

GCSE Combined Science: Trilogy

Worksheet: Metabolism

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Metabolism

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The chemical reactions that take place in cells are controlled by enzymes.

0 1 . 1 What is meant by metabolism?

.....

.....

[1 mark]

0 1 . 2 Which of these is **not** normally described as part of metabolism?

Tick (✓) **one** box.

Converting glucose to glycogen

☐

Breaking down excess amino acids to form urea

☐

Diffusion of oxygen from the air into the blood in the lungs

☐

Forming lipid molecules from glycerol and fatty acids

☐

[1 mark]

0 1 . 3

In which organ do many important metabolic reactions, such as the breakdown of excess amino acids, take place?

.....

.....

.....

.....

[1 mark]

0 2

Metabolism involves many different reactions in cells.

0 2 . 1

What is meant by **metabolism**?

.....

.....

[1 mark]

0 2 . 2

Which **two** of these are part of metabolism?

Tick (✓) **two** boxes.

Breakdown of excess proteins to form urea

☐

Diffusion of oxygen into the blood

☐

Evaporation of sweat from the skin

☐

Formation of lipids from glycerol and fatty acids

☐

Osmosis into root hair cells

☐

[2 marks]

0 2 . 3

Name the waste product formed when excess proteins are broken down.

.....

.....

.....

.....

[1 mark]

0 2 . 4

Name the carbohydrate made from glucose that is stored in animal cells.

.....

.....

.....

.....

[1 mark]

0 3

The energy transferred by respiration is used for the enzyme-controlled reactions of metabolism.

0 3 . 1

One lipid molecule is made from one molecule of glycerol and three molecules of fatty acids.

How many fatty acid molecules are needed to make 20 lipid molecules?

.....

.....

.....

Number of molecules =

[1 mark]

0 3 . 2

Name **two** carbohydrates that plant cells make from glucose.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Explain why these metabolic reactions need energy from respiration.

.....

.....

.....

.....

[2 marks]

0 3 . 4

Plant cells make amino acids.

Give the **two** substances plant cells use to make amino acids.

.....

.....

.....

.....

[2 marks]

0 4

The liver carries out many important metabolic reactions, including converting glucose to glycogen and breaking down excess amino acids.

0 4 . 1

Explain why it is useful for the liver to convert excess glucose into glycogen.

.....

.....

.....

.....

[2 marks]

0 4 . 2

The body cannot store excess amino acids.
Explain what happens to amino acids that are absorbed from digested food but are not needed by the body.

.....

.....

.....

.....

[2 marks]

0 4 . 3

Suggest why it is more useful for the body to break down excess amino acids in this way, rather than simply excreting them unchanged.

.....

.....

[1 mark]

0 5

Some animals, such as hedgehogs, hibernate during winter. Their metabolic rate falls to a small fraction of its normal level, and their body temperature drops close to the temperature of their surroundings.

0 5 . 1

Suggest why a much lower metabolic rate is an advantage to a hibernating animal in winter.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Explain why the hedgehog's body temperature falls during hibernation.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Suggest why it can take a hibernating animal some time to become active again when it wakes up.

.....

.....

[1 mark]

0 6

Table 1 shows the resting (basal) metabolic rate and body mass of three mammals.

Table 1

Animal	Body mass in kg	Resting metabolic rate in kJ per day
Mouse	0.02	33
Rabbit	2	460
Human	70	7300

0 6 . 1

Calculate the resting metabolic rate per kg of body mass for the mouse and for the human.

.....

.....

.....

.....

Rates =

[2 marks]

0 6 . 2

Which animal has the highest resting metabolic rate per kg of body mass?

.....

.....

[1 mark]

0 6 . 3

Suggest why a small animal such as a mouse has a much higher metabolic rate per kg of body mass than a much larger animal such as a human.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Metabolism · 30 marks

Question 1 (3 marks)

01.1 [1 mark]

- the sum of all the (chemical) reactions in a cell or in the body (1)
-

01.2 [1 mark]

Correct: Diffusion of oxygen from the air into the blood in the lungs

01.3 [1 mark]

Answer: Liver

- liver (1)
-
-

Question 2 (5 marks)

02.1 [1 mark]

- the sum of all the reactions in a cell or the body (1)
-

02.2 [2 marks]

Correct: Breakdown of excess proteins to form urea; Formation of lipids from glycerol and fatty acids

02.3 [1 mark]

Answer: Urea

- urea (1)
-

02.4 [1 mark]

Answer: Glycogen

- glycogen (1)
-

Question 3 (7 marks)

03.1 [1 mark]

Answer: 60

- 60 (1)

03.2 [2 marks]

Answer: Starch and cellulose

- starch (1)
- cellulose (1)

Notes: Allow sucrose for either mark. Do not accept glucose or glycogen.

03.3 [2 marks]

- they build larger molecules from smaller molecules (1)
- building larger molecules requires energy (which is transferred by respiration) (1)

03.4 [2 marks]

Answer: Glucose and nitrate ions

- glucose (1)
- nitrate ions (1)

Question 4 (5 marks)

04.1 [2 marks]

- glycogen is a store that can be converted back into glucose when it is needed, e.g. between meals or during exercise (1)
- storing glucose as glycogen, rather than leaving it as glucose, does not affect the cell's water balance by osmosis in the way a high concentration of glucose would (1)

04.2 [2 marks]

- they are broken down in the liver (1)
- the nitrogen-containing part is converted to urea, which is excreted by the kidneys (1)

04.3 [1 mark]

- it allows the remaining part of the molecule, after the nitrogen-containing part is removed, to be used in respiration, rather than the whole amino acid being wasted (1)
-

Question 5 (5 marks)

05.1 [2 marks]

- a lower metabolic rate means the animal uses its stored energy reserves, e.g. fat, much more slowly (1)
- this allows the reserves to last through the winter, when little or no food is available (1)

05.2 [2 marks]

- the rate of respiration (and of the other reactions of metabolism) is much lower (1)
- so less energy is transferred by heating, and the body cools towards the temperature of its surroundings (1)

05.3 [1 mark]

- its metabolic rate, and its body temperature, must rise again before its muscles and other tissues can work at a normal rate (1)

Question 6 (5 marks)

06.1 [2 marks]

Answer: Mouse 1650 kJ per kg per day; human 104.3 kJ per kg per day

- mouse: $33 \div 0.02 = 1650$ (kJ per kg per day) (1)
- human: $7300 \div 70 = 104.3$ (kJ per kg per day) (1)

06.2 [1 mark]

- the mouse (1)

06.3 [2 marks]

- a small animal loses body heat to its surroundings more quickly relative to its body mass (1)
 - it needs a higher rate of respiration (metabolism) to replace this heat and keep its body temperature steady (1)
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