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

H

J250/07 Paper 7 (Higher Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 10 minutes

You may use:
- a scientific or graphical calculator
- a ruler

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **28** pages.

SPECIMEN

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

1 What happens to a plant cell when it is placed in a more dilute solution?

A It absorbs water until it bursts

B It absorbs water until it is turgid

D It loses water and become flaccid

C It loses water and shrinks

Your answer ☐ **[1]**

2 What is common to both xylem and phloem?

A Cell walls containing lignin

B Companion cells

C No nucleus

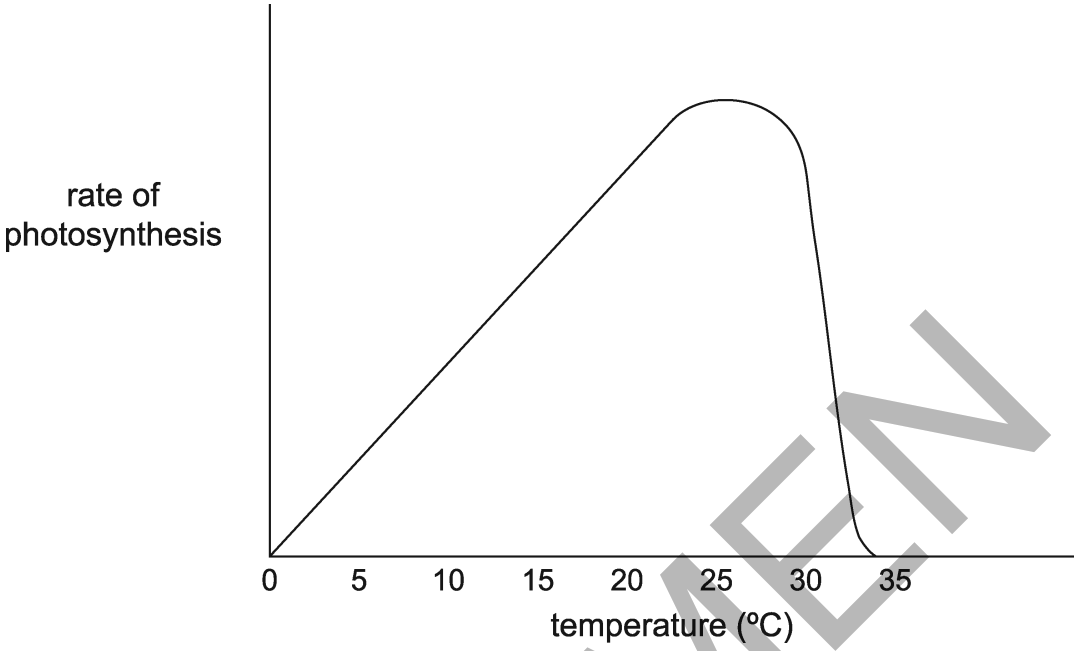
D Sieve plates

Your answer ☐ **[1]**

SPECIMEN

3 Look at the graph.

It shows the effect of temperature on the rate of photosynthesis for a plant.



What is the optimum temperature for photosynthesis for this plant?

A 0°C

B 20°C

C 25°C

D 34°C

Your answer ☐ **[1]**

SPECIMEN

4 Which word equation correctly summarises the balance of blood sugar?

A Glucose $\underset{\text{GLUCAGON}}{\overset{\text{INSULIN}}{\rightleftharpoons}}$ Glycogen

B Glycogen $\underset{\text{GLUCAGON}}{\overset{\text{INSULIN}}{\rightleftharpoons}}$ Glucose

C Glucagon $\underset{\text{GLYCOGEN}}{\overset{\text{INSULIN}}{\rightleftharpoons}}$ Glucose

D Glucose $\underset{\text{INSULIN}}{\overset{\text{GLYCOGEN}}{\rightleftharpoons}}$ Glucagon

Your answer ☐ **[1]**

5 The table shows the number of mitochondria in different types of cell.

Type of cell	Number of mitochondria
heart muscle	5000
liver	1500
skin	100

Which statement best explains the data in the table?

A Heart muscle cells produce more protein than other types of cell.

B Liver cells only respire using anaerobic respiration.

C Muscle contraction requires large amounts of energy.

D Skin cells need large amounts of energy.

Your answer ☐ **[1]**

SPECIMEN

6 What structures do prokaryotic and eukaryotic cells have in common?

A Cell membrane and cytoplasm

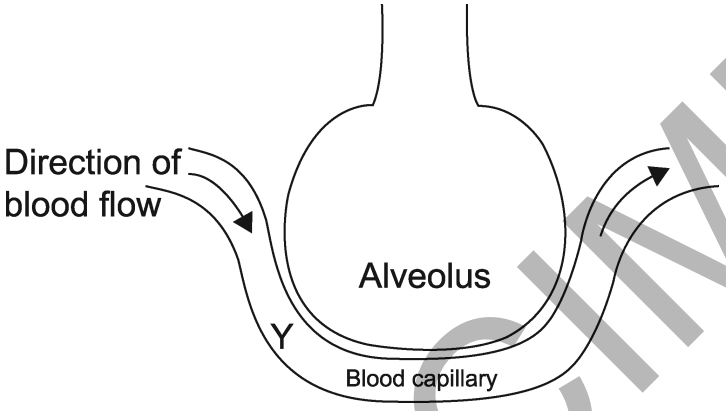
B Cell membrane and nucleus

C Cytoplasm and mitochondria

D Mitochondria and nucleus

Your answer ☐ **[1]**

7 Gas exchange in a mammal occurs between an alveolus and the blood in a capillary.



Which statement is correct at point **Y**?

A Carbon dioxide concentration is higher in the blood than in the alveolus.

B Carbon dioxide concentration is lower in the blood than in the alveolus.

C Oxygen concentration is higher in the blood than in the alveolus.

D Oxygen concentration is the same in the blood as in the alveolus.

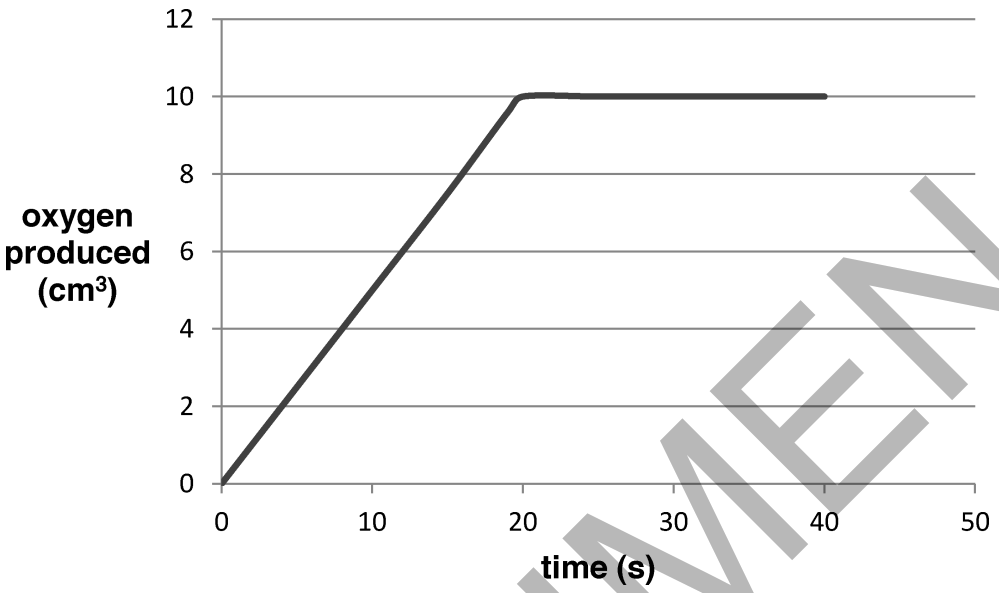
Your answer ☐ **[1]**

SPECIMEN

8 When the enzyme catalase is added to hydrogen peroxide, oxygen and water are produced.

The oxygen produced can be collected and used to show the progress of the reaction.

The graph below shows the results.



Why is oxygen **not** produced after 20 seconds?

A Active sites are all full

B Enzyme has been used up

C Enzyme has denatured

D Substrate has been used up

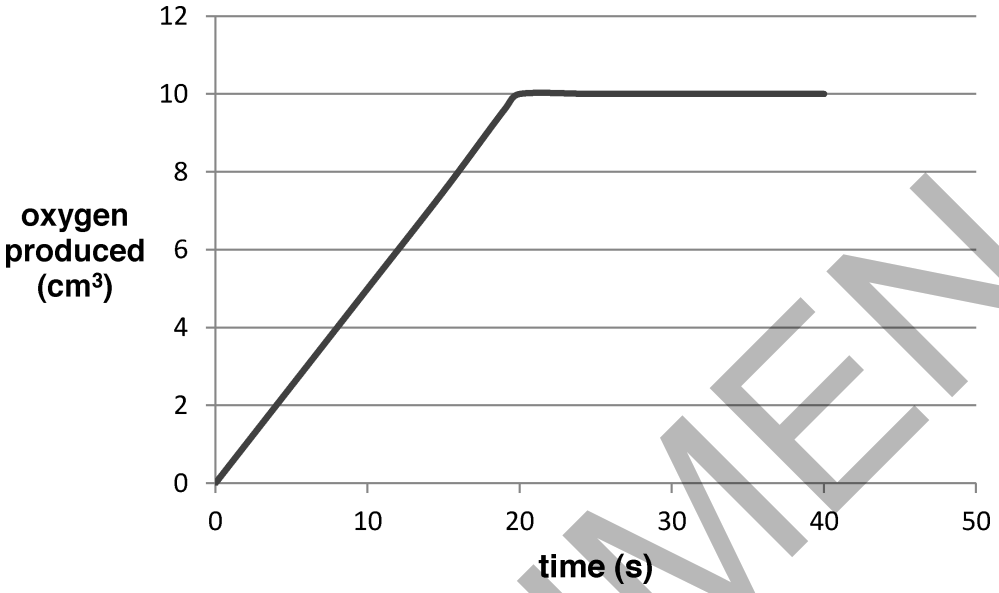
Your answer ☐ **[1]**

SPECIMEN

9 When the enzyme catalase is added to hydrogen peroxide, oxygen and water are produced.

The oxygen produced can be collected and used to show the progress of the reaction.

The graph below shows this reaction.



What is the rate of reaction between 10 and 20 seconds?

A 0.5 cm^3/s

B 2.0 cm^3/s

C 5.0 cm^3/s

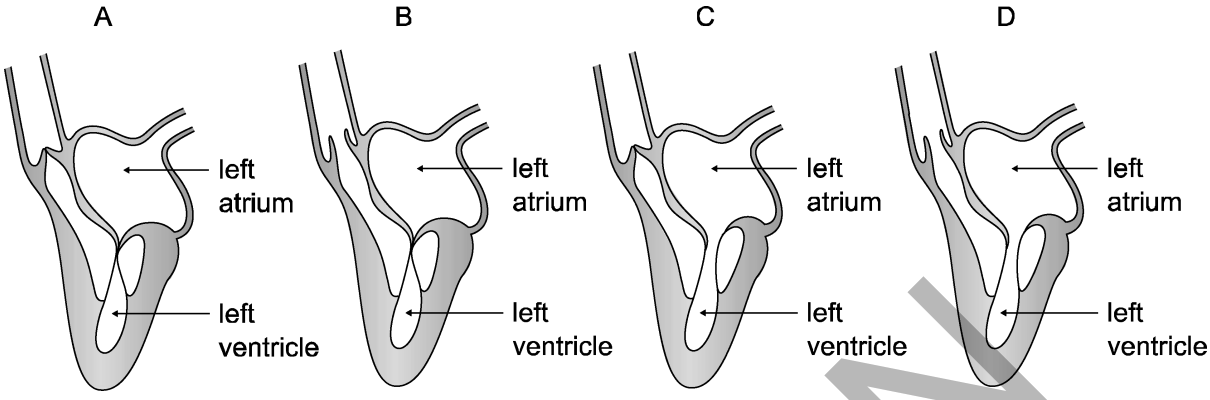
D 10.0 cm^3/s

Your answer ☐ **[1]**

SPECIMEN

10 The diagrams show sections through part of the heart.

Which diagram **A**, **B**, **C** or **D** shows the heart pumping blood to the rest of the body?



Your answer ☐ **[1]**

SPECIMEN

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TURN OVER FOR THE NEXT QUESTION

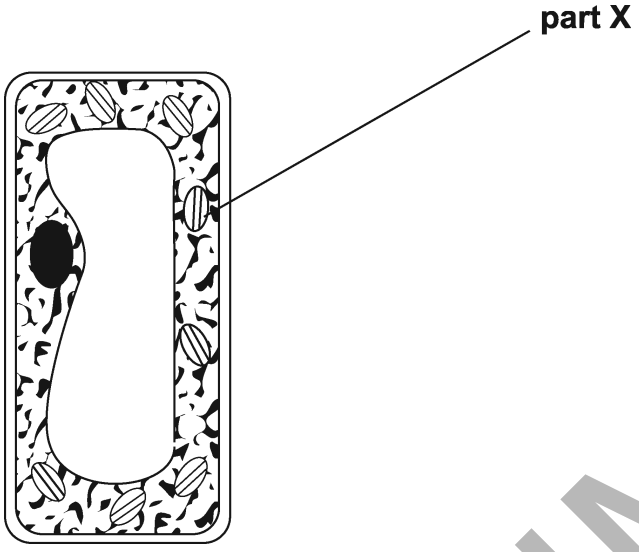
SPECIMEN

SECTION B

Answer **all** the questions.

11 Look at the palisade cell from a leaf.

This cell is important for photosynthesis.



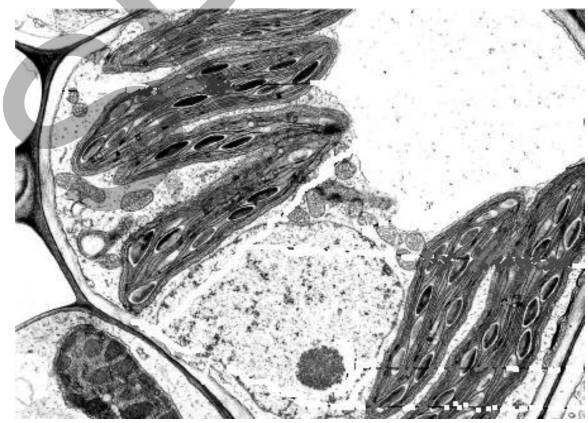
(a) The chemical reactions of photosynthesis take place at part **X**.

What is the name of part **X**.

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

(b) Look at the picture.

It is an electron micrograph of another cell found in the leaf.



Explain how using electron microscopy has improved the understanding of structures inside cells.

.....

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

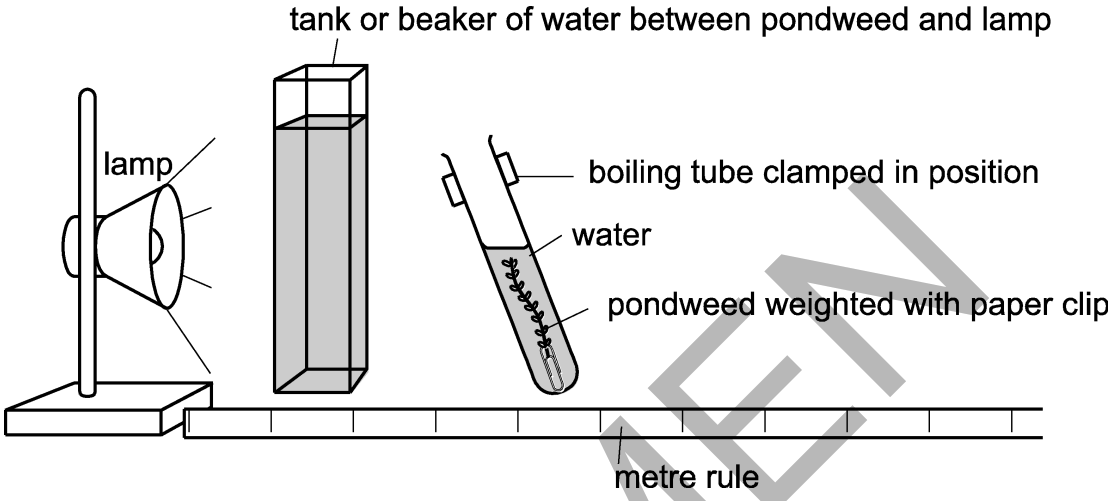
(c) Complete the chemical equation for photosynthesis.

SPECIMEN

..... + $6H_2O$ → ..... + $6O_2$ **[2]**

(d) Look at the diagram.

It shows a set of apparatus that can be used to investigate the rate of photosynthesis.



Method

Step 1 Set up the apparatus and look for a stream of bubbles coming from the cut end of the pond weed.

Step 2 Count the number of bubbles produced in 1 minute.
Repeat for a second minute.
Repeat for a third minute.

Step 3 Change the distance of the lamp from the pondweed to investigate the effect on the rate of photosynthesis.

Step 4 Leave for 2 minutes, then count the number of bubbles produced in one minute.
Repeat for a second minute.
Repeat for a third minute.

Step 5 Change the distance again, and repeat **step 4**.

Students followed this method to investigate the effect of light intensity on photosynthesis.

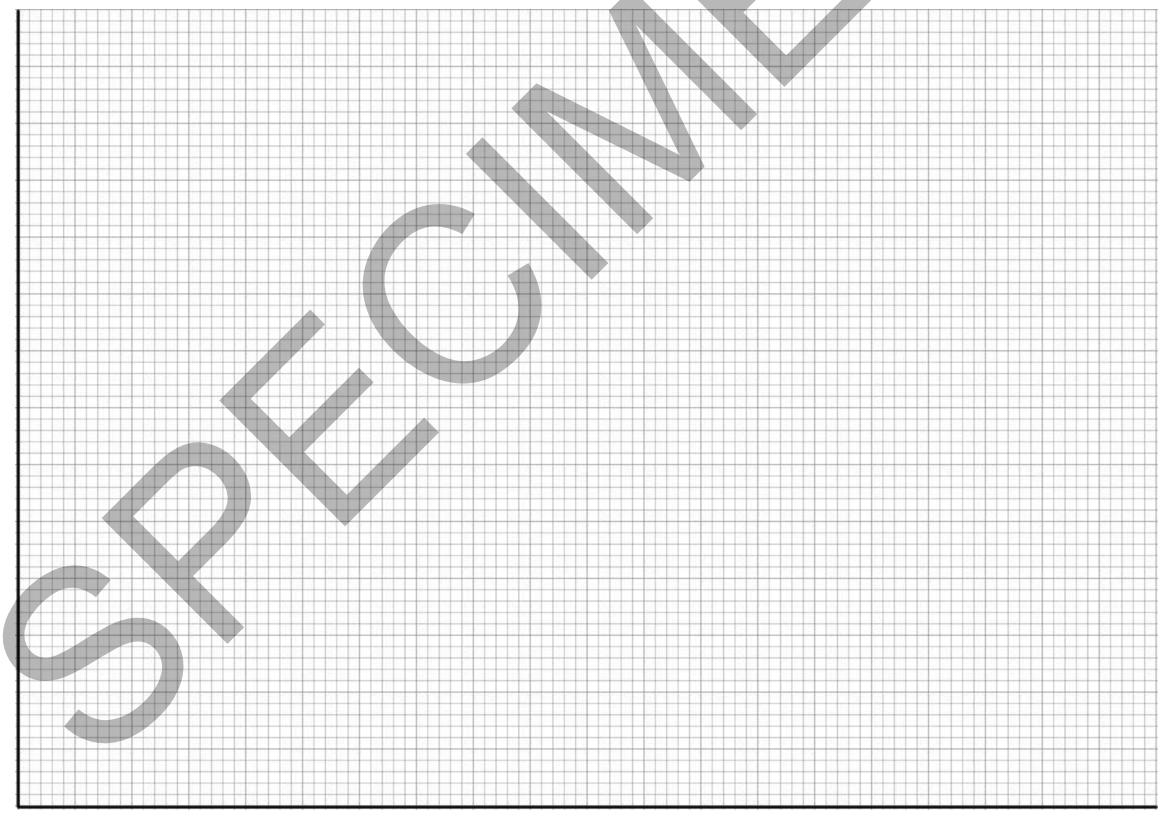
SPECIMEN

The table shows results from this experiment.

Distance of light from the pondweed (in metres)	Number of bubbles counted in 1 minute			Mean
	Trial 1	Trial 2	Trial 3	
1.0	8	6	7	7
0.5	28	32	30	30
0.25	105	106	104	105
0.125	105	104	109	.....

(i) Calculate the mean for the distance 0.125 metres and add it in the table **[1]**

(ii) Plot a graph to show the effect of the **distance of light from the pondweed** on the **mean number of bubbles** produced.



[3]

SPECIMEN

(iii) Describe the effect of light intensity on photosynthesis.

.....

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

(iv) Suggest **one** source of error in the method for measuring the amount of gas given off.

Explain how this method could be improved.

.....

.....

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

SPECIMEN

12 A student investigates the effect of adding the enzyme pepsin and hydrochloric acid to egg-white.

- The student uses four test tubes (Tubes 1–4). Their contents are shown in table 12.1.
- The test tubes are kept at 40°C for 5 minutes.

Tube 1	**Tube 2**	**Tube 3**	**Tube 4**
5.0 cm^3 egg-white	5.0 cm^3 egg-white	5.0 cm^3 egg-white	5.0 cm^3 egg-white
3 drops distilled water	3 drops hydrochloric acid	3 drops hydrochloric acid	3 drops hydrochloric acid
1.0 cm^3 pepsin	..... distilled water	1.0 cm^3 pepsin	1.0 cm^3 of **boiled** pepsin

Table 12.1

(a) What quantity of distilled water must be added to **Tube 2**?

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

(b) Why is it important to set up **Tube 2**?

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

(c) Describe how you would make sure the temperature stayed at 40°C for 5 minutes.

.....

.....

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

(d) Suggest **one** possible source of error in how the tubes were set up, shown in Table 12.1.

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

SPECIMEN

(e) Two techniques were used to collect the results from the test tubes in Table 12.1.

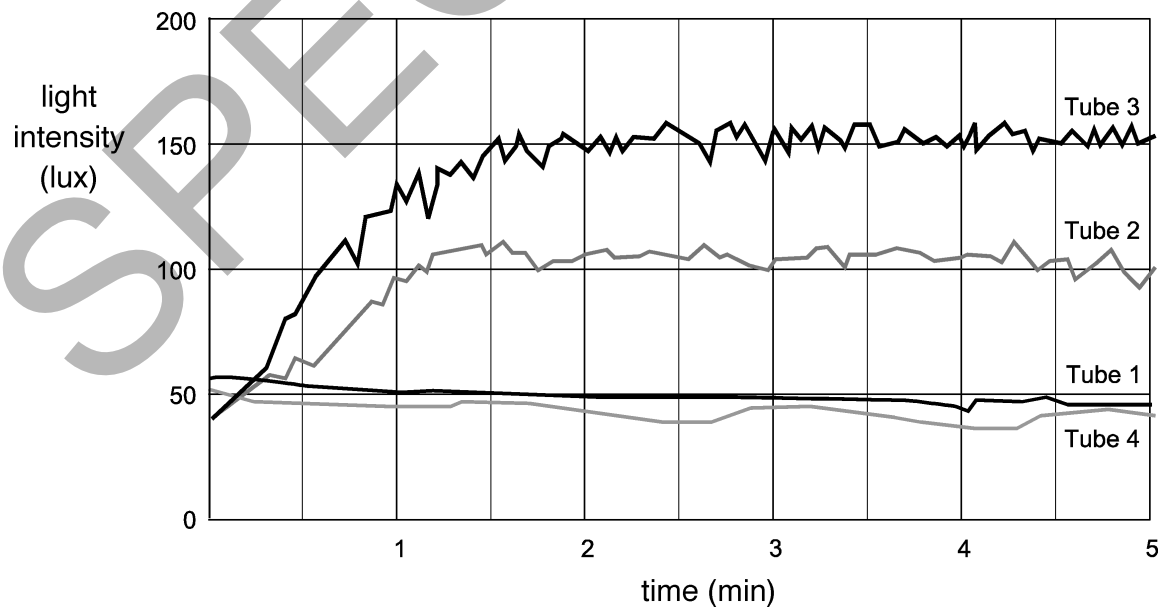
Technique 1
A visual comparison was made to see how cloudy the tubes were at the start and after 5 minutes.

Look at the table of results.

Tube	Contents	Observations of tube contents	
		Start	**After 5 minutes**
1	egg-white, water and pepsin	cloudy	almost clear
2	egg-white, hydrochloric acid and water	cloudy	cloudy
3	egg-white, hydrochloric acid and pepsin	cloudy	clear
4	egg-white, hydrochloric acid and **boiled** pepsin	cloudy	cloudy

Technique 2
A colorimeter was used to measure how much light passed through each tube during the 5 minutes.

Look at the graph plotted from the colorimeter readings.
It shows how much light passes through each tube over 5 minutes.



SPECIMEN

(i) Compare the two techniques used to collect the results to decide which is best.

.....

.....

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

(ii) **Tube 3** has the fastest rate of reaction during the first minute.

How can you tell this from the graph?

.....

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

(f) Explain the results obtained in **Tube 4**.

Use your knowledge and understanding of how enzymes work in your answer.

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..... **[5]**

SPECIMEN

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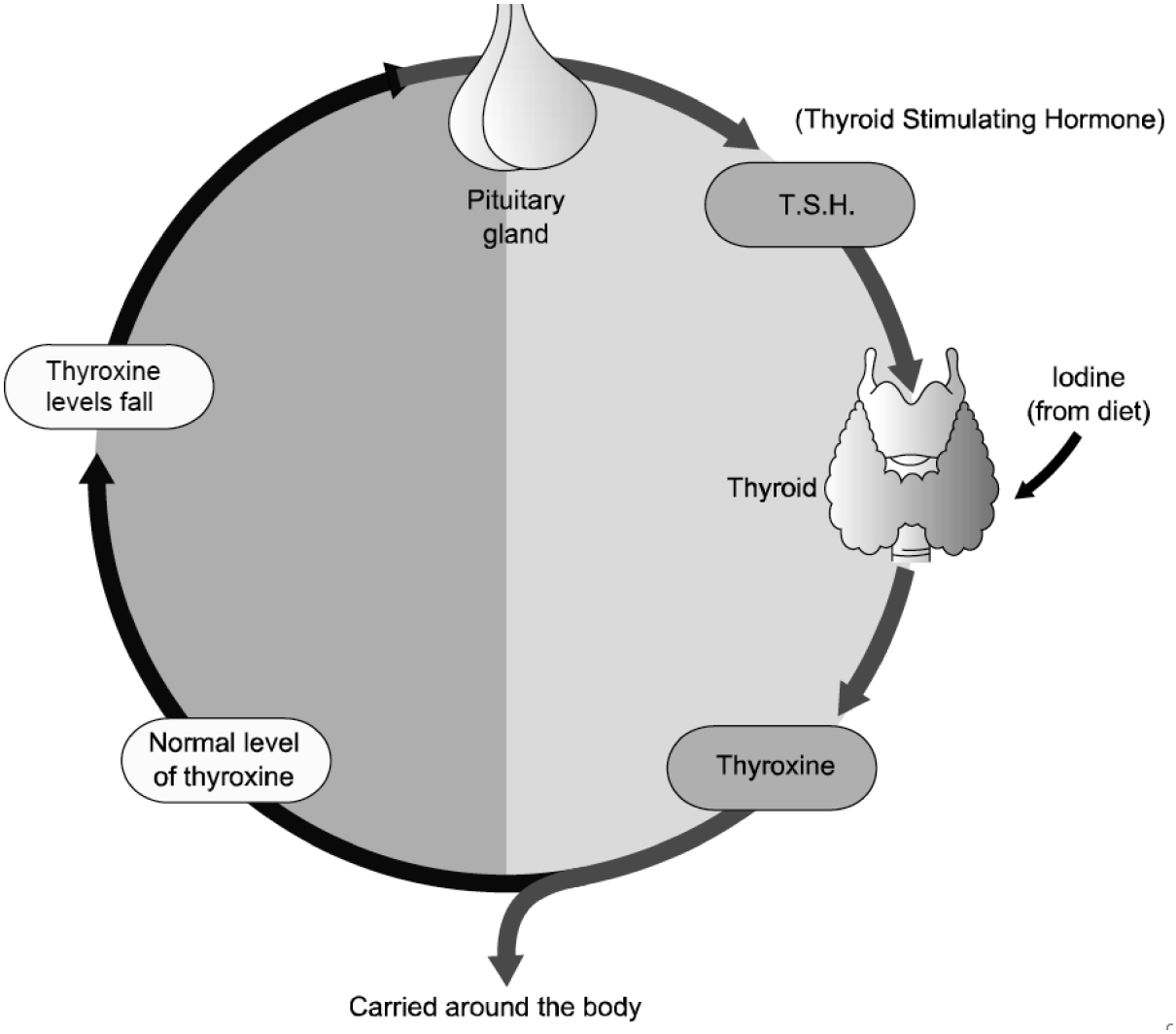
TURN OVER FOR THE NEXT QUESTION

13 Thyroxine is a hormone made by the thyroid gland in the neck.

Look at the diagram. It shows how thyroxine is controlled in the body.



(a)* Describe how hormones are able to co-ordinate and control changes in the body.

Describe the role of thyroxine and explain how the body controls the level of this hormone.

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

(b) Hypothyroidism is caused by an underactive thyroid gland.
A possible cure may be found by using stem cells.

What are stem cells?

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

(c) Scientists have been able to make working thyroid cells from stem cells.
They use embryonic stem cells.

How are embryonic stem cells different to adult stem cells?

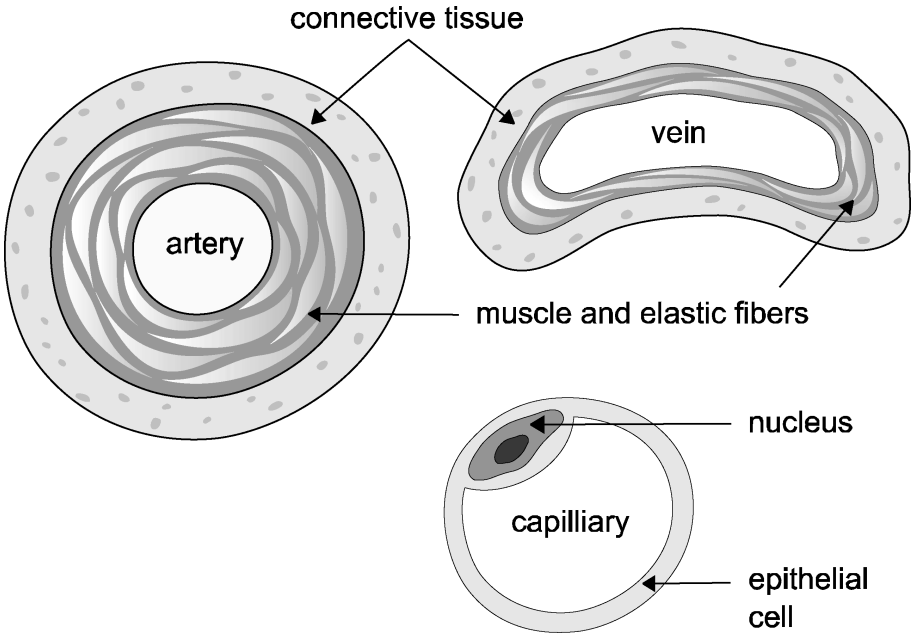
.....

.....

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

14 Look at the picture.

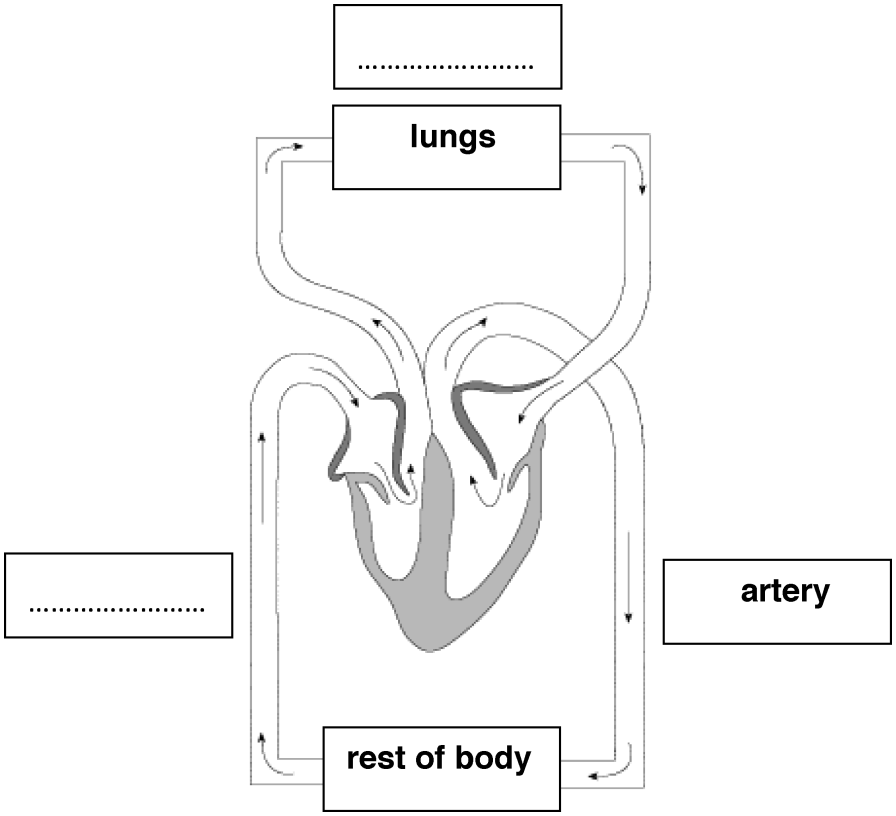
It shows three of the blood vessels found in humans (not drawn to the same scale).



(a) The blood vessels are part of a circulatory system.

In the boxes, write the name of each vessel to show its position in the circulatory system.

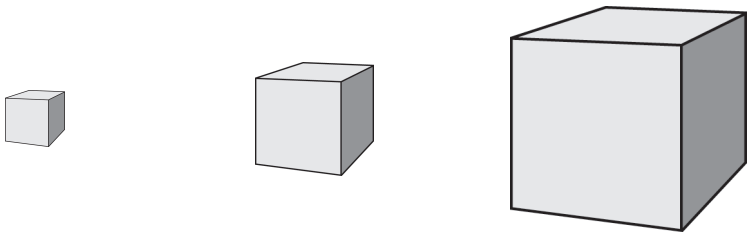
One has been done for you.



[2]

(b) Surface area and volume are important for the transport of substances in the circulatory system.

Look at the diagram.



	1 mm cube	**2 mm cube**	**4 mm cube**
Surface area	6 sides × 1 mm^2 = 6 mm^2	6 sides × 2 mm^2 = 24 mm^2	6 sides × 4 mm^2 = 96mm^2
Volume	$(1\ mm)^3$ = 1 mm^3	$(2\ mm)^3$ = 8 mm^3	$(4\ mm)^3$ = ... mm^3
Surface area : volume ratio	6/1	3/1	.....

(i) Complete the table to calculate the surface area : volume ratio for the 4 mm cube. **[2]**

(ii) Explain which blood vessel you would expect to have the largest surface area : volume ratio.

Use ideas from your answer to part **(i)** and your knowledge of blood vessels in your answer.

.....

.....

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

(c) Look at the diagram in Fig 14.1.

It shows the changes that take place as blood flows around the body.

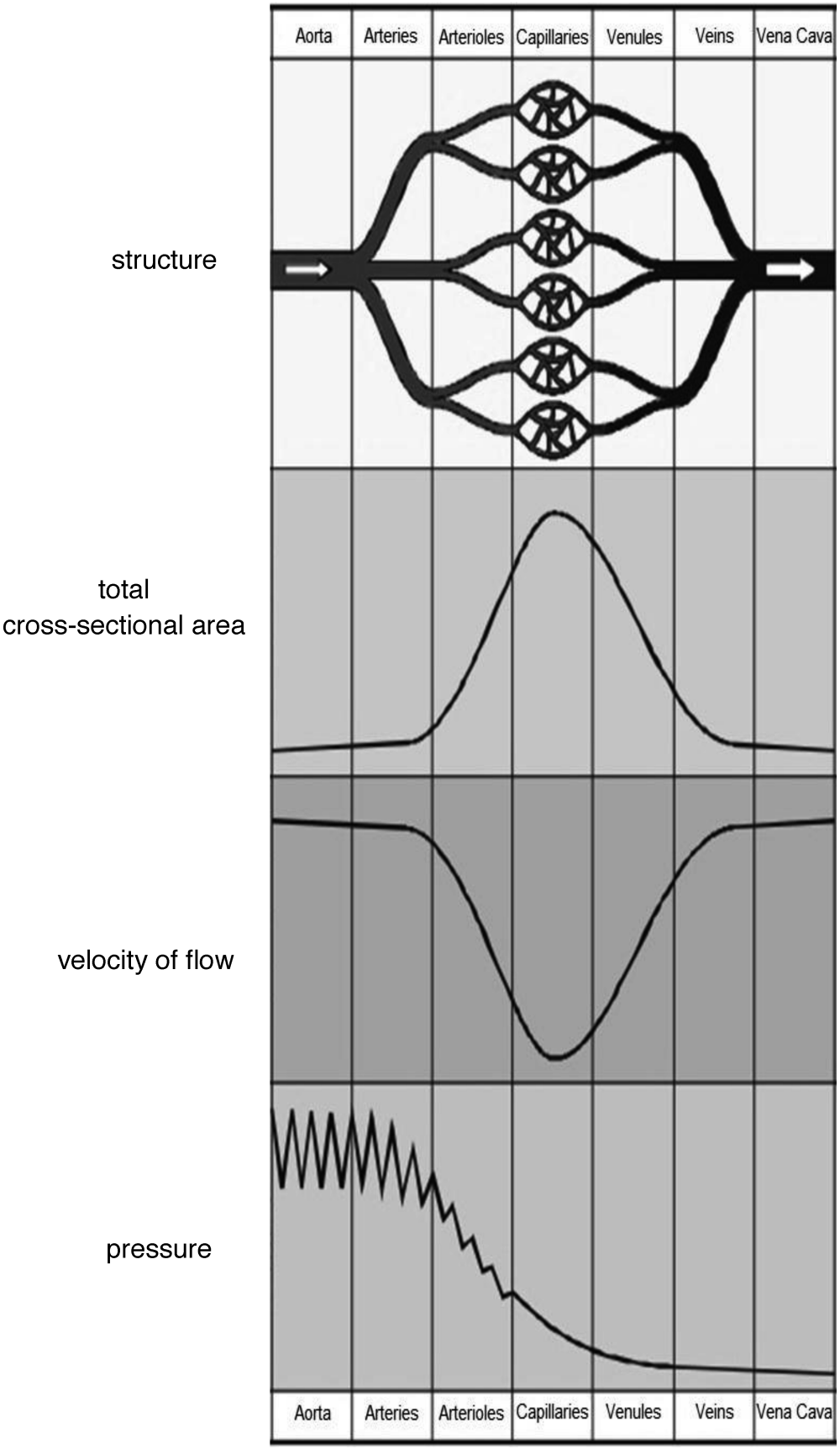


Fig 14.1

Explain how the changes in velocity of flow and pressure are linked to the total cross-sectional area.

Use the information in Fig 14.1 and your understanding of blood vessels in your answer.

.....

.....

.....

.....

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

15 **(a)** Complete the sequence of a reflex arc.

Add your answers to the empty boxes.

stimulus	receptor		CNS	motor neurone		response
→	→	→	→	→	→	→

[2]

(b) Look at the diagram.

It shows the method used by a class of students to investigate reaction time.

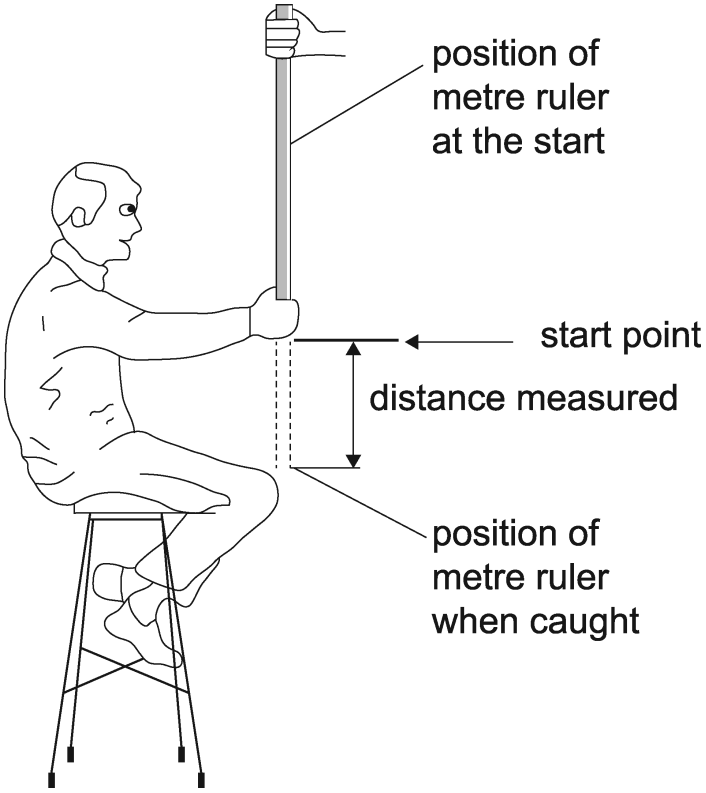


Table 15.1 shows the results from their investigation for 10 boys and 10 girls.

	Distance the ruler falls before it is caught (mm)										Mean (mm)
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Boys	55	54	56	60	58	54	50	48	52	53	.....
Girls	197	194	198	196	195	199	193	198	196	194	.....

The mean **distance** can be converted to a **reaction time** using the conversion table below.

Conversion table

Catch Distance (mm)	Reaction time (milliseconds)
10	45
20	64
30	78
40	90
50	101
60	111
70	120
80	128
90	136
100	143
110	150
120	156
130	163
140	169
150	175
160	180
170	186
180	192
190	197
200	202

(i) • Calculate the mean catch distance for boys and girls. Add the mean to Table 15.1

• Work out the mean reaction time for boys and girls.

Boys ..... milliseconds

Girls ..... milliseconds **[2]**

(ii) The students want to investigate whether the reaction times for boys or girls would be different if the ruler was dropped by a person of the opposite sex.

How would you develop the experiment to test this idea?

.....

.....

.....

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

END OF QUESTION PAPER

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…day June 20XX – Morning/Afternoon

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

J250/07 Paper 7 (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 10 minutes

MAXIMUM MARK 60

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca.

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks.
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. ‘can’t do’, ‘don’t know’)
   - OR if there is a mark (e.g. a dash, a question mark) which isn’t an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.
The communication statement determines the mark within a level.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Combined Science A (Gateway Science):

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	B	1	1.1	
2	C	1	1.1	
3	C	1	2.1	
4	A	1	1.2	
5	C	1	2.1	
6	A	1	1.1	
7	A	1	2.1	
8	D	1	2.1	
9	A	1	2.2	
10	B	1	2.1	

SECTION B

Question			Answer	Marks	AO element	Guidance
11	(a)		chloroplast (1)	1	1.1	**IGNORE** cytoplasm
	(b)		increased resolution of EM **ORA** (1) greater detail seen / can see smaller objects more clearly (1)	2	1.2	**ALLOW** greater magnification
	(c)		$6CO_2$ (1) $C_6H_{12}O_6$ (1)	2	1.1	must be on correct side of equation
	(d)	(i)	106 (1)	1	2.1	
		(ii)	suitable scale on correctly chosen axes (1) plotting accurate (1) suitable line of best fit (1)	3	2.2	**DO NOT ALLOW** scales that use less than half the graph **ALLOW** +/- half a square **DO NOT ALLOW** dot to dot line
		(iii)	increase in light intensity increases the rate of photosynthesis (1)	1	2.1	**ALLOW** the more light the more photosynthesis
		(iv)	source of error bubbles of differing size (1) miscounting bubbles (1) improvement collect volume of gas / use a measuring cylinder/gas syringe to collect gas (1) use a clicker / electronic device to count (1)	2	3.2a 3.3b	improvement must match the error

Question			Answer	Marks	AO element	Guidance
12	(a)		1.0 cm^3 (1)	1	2.2	**ALLOW** 1 cm^3 **ALLOW** if written in the table
	(b)		control tube / to compare results to (1)	1	2.2	
	(c)		any **two** from: set up tubes in a water bath (1) use a Bunsen burner / electric heater for heat (1) use thermostat / Bunsen flame to maintain temperature (1)	2	2.2	
	(d)		drops are not an accurate measure of volume (1)	1	3.3a	**IGNORE** misreading volumes **ALLOW** difficult to maintain temperature if using a Bunsen flame to heat the water bath
	(e)	(i)	colorimeter gives a real-time record throughout the 5 minutes/visual method is an end-point result AW (1) any **two** from: visual measure is subjective AW (1) colorimeter gives a quantitative measure AW (1) colorimeter will provide data that can be graphed **ORA** (1)	1 2	2.2 2 x 3.1a	
		(ii)	steepest slope to the graph / rate is approximately 130 lux per minute and faster than tube 1 at 100 lux per minute (1)	1	3.2b	
	(f)		enzyme has active site (1) active site shape is changed in extreme temperatures (1) so the active site will not fit the substrate (1) any **two** from: as it was boiled / heated to 100°C in Tube 4 (1) changed shape denatures the enzyme (1) irreversibly (1)	3 2	3 x 1.1 2 x 2.1	**ALLOW** description of active site **ALLOW** lock and key do not fit **ALLOW** lock and key labelled diagram

Question			Answer	Marks	AO element	Guidance
13	(a)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3** **(5–6 marks)** **Description of hormonal control and co-ordination and an explanation of the role of thyroxine in the body and an explanation of negative feedback.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2** **(3–4 marks)** **Description of hormonal control and co-ordination and an explanation of the role of thyroxine in the body.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1** **(1–2 marks)** **Description of the endocrine system and hormonal control and co-ordination.** *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit*	**6**	**2 x 1.1** **4 x 1.2**	**AO1.2: Demonstrate knowledge of the negative feedback** • Negative feedback controls the levels of thyroxine • Negative feedback ensures that any changes are reversed and returned back to the normal level • As levels of thyroxine increase in the bloodstream / TSH is inhibited this stops the thyroid gland producing thyroxine **AO1.1: Demonstrate knowledge of hormonal control particularly the role of thyroxine** • Thyroxine controls cell metabolism • Thyroxine ensures metabolism occurs at the correct pace • Hormones are chemical messengers • They are made in endocrine glands • Transported around the body in the bloodstream

Question			Answer	Marks	AO element	Guidance
13	**(b)**		undifferentiated cells / cells that can develop into different cells, tissues and organs (1)	**1**	**1.1**	
	(c)		embryonic stem cells can become all cell types of the body / adult stem cells are thought to be limited to differentiating into different cell types of their tissue of origin (1)	**1**	**1.1**	**ALLOW** they are pluripotent.

Question			Answer	Marks	AO element	Guidance
14	(a)		from the top clockwise: capillary, (artery), vein (2)	2	1.1	**ALLOW** plurals
	(b)	(i)	volume for 4mm cube (4^3) = 64 (1) SA/V for 4mm cube = 1.5/1 (1)	2	2.1	
	(b)	(ii)	capillaries (1) because the large network of tiny capillaries gives a large surface area to volume ratio **ORA** (1)	2	2.1	
	(c)		Any **three** from: total cross-sectional area is greatest in the capillaries / least in arteries and veins (1) as total cross-sectional area increases the velocity of the blood decreases / blood travels more slowly through the capillaries (1) arterial blood velocity is higher due to force of heart pump (1) the increased total cross-sectional area means the blood pressure reduces as blood passes through the capillaries (1)	3	3.1a	

Question			Answer	Marks	AO element	Guidance
15	(a)		<table><tr><td>stimulus</td><td>receptor</td><td>sensory neurone</td><td>CNS</td><td>motor neurone</td><td>effector</td><td>response</td></tr></table> (2)	2	1.2	
	(b)	(i)	boys = 105 milliseconds (1) girls = 200 milliseconds (1)	2	2.2	**ALLOW** 104–106 **ALLOW** 199–201
	(b)	(ii)	control boy-boy / girl-girl pairs (1) opposite sex test e.g. boy-girl / girl-boy pairs (1) Any **one** from: similar sample sizes / similar aged groups (1) compare means for each group (1)	3	3 x 3.3a	**ALLOW** same reaction room **ALLOW** compare reaction times for each group

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Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website