

12.1 Energy

Question Paper

Course	CIE A Level Biology
Section	12. Energy & Respiration
Topic	12.1 Energy
Difficulty	Easy

Time allowed: 30
Score: /24
Percentage: /100

Question 1a

Fig. 1 shows the percentage daily usage of the energy ingested by a typical adult male.

This man has a moderately active lifestyle and shows typical eating/drinking behaviour.

The person's typical total energy output is $10\,500 \text{ kJ day}^{-1}$

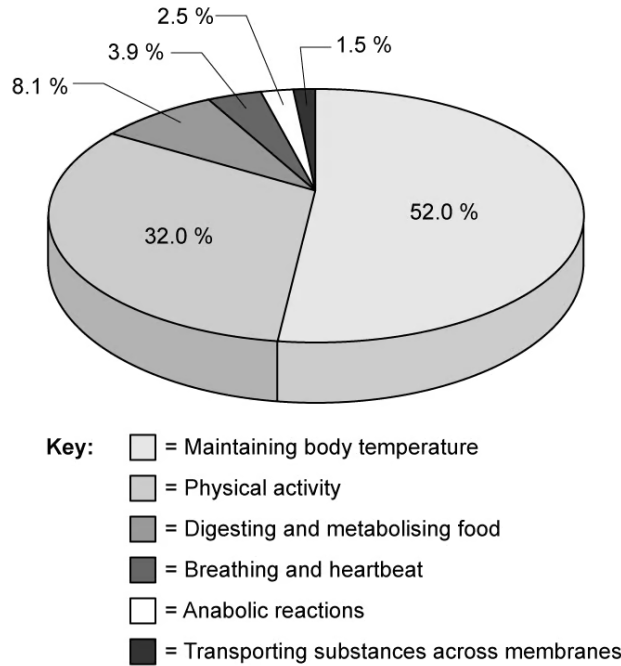


Fig. 1

Calculate the energy, in kJ, that this man expends in maintaining his **breathing and heartbeat**.

State your answer to the nearest whole number of kilojoules.

[3 marks]

Question 1b

Fig. 1 shows that energy is required for **transporting substances across membranes**.

(i)

Give **one** example of a **type** of membrane transport that requires energy.

[1]

(ii)

One **specific example** of a membrane transport process that requires energy is the absorption of amino acids in the digestive system.

Give **two other specific examples** of membrane transport processes that require energy

[2]

[3 marks]

Question 1c

Chemical reactions in living organisms can be anabolic, in which larger molecules are built from smaller molecules, or catabolic, in which larger molecules are broken down.

Contrast the **energy characteristics** of anabolic and catabolic reactions in cells, tissues and organs.

[2 marks]

Question 1d

Fig. 2 shows a molecule of ATP.

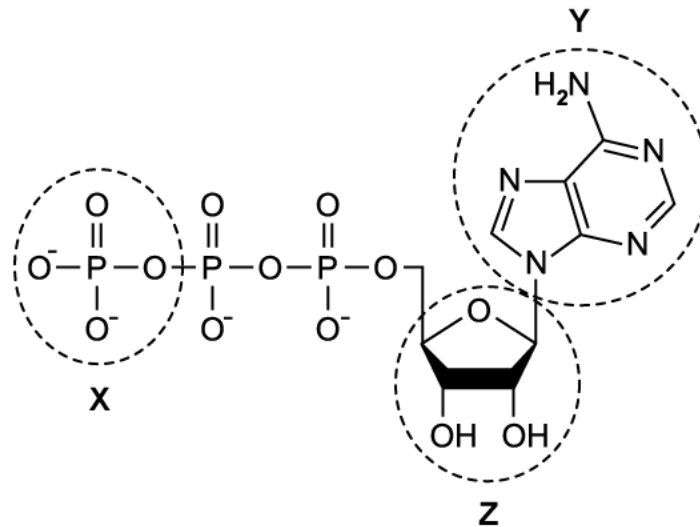


Fig. 2

Identify the parts of the ATP molecule labelled X, Y and Z in Fig. 2.

[3 marks]

Question 2a

List the molecules ADP, AMP and ATP according to the number of phosphate groups that they possess.

Start with the smallest number of phosphate groups and work upwards.

[1 mark]

Question 2b

Aerobic respiration of one molecule of glucose generates roughly 38 molecules of ATP.

Give **one** advantage of gaining energy for cellular processes in small packets from many ATP molecules, rather than all at once from one molecule of glucose.

[1 mark]

Question 2c

Name the enzyme which catalyses the synthesis of ATP.

[1 mark]

Question 2d

Describe the process by which ATP can be recycled in the cell.

[2 marks]

Question 3a

Malic acid ($C_4H_6O_5$) is a substance found naturally in all living organisms and which contributes to the flavours of certain foods such as fruit.

Its respiration by yeast is an important reaction in the process of winemaking.

The balanced chemical equation for the aerobic respiration of malic acid is shown in Fig. 1.

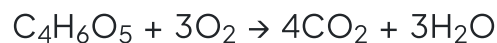


Fig. 1

Calculate the respiratory quotient (RQ) for malic acid.

[2 marks]

Question 3b

The respiratory quotient (RQ) of a food substance known as **substance X** was measured experimentally as 0.72.

(i)

Give the name of the piece of equipment used to measure RQ.

[1]

(ii)

Suggest the major food group to which **substance X** belongs.

[1]

[2 marks]

Question 3c

The equipment named in part (b) (i) can contain a substance known as soda-lime (sodium hydroxide solution).

State the purpose of soda-lime in this equipment.

[2 marks]

Question 3d

Using the equipment from part (b) (i) to demonstrate the measurement of RQ to a class, a teacher was given a choice between an experiment using germinating seeds or small invertebrates such as woodlice.

Both are known to give measurable results. The teacher chose to use the germinating seeds.

Comment on why the teacher's choice of the germinating seeds was the better option.

[2 marks]

