

**I. True or False?**

- T **F** 1. NAD<sup>+</sup> can act as a reductant in redox reactions.
- T **F** 2. Catabolism is primarily a reductive process.
- T **F** 3. While enzyme reactions in general reversible, metabolic pathways are irreversible.
- T **F** 4. GAP, glyceraldehydes3-phosphate, is a “high-energy” phosphate compound.

**II. Match.**

5. On a Lineweaver–Burk plot, the intercept where  $1/v_o = 0$  is **D**.
6. On a Lineweaver–Burk plot, the intercept on the vertical axis is **G**.
7. When  $[S] = K_M$ ,  $v_o =$  **E**  $V_{max}$
8. Turnover number **I**
- A.  $1/K_M$
- B.  $K_M$
- C.  $V_{max}$
- D.  $-1/K_M$
- E. 0.5
- F. 0.67
- G.  $1/V_{max}$
- H.  $1/[S]$
- I.  $k_{cat}$
- J.  $-k_{cat}$

9. Which of the following sugars is not a reducing sugar?

- A. glucose
- B. ribose
- C. sucrose
- D. starch
- E. galactose

10. How many stereoisomers are possible for a ketohexose such as fructose?

- A. 2
- B. 4
- C. 8
- D. 16
- E. 32

[11-14]. In your Senior Honor's thesis you have isolated a new enzyme called Winease which can convert Lemonade to Wine in a unimolecular reaction. Using Lemonade as your substrate, you measure the initial velocities of the enzyme reaction under varied substrate concentrations. The data set is as follows:

[S] (mM)	$V_o$ ( $\mu\text{M/s}$ )
1	2.5
2	4.0
5	6.3
10	7.6
20	9.0

Using the graph paper on one of blank pages at the back of your exam, construct a Lineweaver-Burk plot to answer the following questions.

11. What is the  $K_M$  of the Winease reaction?

- A. 10  $\mu\text{M}$
- B. 0.33 mM
- C. 0.1  $\mu\text{M}$
- D. 0.1 mM
- E. 3.0 mM

12. What is the  $V_{\text{max}}$  of the Winease reaction?

- A. 10  $\mu\text{M/s}$
- B. 0.33 mM/s
- C. 0.1  $\mu\text{M/s}$
- D. 0.1 mM/s
- E. 3.0 mM/s

13. The University of Houston patents Winease and you become so famous for your Winease enzyme discovery that you decide to start your own company upon graduation. You call your new company BiochemStar. A prestigious company based in Boston contracts with you to identify inhibitors of Winease. In your first series of experiments you identify an uncompetitive inhibitor which you named Baylor-X. Thus, when you carry out the kinetic studies of Winease in the presence of increasing concentrations of Baylor-X, you obtain which of the following information.

- A. The slope of your Lineweaver-Burk plot decreases.
- B. The slope of your Lineweaver-Burk plot increases.
- C. The y-intercept of your Lineweaver-Burk plot decreases.
- D. The y-intercept of your Lineweaver-Burk plot increases.
- E. Both "A." and "C."

14. You also measure that the half-life of the Winease catalyzed conversion is 10 sec. If you start with 100mM of Lemonade, approximately how much Lemonade will remain after 100 sec?

- A. 1  $\mu$ M
- B. 10  $\mu$ M
- C. 100  $\mu$ M
- D. 1 mM
- E. 10 mM

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15. During glycolysis, the steps between glucose and formation of the triose phosphates:

- A. consume two ATP and two NADH molecules.
- B. consume two ATP molecules.
- C. produce two ADP and two  $\text{NAD}^+$  molecules.
- D. produce two ATP and two NADH molecules.
- E. consume two NADH molecules.

16. The oxidized form of NADPH is \_\_\_\_\_.

- A.  $\text{NADP}^+$
- B. FAD
- C. NADPH
- D.  $\text{NADH}_2$
- E.  $\text{NAD}^+$

17. At equilibrium in solution, D-glucose consists of a mixture of its anomers. Which statement most accurately describes the solution?
- A. The solution consists of approximately equal amounts of the  $\alpha$ - and  $\beta$ -anomers.
  - B. The straight-chain form is present in high concentration.
  - C. The  $\alpha$ -anomer is more stable and is slightly preferred over the  $\beta$ -anomer.
  - D. The  $\beta$ -anomer predominates over the  $\alpha$ -anomer by a ratio of approximately 2:1.
  - E. All of the above.
18. In skeletal muscle cells, the NADH that is produced by glycolysis under anaerobic conditions (vigorous exercise) is regenerated to  $\text{NAD}^+$  by the conversion of:
- A. acetaldehyde  $\rightarrow$  ethanol.
  - B. lactate  $\rightarrow$  pyruvate.
  - C. phosphoenolpyruvate  $\rightarrow$  pyruvate.
  - D. pyruvate  $\rightarrow$  lactate.
  - E. glyceraldehyde-3-phosphate  $\rightarrow$  1,3-bisphosphoglycerate.
19. In alcoholic fermentation, acetaldehyde is produced by
- A. the decarboxylation of pyruvate
  - B. the carboxylation of pyruvate
  - C. the decarboxylation of lactate
  - D. the carboxylation of lactate
  - E. None of the above
20. The process by which ATP is formed from ADP in glycolysis is referred to as
- A. oxidation
  - B. reduction
  - C. substrate-level phosphorylation
  - D. oxidative phosphorylation
  - E. photophosphorylation