1.10 Biology: Energy Transfers in Organisms: 10-minute Pack

Total Marks

AQA 7402 · Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Glycolysis is the first stage of respiration and occurs in the cytoplasm of all living cells, whether or not oxygen is present.

(a) State the net number of ATP molecules produced per molecule of glucose during glycolysis, and explain why this net figure is lower than the total number of ATP molecules generated directly by substrate-level phosphorylation in this pathway. **(3)**

(b) Name the 3-carbon end product of glycolysis, and the coenzyme that becomes reduced during glycolysis. **(2)**

(c) Dr Chen measured 4.2 mol of ATP produced by substrate-level phosphorylation directly during glycolysis (before subtracting the ATP invested earlier in the pathway) from 1 mol of glucose. Explain why this value is inconsistent with accepted glycolysis stoichiometry, stating the expected value. **(2)**

(Total for Question 1 is 7 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 1.10 Biology: Energy Transfers in Organisms: 10-minute Pack

Question 1

(a) net ATP yield = 2 molecules of ATP per molecule of glucose **B1**

(a) 2 molecules of ATP are produced by substrate-level phosphorylation per molecule of triose phosphate, and 2 molecules of triose phosphate are formed per glucose, giving 4 ATP in total **B1**

(a) 2 molecules of ATP are used earlier in glycolysis to phosphorylate glucose and fructose 6-phosphate, so the net gain is 4 - 2 = 2 ATP **B1**

(a) Answer: Net ATP = 2 per glucose (4 produced by substrate-level phosphorylation, minus 2 invested earlier in the pathway).

(b) pyruvate (2 molecules per glucose) **B1**

(b) NAD, reduced to reduced NAD (NADH); 2 molecules per glucose **B1**

(b) Answer: Pyruvate; NAD (reduced to reduced NAD).

(c) the accepted stoichiometry is 4 mol ATP produced by substrate-level phosphorylation per mol of glucose (2 mol ATP per mol of triose phosphate, and 2 mol of triose phosphate per mol of glucose) **B1**

(c) 4.2 mol is inconsistent with this fixed stoichiometry, since the pathway can only produce whole-number multiples of ATP per triose phosphate (2 ATP each); a non-integer multiple such as 2.1 ATP per triose phosphate is not possible from a single glucose molecule following the defined reaction sequence, so the value likely reflects experimental or measurement error **B1**

(c) Answer: Expected value = 4 mol ATP; 4.2 mol is inconsistent with the fixed reaction stoichiometry and likely reflects experimental error.

© Revision Library | revisionlibrary.co.uk