

University Medicine

Name: _____ Score: _____

1. Haemoglobin has a quaternary structure but myoglobin does not. Why?
 - ☐ Haemoglobin has no α -helices
 - ☐ Haemoglobin has four chains; myoglobin has one
 - ☐ Myoglobin has no haem group
 - ☐ Myoglobin is not a protein
2. An enzyme makes a reaction go further towards products at equilibrium.
 - ☐ True ☐ False
3. A reaction has $\Delta G^\circ = +14.2$ kJ per mol. It is coupled to ATP hydrolysis (-30.5 kJ per mol). What is the overall ΔG° , in kJ per mol?
_____ kJ per mol
4. One glucose gives two acetyl-CoA. How many NADH do the two TCA turns make?
_____ NADH
5. Which glycogen store keeps blood glucose up between meals?
 - ☐ Both equally
 - ☐ Liver glycogen
 - ☐ Brain glycogen
 - ☐ Muscle glycogen
6. How many β -oxidation cycles does stearate (C18) need?
_____ cycles
7. Alanine transaminates with α -ketoglutarate. What are the products?
 - ☐ Aspartate and oxaloacetate
 - ☐ Urea and water
 - ☐ Glucose and ammonia
 - ☐ Pyruvate and glutamate
8. How does glucagon turn on glycogen breakdown in the liver?
 - ☐ It breaks glycogen down directly
 - ☐ It removes phosphates from the enzymes
 - ☐ It enters the nucleus and switches on genes within seconds

☐ It raises cAMP, and PKA phosphorylates the enzymes

9. Myoglobin binds O_2 cooperatively, giving a sigmoid curve.

☐ True ☐ False

10. What is K_m ?

☐ The substrate concentration at half of V_{max}

☐ The rate when $[S] = 1 \text{ mM}$

☐ The maximum rate of the enzyme

☐ The amount of enzyme in the cell

1. Haemoglobin has four chains; myoglobin has one

Quaternary structure is the assembly of several chains. One chain (myoglobin) cannot have it; Hb's $\alpha_2\beta_2$ tetramer does.

2. False

An enzyme speeds both directions equally; it reaches the same equilibrium sooner but does not move it.

3. -16.3 kJ per mol

$+14.2 + (-30.5) = -16.3$ kJ per mol: negative, so the coupled pair runs.

4. 6 NADH

3 NADH per turn $\times$ 2 turns = 6, plus 2 FADH₂ and 2 GTP.

5. Liver glycogen

The liver's ~100 g is exported as glucose; muscle's larger ~400 g is used only by the muscle itself.

6. 8 cycles

$18/2 - 1 = 8$ cycles, giving 9 acetyl-CoA: the last cycle splits a 4-carbon piece into two acetyl-CoA.

7. Pyruvate and glutamate

The amino group moves to α -ketoglutarate, making glutamate; alanine's carbon skeleton is left as pyruvate.

8. It raises cAMP, and PKA phosphorylates the enzymes

Glucagon $\rightarrow$ cAMP $\rightarrow$ PKA $\rightarrow$ phosphorylase on, glycogen synthase off. Insulin does the opposite, by removing those phosphates.

9. False

Myoglobin has one site, so its curve is a hyperbola. Cooperativity needs several sites that influence each other, as in Hb.

10. The substrate concentration at half of V_{max}

Put $[S] = K_m$ into the equation: $v = V_{max}K_m/2K_m = V_{max}/2$.