

Name _____ **yellow version, Feb 25**

Student number _____

Answer questions 1-20 on the computer scoring sheet.

Value 2 marks each

1. Which of the following statements about **fetal hemoglobin** is **not correct**?
A) Fetal hemoglobin has higher affinity for O₂ than maternal hemoglobin A
B) Fetal hemoglobin has fewer positive charged amino acids at γ -globin C-terminal
C) Fetal hemoglobin binds 2,3-bisphosphoglycerate more strongly
D) The sigmoidal O₂ binding curve of fetal hemoglobin is shifted to the left
E) Fetal hemoglobin remains in R-state at lower pO₂ 1) A B C D E

2. Which of the following statements about the **sigmoidal O₂ binding curve** of hemoglobin is **not correct**?
A) Transition from almost empty to almost full occurs over a narrower range of pressures
B) It allows for more efficient release of O₂ at pO₂ found in peripheral tissues
C) Hemoglobin has higher P₅₀ than myoglobin, but still reaches saturation at the same pO₂ as myoglobin
D) It allows more O₂ to bind to hemoglobin than to myoglobin at any given pO₂
E) It indicates that binding affinity increases as more sites are occupied 2) A B C D E

3. Which of the following **correctly describes how CO₂ interacts** with hemoglobin?
A) CO₂ binds to heme Fe²⁺ B) CO₂ binds to heme Fe³⁺
C) CO₂ binds to His F8 D) CO₂ binds to His E7
E) CO₂ binds to the N-terminal of α -globin 3) A B C D E

4. Which of the following does not play a role in the **blood clotting cascade** ?
A) Fibrinogen B) Prothrombin **C) Protein kinase A**
D) Factor Xa E) Factor VIII 4) A B C D E

5. Which of the following enzymes is **directly involved in production of NADPH**?
A) Lactate dehydrogenase B) Glyceraldehyde-3-phosphate dehydrogenase
C) Pyruvate dehydrogenase **D) Glucose-6-phosphate dehydrogenase**
E) Phosphofructokinase 5) A B C D E

6. Which of the following is responsible for activating **Protein kinase A**?
A) Cyclic AMP binds to R subunits of protein kinase A
B) Cyclic AMP binds to C subunits of protein kinase A
C) Cyclic AMP becomes available as phosphate donor
D) Cyclic AMP is hydrolyzed to 5'-AMP
E) The proenzyme form is cut by proteolysis 6) A B C D E

7. If **Cyclin E-Cdk2** activates **DNA replication proteins**, at what phase of the cell cycle does its activity come to a peak?
- A) Progression through G1
 C) Entry to G2 phase
 E) Entry and progress through M phase
- B) Entry to S phase**
 D) Progression through G2 phase
- 7) A B C D E
8. Which of the following statements about **phosphorylase a** is **not correct**?
- A) Phosphorylase *a* preferentially goes to the active R state
B) Phosphorylase a phosphorylates enzymes involved in glycogen metabolism
 C) Phosphorylase *a* is converted to phosphorylase *b* by phosphoprotein phosphatase 1
 D) Phosphorylase *a* is negatively regulated by glucose.
 E) Serine 14 of phosphorylase *a* is phosphorylated
- 8) A B C D E
9. Which hemoglobin form is expressed during **months 2-9 of pregnancy**?
- A) $\zeta\zeta\beta\beta$
 D) $\alpha\alpha\delta\delta$
- B) $\epsilon\epsilon\beta\beta$
 E) $\epsilon\epsilon\gamma\gamma$
- C) aagg**
- 9) A B C D E
10. Which of the following **correctly describes** the role of **tissue plasminogen activator**?
- A) promotes clotting by activating fibrinogen
 C) prevents clotting by binding to fibrinogen
- B) promotes clotting by activating prothrombin
 D) prevents clotting by binding to prothrombin
- E) promotes the dissolution of clots**
- 10) A B C D E
11. Which of the processes for **activation of pancreatic proenzymes** is **not correct**?
- A) Enteropeptidase can activate trypsinogen
 C) **Chymotrypsin can activate trypsinogen**
- B) Trypsin can activate trypsinogen
 D) Trypsin can activate chymotrypsinogen
- E) Trypsin can activate Procarboxypeptidase
- 11) A B C D E
12. What is the mechanism by which **caffeine stimulates glycogen breakdown**?
- A) Caffeine inhibits breakdown of cyclic AMP**
 B) Caffeine is an allosteric activator of glycogen phosphorylase
 C) Caffeine inhibits phosphoprotein phosphatase
 D) Caffeine binds to protein kinase A
 E) Caffeine stimulates production of cyclic AMP
- 12) A B C D E
13. Which of the following enzymes is **not required for gluconeogenesis** in liver?
- A) PEP carboxykinase
 D) **Pyruvate kinase**
- B) Pyruvate carboxylase
 E) Glucose-6-phosphatase
- C) Fructose-1,6-bisphosphatase
- 13) A B C D E

14. Which of the following is the **initiator procaspase** activated by external signals such as **tumour necrosis factor**?
- A) Procaspase 1 B) Procaspase 3 C) Procaspase 7
D) Procaspase 8 E) Procaspase 9 14) A B C D E
15. How many steps in the gluconeogenesis pathway **yield ATP as a product**?
- A) 0** B) 1 C) 2 D) 4 E) 6 15) A B C D E
16. If **transketolase** accepts xylulose-5-phosphate and erythrose-4-phosphate as substrate, **what products are released**?
- A) Sedoheptulose-7-phosphate and glyceraldehyde-3-phosphate
B) Fructose-6-phosphate and glyceraldehyde-3-phosphate
C) Ribulose-5-phosphate and glyceraldehyde-3-phosphate
D) Dihydroxyacetone-3-phosphate and glucose-6-phosphate
E) Dihydroxyacetone-3-phosphate and ribose-5-phosphate 16) A B C D E
17. What are the characteristics of **hemoglobin variant bbbb** produced in α -thalassemia?
- A) It binds O₂ like normal hemoglobin B) It binds O₂ like fetal hemoglobin
C) It is unable to bind O₂ **D) It binds O₂ like myoglobin**
E) It polymerizes into fibres in red blood cells 17) A B C D E
18. Which of the following properties is directly related to the **concentration of 5'-AMP as an indicator of energy status**?
- A) 5'-AMP level is correlated with high [ATP]
B) 5'-AMP level is correlated with [ADP]
C) 5'-AMP level is controlled by external hormones
D) 5'-AMP level is controlled by phosphofructokinase 2
E) 5'-AMP level is correlated with the square of [ADP] 18) A B C D E
19. Which of the following is used as **substrate** by **glycogen synthase**?
- A) UTP-Glucose **B) UDP-Glucose** C) Glucose-1-phosphate
D) Glucose-6-phosphate E) Glucose + ATP 19) A B C D E
20. What compound is **exported from mitochondria** to provide substrate gluconeogenesis in the cytoplasm when **lactate** is the starting point?
- A) Pyruvate B) Malate C) Oxaloacetate
D) PEP E) Acetyl CoA 20) A B C D E