

Single choice (1-20, 每題 4 分)

1. To 550 mL of a 20 mM phosphate buffer at pH 6.7 is added 4.5 mL of 1 M NaOH ( $pK_a$  of phosphate is 6.7). The final pH of the solution is
  - A. 6.9
  - B. 7.1
  - C. 7.3
  - D. 7.5
  - E. 7.7
2. Pyruvate generated by glycolysis must enter the mitochondria to be oxidized
  - A. because the mitochondria are impermeable to lactate
  - B. so that the cytosol remains electrically neutral
  - C. because pyruvate dehydrogenase is a mitochondrial enzyme
  - D. by exchange with malate
  - E. to generate malate in the malic enzyme reaction
3. A requirement for the conversion of glucose-1-phosphate to glucose-6-phosphate is
  - A. ATP
  - B.  $NAD^+$
  - C. phosphoglucose isomerase
  - D. glucose-1,6-bisphosphate
  - E. fructose-1,6-bisphosphate
4. A spectrophotometric assay for glucose is based on the measurement of NADH or NADPH at 340 nm. (They have identical spectra in this region.) The response is calibrated by observing that 0.025  $\mu$ mol glucose-6-phosphate in 1.0 mL of buffered solution oxidized to the pentose-phosphate level reduces  $NADP^+$  enough to cause a rise in  $A_{340}$  of 0.31. When 0.1  $\mu$ mol glucose is incubated with lactate dehydrogenase, hexokinase, and pyruvate kinase, and an excess of phosphoenolpyruvate, ATP, and NADH in 1.0 mL, the change in  $A_{340}$  is
  - A. -1.24
  - B. -0.62
  - C. -0.31
  - D. +0.31
  - E. +0.62
5. Carbonic acid has  $pK_a$  values of 3.9 and 10.2. Why is it a good buffer for physiological fluids in the range of 7.4?
  - A. The average of 3.9 and 10.2 is very close to the pH of blood
  - B.  $CO_2$  combines with amino groups and the  $pK_a$  of the  $-NHCOOH$  group is 6.1
  - C. In vivo  $CO_2$  is under pressure. This facilitates the ionization of carbonic acid and makes its  $pK_a$  values 6.1 and 12.9
  - D. The equilibrium that is relevant to physiological buffers is not the one referred to in the question, but the one between dissolved  $CO_2 + H^+$  and  $HCO_3^-$
  - E. The action of carbonic anhydrase raises the first  $pK_a$  of carbonic acid to 6.1
6. In mammalian bile, the bile acids are usually present
  - A. in the free form
  - B. conjugated to ascorbic acid
  - C. in the form of cholesterol esters
  - D. conjugated to glycine or taurine
  - E. conjugated to  $\beta$ -glucuronic acid
7. Catabolism of tryptophan begins with formation of
  - A. nicotinate
  - B. urocanate
  - C. serotonin
  - D. N-formylkynurenine
  - E. anthranilate
8. In man, the chief catabolic product of purines is
  - A. ammonia
  - B. allantoin
  - C. hypoxanthine
  - D. urea
  - E. uric acid
9. Thiouracil inhibits thyroid function by
  - A. inhibition of thyroxine synthesis
  - B. destruction of thyrotropin
  - C. reduction of thyrotropin production by the pituitary gland
  - D. formation of thiocyanate from thiouracil
  - E. formation of D-thyroxine, which is an antagonist of L-thyroxine
10. Aspirin acts by
  - A. inhibition of the uptake of catecholamines by chromaffin cells after stimulation of the cell ceases
  - B. inhibition of phosphodiesterase
  - C. inhibition of acetylcholine synthetase
  - D. inhibition of recycling of norepinephrine receptors on the plasma membrane
  - E. acetylation of an active site serine of cyclooxygenase
11. In an enzyme assay in which substrate concentration is much higher than  $K_m$ , the rate
  - A. approaches one-half of  $V_{max}$
  - B. shows zero-order kinetics
  - C. is proportional to substrate concentration
  - D. is independent of temperature
  - E. is independent of temperature
12. In enzyme assays, initial rates are used to
  - A. increase the sensitivity of the assay
  - B. avert substrate inhibition
  - C. promote substrate inhibition
  - D. minimize the contribution of the reverse reaction
  - E. maintain second-order kinetics
13. In competitive inhibition,
  - A. the apparent concentration of active enzyme molecules is reduced
  - B.  $V_{max}$  is increased
  - C. the concentration of active enzyme molecules is unchanged
  - D. the apparent  $K_m$  is increased
  - E. the apparent  $K_m$  is decreased
14. Isozymes
  - A. are enzymes that exist in more than one amino acid sequence in the same species
  - B. cannot be distinguished in a given species except immunologically
  - C. by definition must have the same amino acid composition
  - D. are single polypeptide chains that differ by an amino acid replacement
  - E. have identical catalytic properties
15. When a coenzyme is required in an enzymatic reaction, it often functions to
  - A. accept one of the cleavage products
  - B. enhance the specificity of the apoenzyme
  - C. increase the active sites of the apoenzyme
  - D. activate the substrate
  - E. raise the activation energy of the enzymatic reaction

16. The terms *primary*, *secondary*, and *tertiary* in protein chemistry refer, respectively, to
- $\alpha$ -helix,  $\beta$ -helix, and  $\gamma$ -helix
  - peptide bonds, disulfide bonds, and  $\alpha$ -helix
  - peptide bonds, hydrogen bonds, and  $\alpha$ -helix
  - electrostatic interactions, van der Waals forces, and disulfide bonds
  - amino acid sequence,  $\alpha$ -helix, and hydrophobic forces
17. A Scatchard plot (bound/free vs. bound hormone) of hormone binding to the plasma membrane fraction of a cell CANNOT demonstrate
- the number of receptors present
  - the affinity of hormone for receptor
  - whether there are present two classes of receptors that differ in their affinities for the hormone
  - the molecular weight of the receptor
  - the concentration of hormone that will half-saturate the binding sites

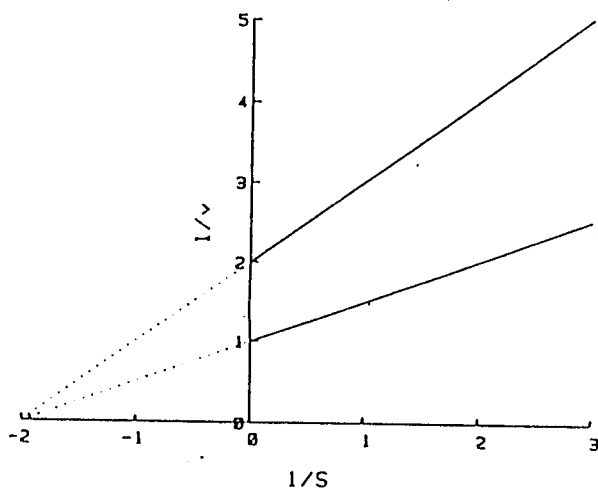


Figure 1. Dependence of enzyme rate  $v$  ( $\mu\text{mol}/\text{min}$ ) as a function of substrate concentration  $S$  ( $\text{mM}$ ). Also shown is the dependence of the rate in the presence of an inhibitor, present at a concentration of  $2 \text{ mM}$ .

Questions 18-20 (Figure 1):

18. The  $V_{\text{max}}$  of the enzyme is
- $0.25 \mu\text{mol}/\text{min}$
  - $0.5 \mu\text{mol}/\text{min}$
  - $1 \mu\text{mol}/\text{min}$
  - $2 \mu\text{mol}/\text{min}$
  - $4 \mu\text{mol}/\text{min}$
19. The  $K_m$  of the substrate is
- $0.25 \text{ mM}$
  - $0.5 \text{ mM}$
  - $1 \text{ mM}$
  - $2 \text{ mM}$
  - $4 \text{ mM}$
20. The  $K_i$  of the inhibitor is
- $0.25 \text{ mM}$
  - $0.5 \text{ mM}$
  - $1 \text{ mM}$
  - $2 \text{ mM}$
  - $4 \text{ mM}$

Match (21-30, 每題 2 points)

Please select the proper answer from the following for questions 21-23:

- Phosphoenolpyruvate carboxylkinase
- Glucose 1-phosphate
- Pyruvate kinase

- Glycolysis
- Gluconeogenesis
- Glycogen synthesis

Please select the proper answer from the following for questions 24-25:

- Promote liver phosphorylase activity
- Secretion regulated, in part, by blood glucose level

- Insulin
- Epinephrine

Please select the proper answer from the following for questions 26-30:

- DNA assessment
- RNA abundance
- Protein abundance
- Epithelial cell basolateral membrane marker
- Mitochondrial enzyme marker

- Na,K-ATPase
- Succinate dehydrogenase
- Western blot
- Southern blot
- Northern blot