

2.4 TCA cycle and oxidative phosphorylation

Name: _____ Class: _____ Date: _____

Total: 24 marks**KEY WORDS** ATP synthase ATP

Objective

Count reducing equivalents, protons and ATP through the TCA cycle and the chain.

1 Key knowledge and worked examples

■ Per-acetyl yield

3 NADH + 1 FADH₂ + 1 GTP per TCA turn. Chain: 10 H⁺/NADH, 6 H⁺/FADH₂, ~4 H⁺/ATP ⇒ 2.5 and 1.5.

■ Worked example: the glucose total

Counting every carrier: 2 + 5 (glyc NADH, malate) + 5 (PDH) + 2 GTP + 15 + 3 = **32 ATP** (malate) or **30** (glycerol-P) ✓.

2 Practice

2.1 How many protons does one FADH₂ pump, and why fewer than NADH? [3]

2.2 Compute ATP per acetyl-CoA through TCA + chain. [3]

2.3 Which complex does NOT pump protons? [3]

3 Exam-style questions

3.1 Compute the full aerobic ATP yield per glucose, showing every contribution.

List the NADH/FADH₂ sources with counts, convert with 2.5/1.5, and sum. Compare with the older 36–38 count and explain the difference. [8]

3.2 (Fictional) cyanide poisoning vignette.

State the inhibited complex and the immediate consequence for the proton gradient. Explain why venous blood is bright red and lactate rises. Give the mechanism-first rationale for one antidote approach. [7]
