thumb
- measures a variable

Figure 11

- (i) Which measurement should be recorded to compare reaction times?

(1)

- ☐ A the time taken to complete the investigation
- ☐ B the distance the ruler falls
- ☐ C the distance between the two hands
- ☐ D the temperature of the room

(ii) Figure 12 shows the results of five students.

student	distance measured in cm
J	15
K	12
L	14
M	13
N	13

Figure 12

Which is the mean of the results in Figure 12?

(1)

- ☐ **A** 12.2 cm
- ☐ **B** 12.8 cm
- ☐ **C** 13.4 cm
- ☐ **D** 14.3 cm

(iii) Explain which of the five students had the slowest reaction time.

(2)

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(iv) Give **two** variables that need to be controlled during this investigation.

(2)

1

2

(b) Figure 13 shows a motor neurone.

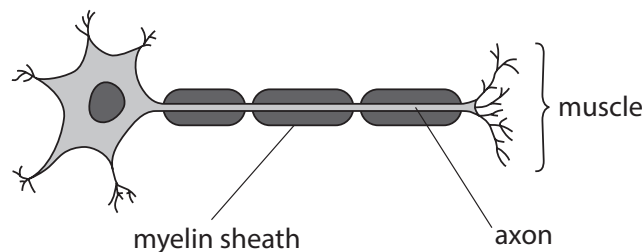


Figure 13

(i) State the role of a motor neurone in a reflex arc.

(1)

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(ii) Explain the function of the myelin sheath.

(2)

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(iii) Describe how a nerve impulse passes across the gap between two neurones.

(3)

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(Total for Question 6 = 12 marks)



13-MARK QUESTIONS

2 questions in this booklet



7 (a) (i) Which part of the eye carries impulses to the brain?

(1)

- ☐ A cornea
- ☐ B iris
- ☐ C lens
- ☐ D optic nerve

(ii) Name the structure within the eye that controls the amount of light entering the eye.

(1)

(b) Explain the functions of the two types of cell in the retina that detect light.

(4)

(c) The eye can be infected by bacteria.

State the type of drug used to treat infections caused by bacteria.

(1)



*(d) Figure 12 shows two defects of the eye.

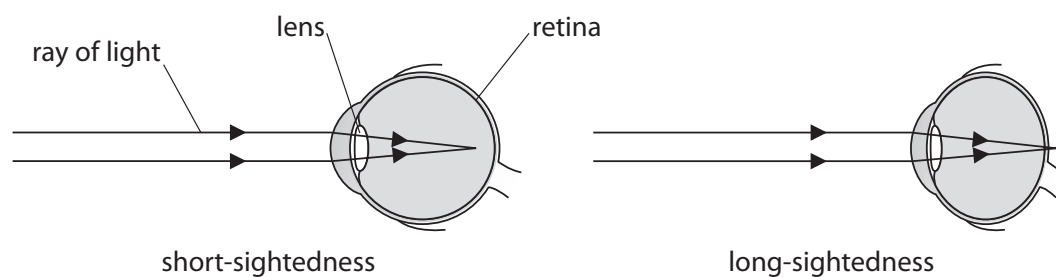


Figure 12

Describe the causes of short-sightedness and long-sightedness.

Use information from Figure 12 to help with your answer.

(6)

(Total for Question 7 = 13 marks)

9 Figure 14 shows a banana plantation.



© warmer/Shutterstock

Figure 14

After the bananas have been harvested, the old plants are cut down.

The suckers then develop into mature plants producing the next crop of bananas.

The tip of each sucker contains a group of cells called a meristem.

(a) (i) Describe the function of a meristem in the growth of a plant.

(2)

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(ii) A student took a sample of cells from a meristem to view under a light microscope.

Describe how the student would prepare a microscope slide using these cells.

(3)

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(b) Figure 15 is a drawing of a eukaryotic cell.

Structure **Z** is found in plant leaf cells.

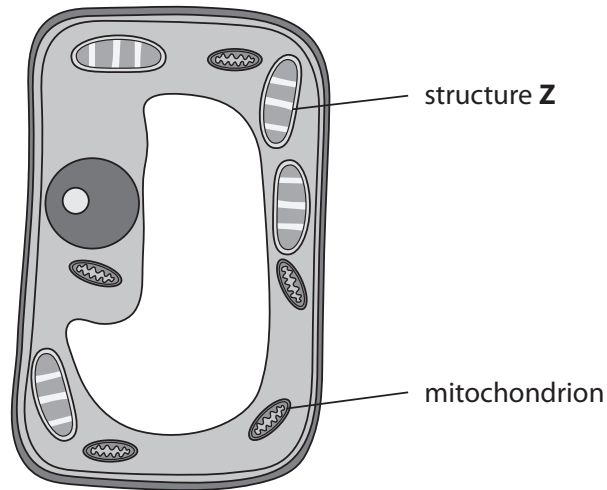


Figure 15

(i) Name structure **Z**.

(1)

(ii) Give **one** function of the mitochondrion.

(1)

* (c) DNA is found in the nucleus of cells.

Describe the structure of DNA and how it can be extracted from plant cells.

(6)

(Total for Question 9 = 13 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number	Answer	Mark
2(a)(i)	B chromosome The only correct answer is B <i>A is not correct because Z is not an allele</i> <i>C is not correct because Z is not the spindle</i> <i>D is not correct because Z is not the nuclear membrane</i>	(1) AO1 1

Question Number	Answer	Mark
2(a)(ii)	Any two from: • for growth (1) • for repair (of tissues / organs) (1) • for asexual reproduction (1)	(2) AO1 1

Question Number	Answer	Mark
2(a)(iii)	stage of cell cycle description interphase the nuclear membrane breaks down cytokinesis two nuclei are formed the cell divides in two a spindle is formed DNA is copied Do not award mark if two lines are drawn from interphase box Do not award mark if two lines are drawn from cytokinesis box	(2) AO1 1

Question Number	Answer	Additional guidance	Mark
2(b)(i)	use a stain / named stain	accept dye accept add a cover slip	(1) A02 2

Question Number	Answer	Mark
2(b)(ii)	D x 400 The only correct answer is D <i>A is not correct because the total magnification is not x 4</i> <i>B is not correct because the total magnification is not x 30</i> <i>C is not correct because the total magnification is not x 50</i>	(1) A02 2

Question Number	Answer	Additional guidance	Mark
2(c)	focusing wheel	accept (move the) stage / lens (up and down) accept (adjust) mirror	(1) A01 1

(Total for question 2 = 8 marks)

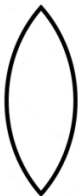
Question number	Answer	Mark
3(a)(i)	A P The only correct answer is A <i>B is incorrect because Q is not the retina</i> <i>C is incorrect because R is not the retina</i> <i>D is incorrect because S is not the retina</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
3(a)(ii)	cornea		(1) AO1 1

Question number	Answer	Additional guidance	Mark
3(a)(iii)	An explanation linking two from: • R is the iris (1) • (muscles in R) can contract / relax (1) • to change the size of the pupil	accept become bigger / smaller reject ciliary muscles accept makes the pupil smaller / larger	(2) AO2 1

	so {less / more} light enters the eye (1)	accept constrict / dilate ignore expand / decrease	
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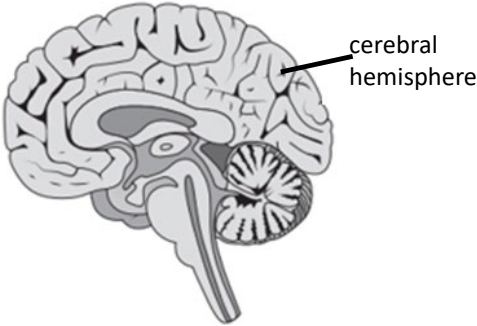
Question number	Answer	Additional guidance	Mark
3(b)	An explanation linking two from: - the eye ball is too short / the {cornea / lens} is not curved enough (1) - so light is not focused / converged (1) (on the) retina (1)	ignore lens is the wrong shape ignore eyeball is too large / small accept light is not refracted enough / light rays do not meet ignore reflecting ignore back of the eye accept the person is long-sighted (1)	(2) AO2 1

Question number	Answer	Additional guidance	Mark
3(c)(i)		accept any reasonable drawing of a convex lens ignore (	(1) AO2 1

Question number	Answer	Additional guidance	Mark
3c(ii)	cataracts / colour blindness	accept astigmatism / glaucoma	(1) AO1 1

Total marks for question 3 = 8 marks

Question number	Answer	Mark
3(a)	A to control balance The only correct answer is A B, C and D are not correct as these are controlled by the medulla oblongata	(1) AO1 1

Question number	Answer	Additional guidance	Mark
3(b)(i)	a labelled line touching any part of the cerebral hemisphere 		(1) AO2 1

Question number	Answer	Additional guidance	Mark
3(b)(ii)	Any two from: memory / learning (1) vision / hearing (1) speech / language (1) decision making / problem solving (1) conscious thought (1) muscle {control / function} (1) language (1)	accept communication	(2) AO1 1

Question number	Answer	Additional guidance	Mark
3(c)(i)	motor (neurone)		(1) AO1 1

Question number	Answer	Additional guidance	Mark
3(c)(ii)	An explanation linking two from: • (the pupil) gets bigger / smaller (1) • (because) muscles (1) • (in the) iris (1) • contract / relax (1) • (so the iris) gets smaller/ bigger (1)	accept dilate or constrict reject suspensory ligaments ignore dilate or constrict	(2) AO1 1

Question number	Answer	Additional guidance	Mark
3(c)(iii)	eyeball is too long / lens is too {thick / curved} / cornea is too curved	accept it can be inherited	(1) AO1 1

Total for Question 3 = 8 marks



Question Number	Answer	Mark
4(a) (i)	D lens 1. The only correct answer is D <i>A is not correct because cataracts do not form in the retina</i> <i>B is not correct because cataracts do not form in the iris</i> <i>C is not correct because cataracts do not form in the cornea</i>	(1) AO 1 1

Question Number	Answer	Mark
4(a) (ii)	An explanation linking: • lens becomes cloudy (1) • less light reaches retina (1)	(2) AO 2 1

Question Number	Answer	Additional guidance	Mark
4(b)	Any two from: • positive correlation/increases (1) • by 125 million people/correct manipulation of data (1)	accept increases by 125 million for two marks	(2) AO 3 1a AO 3 1b

Question Number	Answer	Additional guidance	Mark
4(c) (i)	Any two from: • surgery / removing the lens (1) • replaced with plastic lens (1)	accept laser (eye) surgery/ use lasers accept replace with a new lens	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
4(c) (ii)	Any two from: • less risk of infection (to eye) (1) • less risk of permanent damage (to eye) (1) • less cost / easier to do / fewer visits to hospital / no recovery time needed (1)	accept no surgery needed	(2) AO 2 1

Total for Question 4 = 9 marks

Question number	Answer	Mark
10(a)(i)	D retina The only correct answer is D <i>A is incorrect because the cornea does not contain light receptor cells</i> <i>B is incorrect because the iris does not contain light receptor cells</i> <i>C is incorrect because the lens does not contain light receptor cells</i>	(1) A02 1

Question number	Answer	Mark
10(a)(ii)	mitochondria / mitochondrion accept phonetic spellings	(1) A02 1

Question number	Answer	Mark
10(a)(iii)	nucleus / nuclei accept phonetic spellings	(1) A02 1

Question number	Answer	Additional guidance	Mark
10(a)(iv)	rods / rod cells	reject cones	(1) A02 1

Question number	Answer	Additional guidance	Mark
10(a)(v)	A description including two of the following: - cell B is a cone cell (1) - involved in colour vision (1)	accept responds to bright light / high light intensities accept responds to different wavelengths frequencies of light (1)	(2) AO2 1

Question number	Answer	Additional guidance	Mark
10(b)(i)	Change the subject of the equation $\text{time} = \text{distance} \div \text{speed} \quad (1)$ Conversion of mm to m $47 \div 1000 = 0.047(\text{m}) \quad (1)$ Substitution $0.047 \div 75 = 0.0006267 \text{ (seconds)}$ OR Change the subject of the equation $\text{time} = \text{distance} \div \text{speed} \quad (1)$ Conversion of m to mm $75 \times 1000 = 75000 \text{ (mm)} \quad (1)$ Substitution $47 \div 75000 = 0.0006267 \text{ (seconds)}$	award full marks for correct answer no working accept any correct rounding - 0.00063 / 0.000626(recurring) / 0.0006 accept answers in standard form accept any correct rounding - 0.00063 / 0.000626(recurring) / 0.0006 accept answers in standard form	(3) AO2 1

Question number	Answer	Mark
10(b)(ii)	A cerebral hemispheres The only correct answer is A <i>B is incorrect because the occipital lobe is not located in the medulla oblongata</i> <i>C is incorrect because the occipital lobe is not located in the cerebellum</i> <i>D is incorrect because the occipital lobe is not located in the hypothalamus</i>	(1) AO1 1

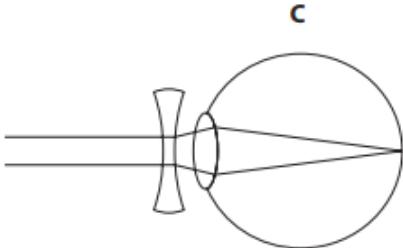
Question number	Answer	Mark
10(b)(iii)	(eye)sight / vision / seeing / being able to see	(1) AO2 1

(Total for question 10 = 11 marks)



Question number	Answer	Additional guidance	Mark
10(a)(i)	240 × 0.35 / 84 (1) 240 – 84 (1) 156 (people) OR 100 – 35 / 65 / 0.65 (1) 0.65 × 240 / 65 ÷ 100 × 240 (1) 156 (people) OR 240 ÷ 100 / 2.4 (1) 2.4 × 65 (1) 156 (people)	Award full marks for the correct answer with no workings ecf for an incorrect value subtracted from 240 shown in workings ecf for an incorrect value multiplied by 240 shown in workings ecf for an incorrect value multiplied by 65 shown in workings	(3) A02 1

Question number	Answer	Additional guidance	Mark
10(a)(ii)	Any one from: - the eye(ball) is too long (1) - the cornea is too curved (1) - lens is too thick/too curved (1) - the {cornea/lens} refracts the light too much (1) {light rays focus/focal point is} in front of the retina (1)	ignore the eye(ball) is too big ignore image forms in front of the retina accept it is inherited / caused by genetics (1)	(1) AO1 1

Question number	Answer	Mark
10(a)(iii)	C  The only correct answer is C <i>A is not correct because a convex lens is not used</i> <i>B is not correct because a convex lens is not used</i> <i>D is not correct because a concave lens doesn't refract light in this way</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
10(b)(i)	an answer including two from: protein (has built up) (1) (in the) <u>lens</u> (1) - light is dispersed (1)	accept cloudy lens accept not all the light rays pass through ignore blurry vision	(2) AO1 1

Question number	Answer	Additional guidance	Mark
10(b)(ii)	(surgery to) replace the lens / use an {artificial / plastic lens}	ignore surgery /laser surgery	(1) AO1 1

Question number	Answer	Mark
10c(i)	A cerebellum The only correct answer is A <i>B is not correct because structure X is not the cerebral hemisphere</i> <i>C is not correct because structure X is not the medulla oblongata</i> <i>D is not correct because structure X is not the spinal cord</i>	(1) AO2 1

Question number	Answer	Additional guidance	Mark
10c(ii)	An answer including: • by electrical impulses (1) • along a motor neurone (to the effector) (1)	accept electrical message / signal accept motor neurone in the correct place in a description of a reflex arc	(2) A02 1

(Total for question 10 = 11 marks)



Question Number	Answer	Mark
8(a)(i)	arrow showing direction of travel is from left to right	(1) AO1 1

Question Number	Answer	Mark
8(a)(ii)	K – myelin (sheath) (1) L – axon (1)	(2) AO1 1

Question Number	Answer	Additional guidance	Mark
8(b)(i)	A description including three from: - the impulse (in the relay neurone) triggers the release of a chemical (1) - neurotransmitter (1) (neurotransmitter) diffuses (1) - across the synapse (1) - new impulse triggered in {motor neurone / next neurone} (1)	accept chemical messenger accept across the gap	(3) AO1 1

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation linking two from: - a process that occurs in response to danger (1) - which bypasses the {brain / parts of the brain} / is an {involuntary process / subconscious process} (1) - so there is a faster transmission (of electrical impulses) / faster response / allows a quick reaction (1) - to protect the body from harm (1)	accept goes to the spinal cord accept react without thinking accept examples of actions to protect the body e.g. pulling hand away	(2) AO1 1

Question Number	Answer	Mark
8(c)(i)	C 215 milliseconds The only correct answer is C <i>A is not correct because the median is not 200 milliseconds</i> <i>B is not correct because the median is not 210 milliseconds</i> <i>D is not correct because the median is not 225 milliseconds</i>	(1) AO2 1

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	A description including three from: • measure their reaction time using red squares (1) • keep everything else the same (as using blue squares) (1) • repeat measurements (for each student) (1) • calculate a mean reaction time (1) • control other variables (1)	accept see how fast they react with red squares accept examples of other variables e.g. tiredness / environment / health	(3) AO3 3a

(Total for question 8 = 12 marks)

Question number	Answer	Mark
6(a)(i)	C 50th to 75th The only correct answer is C <i>A is incorrect because his height percentile is 50 – 75</i> <i>B is incorrect because his height percentile is 50 – 75</i> <i>D is incorrect because his height percentile is 50 – 75</i>	(1) A03 1a

Question number	Answer	Mark
6(a)(ii)	Any one from: - to monitor height / growth (over time) (1) - to compare the growth of an individual against the standard growth pattern (1)	(1) A01 1

Question number	Answer	Additional guidance	Mark
6(b)(i)	A description including any two from: - tail / flagellum (1) - acrosome / sac with enzymes (1) (many) mitochondria (1) - streamlined (1) - haploid / has 23 chromosomes (1)	accept has enzymes to digest the membrane around the egg	(2) A01 1

Question number	Answer	Mark									
6(b)(ii)	Award one mark for each correct square in the table. <table border="1"> <thead> <tr> <th></th><th>mitosis</th><th>meiosis</th></tr> </thead> <tbody> <tr> <td>number of daughter cells produced</td><td>2</td><td>4</td></tr> <tr> <td>number of chromosomes in each daughter cell</td><td>46 / <u>23 pairs</u></td><td>23</td></tr> </tbody> </table> For mitosis (number of chromosomes) ignore 23 on its own, must be qualified as 23 pairs		mitosis	meiosis	number of daughter cells produced	2	4	number of chromosomes in each daughter cell	46 / <u>23 pairs</u>	23	(4) AO1 1
	mitosis	meiosis									
number of daughter cells produced	2	4									
number of chromosomes in each daughter cell	46 / <u>23 pairs</u>	23									

Question number	Answer	Mark
6(c)(i)	A meristem The only correct answer is A <i>B is incorrect because root hair cells are not the area of the root where many cells are dividing by mitosis.</i> <i>C is incorrect because xylem is not the area of the root where many cells are dividing by mitosis.</i> <i>D is incorrect because phloem is not the area of the root where many cells are dividing by mitosis.</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(c)(ii)	An answer including three of the following • add {enzyme (solution) / plant root cells} to glucose (solution) (1) • test for presence of starch (1) • test {each minute / at set time intervals} / time until a positive result for starch (1) • repeat at more than one pH / (in buffers) of different pH values (1) • reference to controlling one variable, e.g. same volume of solutions / same temperature (1)	accept use iodine	(3) AO3 3a

(Total marks for question 6 = 12)



Question number	Answer	Mark
7(a)(i)	C structure S The only correct answer is C <i>A is incorrect because cataracts do not develop in the retina.</i> <i>B is incorrect because cataracts do not develop in the sclerotic.</i> <i>D is incorrect because cataracts do not develop in the cornea.</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
7(a)(ii)	A description including two of: • cut into the eye / use a laser (to open the eye) (1) • replace (old / opaque) lens (1) • with a new clear artificial / plastic / glass lens (1)		(2) AO1 1

Question number	Answer	Additional guidance	Mark
7(b)(i)	An explanation linking: • the pupil gets smaller (1) • (the) iris (1) • gets bigger (1)	accept (circular) muscles contract (1) accept radial muscles relax (1)	(3) AO1 1



Question number	Indicative content	Mark
7 (b)(ii)	A02 why distant objects cannot be seen clearly • person is near-sighted / short-sighted / has myopia • light is not focused on retina • light is focused in front of the retina • the eyeball is too long • the cornea is too curved / convex /converging • the lens cannot be made thin enough • so the light is refracted too much how the problem can be corrected • go to the opticians • go to have your eyesight tested • have glasses / contact lenses prescribed • glasses / contact lenses need to be concave / diverging • have laser treatment (of cornea) • cornea needs to be less convex • so light is refracted less before it enters the eye • so light is focused on the retina	(6) A02 1



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is accurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. • Presents a description which is not logically ordered and with significant gaps.
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing.
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. • Presents a description that has a well-developed structure which is clear, coherent and logical.



Level	Mark	Additional Guidance	General additional guidance The level is determined by the areas of indicative content covered within the response. The mark within the level is determined by the detail within each description.
	0	No rewardable material	
Level 1	1–2	Makes a simple reference to the eye problem or how it can be corrected.	<u>Possible candidate responses</u> - Wear glasses (bottom of level 1) - The light comes together in front of the retina (good level 1)
Level 2	3–4	- Refers to both areas of indicative content OR - Gives an explanation of the eye problem OR how to correct the eye problem.	<u>Possible candidate responses</u> - The light is bent too much at the front of the eye so you need to wear glasses (bottom of level 2 – both areas referred to) - Light is bent too much at the cornea so it focuses in front of the retina (good level 2 – an explanation of one area)
Level 3	5–6	- Refers to both areas of indicative content and gives a detailed explanation of one area OR - Gives a detailed explanation of both areas of indicative content	<u>Possible candidate responses</u> - The person is short-sighted. The cornea is too curved so the light is bent so that it is focused in front of the retina. Glasses need to be worn to correct the problem (bottom of level 3 – both areas and one in detail) - The person is short-sighted because the cornea is too convex, so light is focused in front of the retina. To correct the problem you need glasses to make light meet on the retina (good level 3 – both areas explained)

(Total marks for question 7 = 12)

7(a)(i)	(cancer cells) divide uncontrollably / have mutations	accept {multiply / grow / reproduce} rapidly	(1) AO1 1
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Question number	Answer	Additional guidance	Mark
7(a)(ii)	cells in tissue culture may respond differently to cells in the body	accept the drug may not work the same / might produce different results	(1) AO2 1

Question number	Answer	Additional guidance	Mark
7(b)(i)	autoclave	accept use gamma (rays) / UV ignore heating / radiation	(1) AO1 1

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation linking: - to kill bacteria / pathogens (1) - so {plant cells / plantlets} can grow disease-free / growth of {plant cells / plantlets} is unaffected (1) - so {plant cells / plantlets} do not compete for resources (with pathogens) (1)	accept to prevent contamination / prevent growth of unwanted organisms ignore reduce the number of bacteria / pathogens accept so {plant cells / plantlets} are not damaged / killed (by pathogens) accept a named resource e.g. nutrients	(2) AO1 1

Question number	Answer	Additional guidance	Mark
7(b)(iii)	One from: (tissue culture) allows a {large number of / more} new plants to be produced (1) - only a small quantity of original plant tissue needed (1) - plants do not become extinct (1)	ignore references to yield / less space required / faster process accept genetic material is not lost accept can control environmental factors / can grow plants at any time of year (1) accept plants are easier to monitor (1)	(1) AO1 1

Question number	Indicative content	Mark
7(c)*	A01 <u>cell wall</u> • made of cellulose • tough • difficult for pathogens to break down / digest / gain entry <u>waxy cuticle</u> • protects epidermis and tissues below • difficult for pathogens to get through <u>thorns / prickles / spines</u> • deter herbivores from eating them <u>bark</u> • difficult for pathogens / pests to get through • protects living tissue beneath	(6) A01 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents a description with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. - Presents a description that has structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents a description that has a well-developed structure which is clear, coherent and logical.

Level	Mark	Additional Guidance	General additional guidance The level is determined by the number of physical barriers described. The mark within the level is determined by the level of detail in each description.
Level 1	1-2	- The answer refers to a physical barrier - The response includes a detail about a physical barrier	<u>Possible candidate response</u> - Some stems have thorns - Some stems have thorns, which stop animals eating the plant
Level 2	3-4	- The description refers to more than one physical barrier - The response includes some detail about a physical barrier	<u>Possible candidate response</u> Plant cells have a tough cell wall. Some stems have thorns.

			Plant cells have a tough cell wall that stops pathogens getting in. Some stems have thorns.
Level 3	5-6	- The description refers to several physical barriers - The response includes details of at least two physical barriers	<u>Possible candidate responses</u> - Leaves have a waxy cuticle. Plant cells have a cell wall. Trees have bark on the outside. - Leaves have a waxy cuticle on top. Plant cells have a cellulose cell wall. These stop pests piercing the plant. Trees have bark on the outside, which protects living tissue on the inside.

Total for Question 7 = 12 marks



Question number	Answer	Mark
6(a)(i)	B the distance the ruler falls The only correct answer is B A, C and D are not correct because they would not allow the reaction times to be compared	(1) AO2 2

Question number	Answer	Mark
6(a)(ii)	C 13.4 cm The only correct answer is C A, B and D are not correct because they are not the calculated mean	(1) AO2 1

Question number	Answer	Mark
6(a)(iii)	An explanation linking: (student) J (1) - because the ruler fell the longest distance before it was caught / 15 cm is the longest distance (1)	(2) AO3 2a 2b

Question number	Answer	Additional guidance	Mark
6(a)(iv)	Any two from: - the same ruler (1) - distance between {the finger and thumb / hands} / height ruler is dropped from (1) - catch ruler with same / dominant hand (1) - no stimulant / depressant / drugs taken (1) - same environmental conditions (1)	accept size / length / mass of ruler accept keeping named environmental conditions the same, e.g. noise, room temperature	(2) AO3 3b

Question number	Answer	Additional guidance	Mark
6(b)(i)	transmit (electrical) {impulses / messages / signals} from the CNS (1) OR transmit (electrical) {impulses / messages / signals} to effectors (1)	accept brain / spinal cord / relay neurone for CNS accept muscles / glands for effector	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation including two from: - insulates the axon (1) - so nerve impulses travel faster (1)	accept messages / signals for impulses accept ensures impulses move in one direction (1)	(2) AO1 1

Question number	Answer	Additional guidance	Mark
6(b)(iii)	A description including three from: • a chemical is released (1) • neurotransmitter (1) • (neurotransmitter / chemical) diffuses (1) • (across the) synapse (1) • (neurotransmitter / chemical) binds to receptors (1)	accept named neurotransmitter accept moves from a high concentration to a low concentration reject impulse diffuses across accept (across the) synaptic cleft (neurotransmitter / chemical) triggers an impulse / message / signal in the next neurone (1) by neurotransmission (1)	(3) AO1 1

Total for Question 6 = 12 marks

Question number	Answer	Mark
7(a)(i)	D optic nerve The only correct answer is D <i>A is not correct because the cornea does not carry impulses to the brain</i> <i>B is not correct because the iris does not carry impulses to the brain</i> <i>C is not correct because the lens does not carry impulses to the brain</i>	(1)

Question number	Answer	Additional guidance	Mark
7(a)(ii)	iris	accept radial muscles / circular muscles	(1)

Question number	Answer	Mark
7(b)	An answer linking four from: • cone cells (1) • (cone cells) responsible for colour vision (1) • rod cells (1) • (rod cells) detect intensity of light (1) • (both) send impulses to the brain (1)	(4)



Question number	Answer	Mark
7(c)	antibiotics / antibacterials / named antibiotics	(1)

Question number	Indicative content	Mark
*7(d)	Short-sightedness • eyeball too long • cornea too curved • lens too curved / too convex • light refracted too much by cornea / lens • light rays not brought to a focus on retina • light rays focused in front of retina Long-sightedness • eyeball too short • cornea not curved enough • lens too thin /not convex enough • light refracted too little by cornea / lens • light rays not brought to a focus on retina • light rays focused behind retina	(6)



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. - Presents a description which is not logically ordered and with significant gaps.
Level 2	3–4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. - Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing.
Level 3	5–6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. - Presents a description that has a well-developed structure which is clear, coherent and logical.



Level	Mark	Additional Guidance	General additional guidance The level is determined by the number of eye defects covered within the response. The mark within the level is determined by the detail within the descriptions.
	0	No rewardable material	
Level 1	1–2	- A description of one cause of the eye defects. - Linked to an interpretation of the structures in a relevant diagram.	<u>Possible candidate responses</u> - With short-sightedness, light rays are focused in front of the retina. - The eyeball is too long. - With long-sightedness, light rays are focused behind the retina.
Level 2	3–4	- A description of at least two causes of the eye defects. - Linked to an interpretation of the structures in both diagrams.	<u>Possible candidate responses</u> - With short-sightedness, light rays are focused in front of the retina and the eyeball is too long. - With long-sightedness, light rays are focused behind the retina and the eyeball is too short.
Level 3	5–6	- A description of more than two causes of the eye defects. - Linked to an interpretation of both diagrams.	<u>Possible candidate responses</u> - With short-sightedness light rays are focused in front of the retina and the cornea refracts light rays too much. The cornea is too convex. - With long-sightedness light rays are focused behind the retina and the lens doesn't refract light enough. The eyeball is too short.

(Total for question 7 = 13 marks)



Question number	Answer	Additional guidance	Mark
9(a)(i)	Two from: (meristem cells) are undifferentiated (1) (meristem cells) divide / produce more cells (1) - by mitosis (1)	accept are stem cells accept (the cells produced) can differentiate /become specialised/elongate (1)	(2)

Question number	Answer	Additional guidance	Mark
9(a)(ii)	An answer including - use a thin section of {cells/meristem} (1) - add a stain / named stain (1) - place a cover slip on top of the sample (1)	accept add a sample of the cells to the microscope slide accept a description of a coverslip	(3)

Question number	Answer	Mark
9(b)(i)	chloroplast / chloroplasts accept phonetically correct misspellings	(1)

Question number	Answer	Additional guidance	Mark
9(b)(ii)	(aerobic) respiration / release energy	ignore make / produce energy accept word equation for respiration accept to produce ATP	(1)



Question number	Indicative content	Mark
9(c)	Structure of DNA • polymer • four bases (A, T, C, G) • (complementary) base pairs • A-T and C-G • (weak) hydrogen bonds join bases • two strands • double helix • nucleotides DNA extraction • crush up / grind / squash cells • add detergent / salt solution / protease • heat in a water bath / heat to 60°C • add to (ice cold) ethanol • DNA forms as a precipitate /white strands	(6)

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is accurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. • Presents a description which is not logically ordered and with significant gaps.
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing.
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. • Presents a description that has a well-developed structure which is clear, coherent and logical.



Level	Mark	Additional Guidance	General additional guidance The level is determined by the areas of indicative content covered within the response. The mark within the level is determined by the detail within each description.
	0	No rewardable material	
Level 1	1–2	- A simple description of DNA structure. - A brief description of how to extract DNA from plants	<u>Possible candidate responses</u> - DNA contains four bases - DNA can be extracted by crushing up fruit
Level 2	3–4	- A description of DNA structure. - A description of how to extract DNA from plants	<u>Possible candidate responses</u> - DNA contains four bases A, T, C and G and DNA is a double helix. - DNA can be extracted by crushing up fruit and adding detergent.
Level 3	5–6	- A detailed description of DNA structure. - A detailed description of how to extract DNA from plants.	<u>Possible candidate responses</u> - The DNA molecule is a double helix. DNA contains four bases which pair A-T and C-G. The bases are held together by hydrogen bonds. - DNA can be extracted by crushing up fruit with detergent and pouring the mixture into (ice-cold) ethanol. DNA appears as a precipitate.

(Total for question 9 = 13 marks)

