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 $FADH_2$ + 1 GTP per TCA turn. Chain: 10 H^+/NADH, 6 H^+/$FADH_2$, ~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 $FADH_2$ 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/$FADH_2$ 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]