GCSE TOPIC TEST
BIOLOGY

H

Higher Tier
4.4 Bioenergetics

Materials

For this paper you must have:
- a ruler
- a scientific calculator

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 44.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

01.1

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

Table 1 below shows the results.

Table 1

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	**Test 2**	**Test 3**	**Mean**
20	18.5	19.3	19.5	**X**
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

Calculate mean value **X**.

_____

_____

X = _____ cm^3/hour

[2 marks]

01.2 The students identified one anomalous result in **Table 1** above.

(a) Identify the anomalous result.

Anomalous result = _____

(1)

(b) Suggest **one** possible cause of the anomalous result.

_____

_____

(1)

(c) How did the students deal with the anomalous result?

_____

_____

(1)

[3 marks]

01.3 Give **one** factor the students should have kept constant in this investigation.

_____

_____

[1 mark]

02.1 **Table 2** shows the mean metabolic rate of humans of different ages.

Table 2

Age in years	Mean metabolic rate in kJ/m^2/hour	
	Males	**Females**
5	53	53
15	45	42
25	39	35
35	37	35
45	36	35

Calculate the percentage decrease in the mean metabolic rate of males between 5 years and 45 years of age.

Use the equation:

$$\text{percentage decrease} = \frac{\text{decrease in metabolic rate}}{\text{original metabolic rate}} \times 100$$

Give your answer to 3 significant figures.

Percentage decrease =

[3 marks]

02.2 Regular exercise can increase metabolic rate.

Two people did five minutes of gentle exercise from rest.

Table 3 shows the effect of the exercise on their heart rates.

Table 3

Time in minutes	Heart rate in beats per minute	
	Person R	**Person S**
0 (at rest)	60	78
1	76	100
2	85	110
3	91	119
4	99	129
5	99	132

After five minutes of exercise, the heart rate of person **S** was 132 beats per minute.

When person **S** rested, his heart rate decreased steadily at a rate of 12 beats every minute.

Calculate how much time it would take the heart rate of person **S** to return to its resting rate.

_____

_____

Time = [   ] minutes

[2 marks]

03 Some people may be treated with a drug to slow their heart rate.

Beta blockers are a type of drug that slows the heart rate.

Table 4 shows information for people who do not take beta blockers and for people who do take beta blockers.

- Stroke volume is the volume of blood pumped out of the heart each time it beats.
- Cardiac output is the total volume of blood pumped out of the heart each minute.

Table 4

	No beta blockers taken		Taking beta blockers	
	At rest	**During exercise**	**During exercise**	**During exercise**
Heart rate in beats per minute	68	150	52	88
Stroke volume in cm^3	80	120	**X**	98
Cardiac output in cm^3 per minute	5440	18 000	2800	8624

(a) Calculate stroke volume **X** in **Table 4** above.

Use the equation:

cardiac output = stroke volume × heart rate

Give your answer to 2 significant figures.
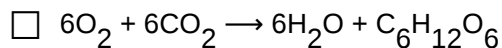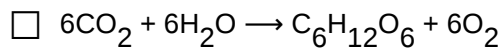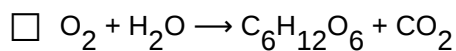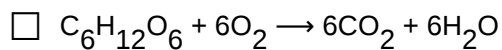
Stroke volume **X** = [ ] cm^3

(3)

(b) Some people who take beta blockers get out of breath when they exercise.

Explain why beta blockers can have this effect during exercise.

You should refer to information given in **Table 4**.

_____

_____

_____

_____

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_____

_____

_____

(6)

[9 marks]

04 People are encouraged to control their body mass with diet and exercise.

Describe how the balance between the mass of food eaten and the amount of exercise a person does controls body mass.

_____

_____

_____

_____

_____

_____

[3 marks]

05 What is the correct balanced equation for photosynthesis?

Tick **one** box.

☐ $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

☐ $O_2 + H_2O \longrightarrow C_6H_{12}O_6 + CO_2$

☐ $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

☐ $6O_2 + 6CO_2 \longrightarrow 6H_2O + C_6H_{12}O_6$

[1 mark]

06.1 This question is about photosynthesis and food production.

How can oxygen production be used to show the **rate** of photosynthesis?

_____

_____

[1 mark]

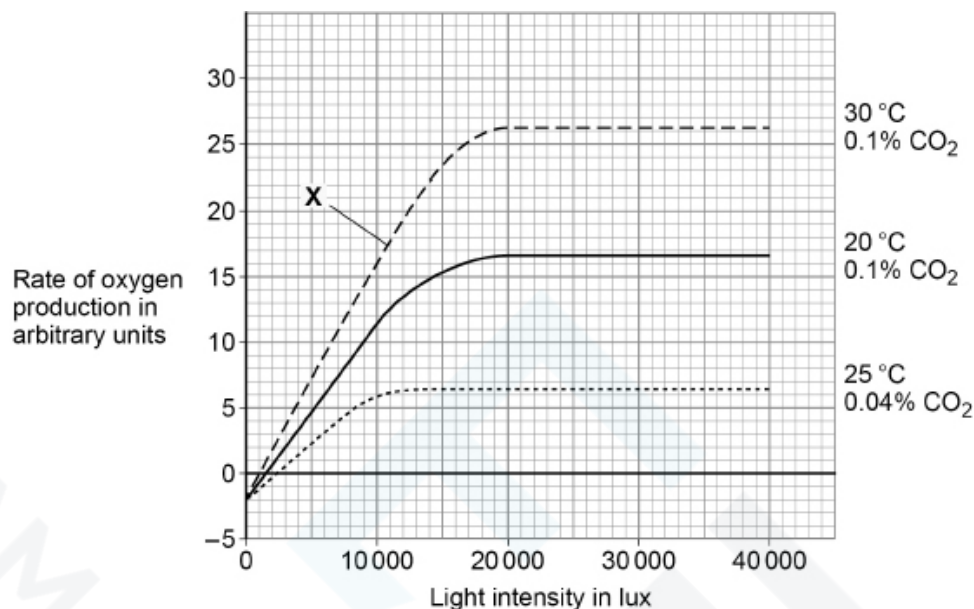**06.2** Scientists investigated factors affecting the rate of photosynthesis in tomato plants.

The tomato plants were growing in a commercial greenhouse in the UK during winter.

Figure 1 below shows the results.

Figure 1

The percentage of carbon dioxide in the Earth's atmosphere is 0.04%

Farmers growing tomatoes commercially try to control the rate of photosynthesis and make maximum profit.

A farmer can control the temperature and carbon dioxide concentration in a greenhouse.

(a) What is the **minimum** light intensity a farmer should use to get the maximum rate of photosynthesis shown above in **Figure 1**?

Light intensity = _____ lux

(1)

(b) The light intensity you gave in part **(a)** may **not** give the farmer maximum profit.

Explain why.

_____

_____

_____

_____

_____

_____

(3)

[4 marks]

06.3 Explain the results when the light intensity was 0 lux.

Use **Figure 1** above.

_____

_____

_____

_____

_____

_____

_____

[4 marks]

07 Students investigated the presence of starch and glucose in the leaves of geranium plants.

This is the method used.

1. Place two identical geranium plants on a bench near a sunny window for two days.
2. After two days:
    - Leave one plant near the window for two more days.
    - Place one plant in a cupboard with no light for two more days.
3. Remove one leaf from each plant.
4. Crush each leaf to extract the liquid from the cells.
5. Test the liquid from each leaf for glucose and for starch.

Table 5 below shows the students' results.

Table 5

Test	Leaf from plant kept in light for four days	Leaf from plant kept in light for two days and then no light for two days
Glucose	Strong positive	Weak positive
Starch	Positive	Negative

Explain why the leaf left in a cupboard with no light for two days did contain glucose but did **not** contain starch.

_____

_____

_____

_____

_____

[3 marks]

08 Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight.

Do **not** refer to hormones in your answer.

_____

_____

_____

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_____

[4 marks]

09 A small animal called an axolotl lives in water. The axolotl has a double circulatory system.

Figure 2 shows an axolotl.

Figure 2

Gills

If a gill of an axolotl is removed, a new gill will grow in its place.

Scientists hope to use information on how axolotls grow new gills to help with regenerating human tissue.

Explain why an axolotl may die in water with a low concentration of oxygen.

_____

_____

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_____

[4 marks]