2.3 Bioenergetics and glycolysis

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS glycolysis

Objective

Track carbons, ATP and control through glycolysis, and reason about a blocked gate.

1 Key knowledge and worked examples

■ The ledger

Glucose → 2 pyruvate: invest 2 ATP, return 4 ATP + 2 NADH – net 2 ATP + 2 NADH. Gates: hexokinase −16.7, PFK-1 −14.2 (committed), pyruvate kinase −23.0 kJ/mol.

■ Worked example: the anaerobic ceiling

Without O_2 the 2 NADH are spent on lactate: yield exactly 2 ATP per glucose ✓. PFK-1 reads AMP (on), ATP/citrate (off), F-2,6-BP (strongly on).

2 Practice

2.1 Where does the carbon of glucose end up anaerobically? [3]

2.2 Name the enzyme of the payoff phase that MAKES ATP directly. [3]

2.3 Why is hexokinase NOT the committed step? [3]

3 Exam-style questions

3.1 A cell has 1 glucose and no oxygen.

Trace the fate of all six carbons. Count net ATP and the NAD^+/NADH turnover. Explain why the process must stop if NAD^+ is not regenerated. State the enzyme that performs regeneration. [8]

3.2 (Fictional) PFK-1 deficiency, exertional cramps, no lactate rise on sprint testing.

Localise the block precisely and explain the absent lactate. State which glycolytic intermediates accumulate. Predict the effect of an infusion of fructose-1,6-bisphosphate bypass candidates and why this does not fully rescue muscle. [7]