

4A-C Exam

This is exam that will be open from 2:00 pm - 6:00 pm on 5/6/2018. All answers must be placed in Engage. Failure to submit answers on t result in you receiving a zero.

Ms. Gore will close Engage and take the exam down at 6:00 pm on 5/6/2018.

Remember your explanations/justification is due 5/7/2018 by 8:30am to Ms. Gore from you.

All late justifications will cause you to have point's deducted.

You must include what book and page number in your justification. (I will be checking your sources.)

Failure to do so will result in points being deducted and/or a zero for this exam.

Name \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 1) If cells are grown in a medium containing radioactive  $^{15}\text{N}$ , which of these molecules will be labeled? 1) \_\_\_\_\_
- A) fatty acids only
  - B) proteins only
  - C) nucleic acids only
  - D) both fatty acids and proteins
  - E) both proteins and nucleic acids

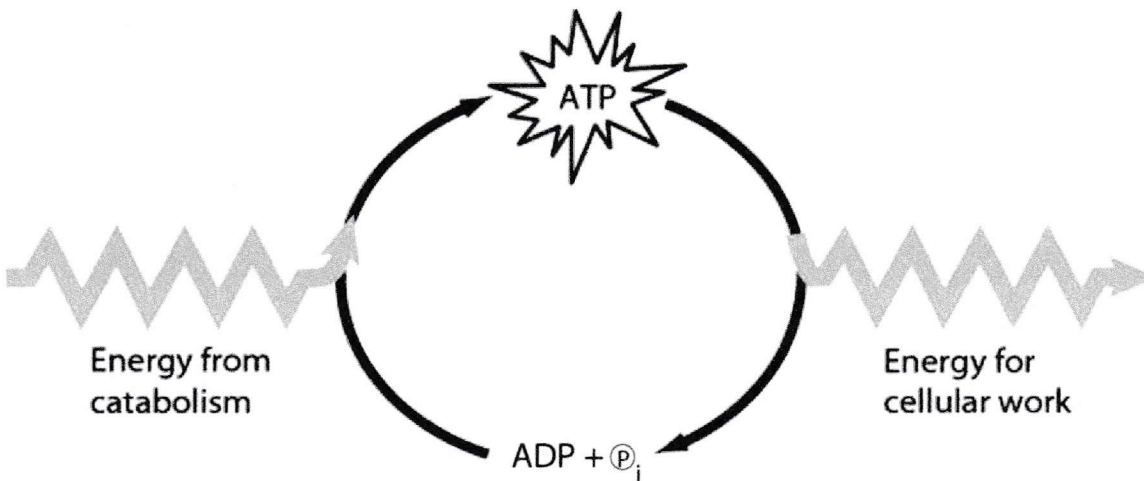


Figure 6.1

- 2) Which of the following is the most correct interpretation of Figure 6.1? 2) \_\_\_\_\_
- A) ATP is a molecule that acts as an intermediary to store energy for cellular work.
  - B) P<sub>i</sub> acts as a shuttle molecule to move energy from ATP to ADP.
  - C) Inorganic phosphate is created from organic phosphate.
  - D) ADP + P<sub>i</sub> are a set of molecules that store energy for catabolism.
  - E) Energy from catabolism can be used directly for performing cellular work.

- 3) Cells use the ATP cycle shown in Figure 6.1 to \_\_\_\_\_  
A) recycle the energy used for cellular work.  
B) move energy from ATP to ADP.  
C) recycle ADP and phosphate.  
D) recycle energy released by ATP hydrolysis.

Please use the following information to answer the question(s) below.

A series of enzymes catalyze the reactions illustrated in the following metabolic pathway:  $X \rightarrow Y \rightarrow Z \rightarrow A$ . Product A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme.

- 4) What is substance X? \_\_\_\_\_  
A) a substrate  
B) a coenzyme  
C) an intermediate  
D) an allosteric inhibitor
- 5) With respect to the enzyme that converts X to Y, substance A functions as \_\_\_\_\_  
A) an allosteric inhibitor.  
B) the substrate.  
C) a competitive inhibitor.  
D) a coenzyme.  
E) an intermediate.
- 6) About 20–25% of the 92 natural elements are known to be essential to life. Which four of these elements make up approximately 96% of living matter? \_\_\_\_\_  
A) carbon, oxygen, phosphorus, hydrogen  
B) carbon, oxygen, nitrogen, calcium  
C) oxygen, hydrogen, calcium, nitrogen  
D) carbon, hydrogen, nitrogen, oxygen  
E) carbon, sodium, hydrogen, nitrogen
- 7) The atomic number of each atom is given to the left of each of the following elements. Which of the atoms has the same valence as carbon ( ${}^{12}_6\text{C}$ )? \_\_\_\_\_  
A)  ${}^{14}\text{Si}$  silicon  
B)  ${}^{10}\text{Ne}$  neon  
C)  ${}^7\text{N}$  nitrogen  
D)  ${}^9\text{F}$  fluorine  
E)  ${}^{12}\text{Mg}$  magnesium
- 8) The molar mass of water is 18 g/mol. What is the molarity of 1 liter of pure water? (*Hint: One liter of pure water has a mass of 1 kg.*) \_\_\_\_\_  
A) 37 M                      B) 18 M                      C) 0.66 M                      D) 55.6 M                      E) 1.0 M
- 9) What is the pH of a 1-millimolar NaOH solution? \_\_\_\_\_  
A) pH 9                      B) pH 10                      C) pH 3                      D) pH 11                      E) pH 8

- 10) Which of the following statements about buffer solutions is true? 10) \_\_\_\_\_
- A) They maintain a relatively constant pH when either acids or bases are added to them.
  - B) They are found only in living systems and biological fluids.
  - C) They maintain a constant pH when acids are added to them but not when bases are added to them.
  - D) They maintain a constant pH when bases are added to them but not when acids are added to them.
  - E) They maintain a relatively constant pH of approximately 7 when either acids or bases are added to them.
- 11) Increased atmospheric CO<sub>2</sub> concentrations will have what effect on seawater? 11) \_\_\_\_\_
- A) Seawater will become more acidic, and carbonate concentrations will decrease.
  - B) There will be no change in the pH of seawater because carbonate will turn to bicarbonate.
  - C) Seawater will become more acidic, and bicarbonate concentrations will decrease.
  - D) Seawater will become more alkaline, and carbonate concentrations will decrease.
  - E) Seawater will become more acidic, and carbonate concentrations will increase.

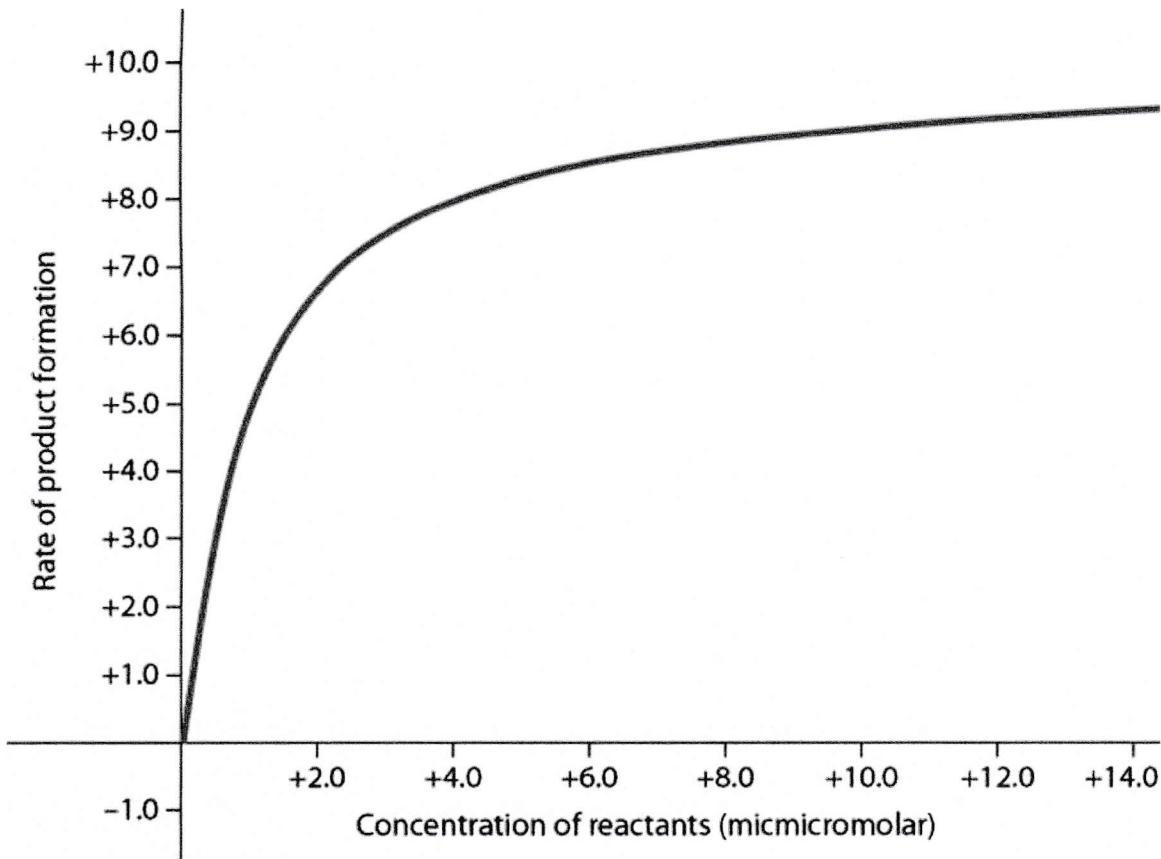


Figure 6.2 Rate of an enzyme-catalyzed reaction as a function of varying reactant concentration, with the concentration of enzyme held constant.

- 12) For the enzyme-catalyzed reaction shown in Figure 6.2, which of these treatments will cause the greatest increase in the rate of the reaction if the initial reactant concentration is 1.0 micromolar? 12) \_\_\_\_\_
- A) increasing the concentration of reactants to 10.0 micromolar, while reducing the concentration of enzyme by half
  - B) doubling the activation energy needed
  - C) doubling the concentration of the reactants to 2.0 micromolar
  - D) doubling the enzyme concentration
  - E) cooling the reaction by 10°C
- 13) In Figure 6.2, why does the reaction rate plateau at higher reactant concentrations? 13) \_\_\_\_\_
- A) Most enzyme molecules are occupied by substrate at high reactant concentrations.
  - B) Feedback inhibition by product occurs at high reactant concentrations.
  - C) The activation energy for the reaction increases with reactant concentration.
  - D) The rate of the reverse reaction increases with reactant concentration.
  - E) The reaction nears equilibrium at high reactant concentrations.

- 14) A greenhouse experiment to test growth rates in tomato cultivars was conducted using sterile soil mix and watering with sterile solutions of water and fertilizer. Following germination, half of the plants in each group were transplanted into soil that was obtained from a nearby agricultural field (nonsterile) and the other half into sterile soil. After several weeks the plants that were transplanted into nonsterile soil exhibited a much higher growth rate compared to the plants transplanted into sterile soil. The most likely explanation for this result is 14) \_\_\_\_\_
- A) the plants transplanted into the nonsterile soil received more fertilizer.
  - B) the plants transplanted into sterile soil suffered anoxia from improper water drainage.
  - C) the plants transplanted into the sterile soil were stunted due to overfertilization.
  - D) the plants transplanted into the nonsterile soil were inoculated with mycorrhizae.
- 15) How many electron pairs does carbon share in order to complete its valence shell? 15) \_\_\_\_\_
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 8
- 16) The sequence 5'-GAACUT-3' may be found in which of the following? 16) \_\_\_\_\_
- A) DNA only
  - B) RNA only
  - C) either DNA or RNA
  - D) neither DNA nor RNA
- 17) One of the primary functions of RNA molecules is to 17) \_\_\_\_\_
- A) act as a pattern or blueprint to form DNA.
  - B) transmit genetic information to offspring.
  - C) make a copy of itself, thus ensuring genetic continuity.
  - D) function in the synthesis of proteins.
- 18) Normal hemoglobin is a tetramer, consisting of two molecules of  $\beta$ -globin and two molecules of  $\alpha$ -globin. In sickle-cell disease, as a result of a single amino acid change, the mutant hemoglobin tetramers associate with each other and assemble into large fibers. Based on this information alone, we can conclude that sickle-cell hemoglobin exhibits 18) \_\_\_\_\_
- A) altered primary structure.
  - B) altered secondary structure.
  - C) altered tertiary structure.
  - D) altered quaternary structure.
  - E) altered primary structure and altered quaternary structure; the secondary and tertiary structures may or may not be altered.

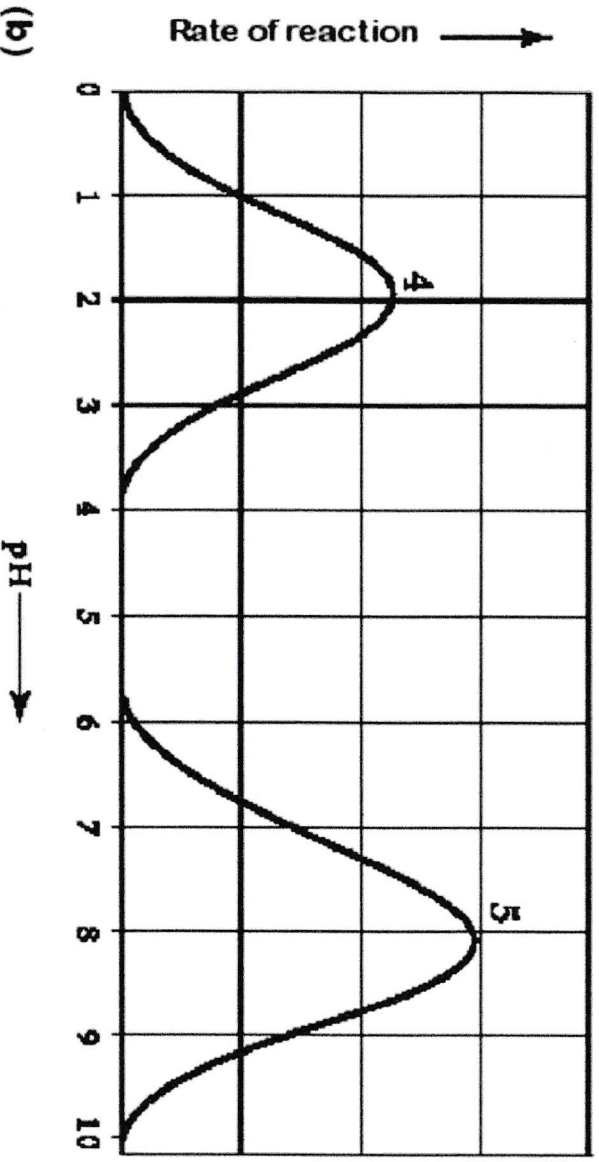
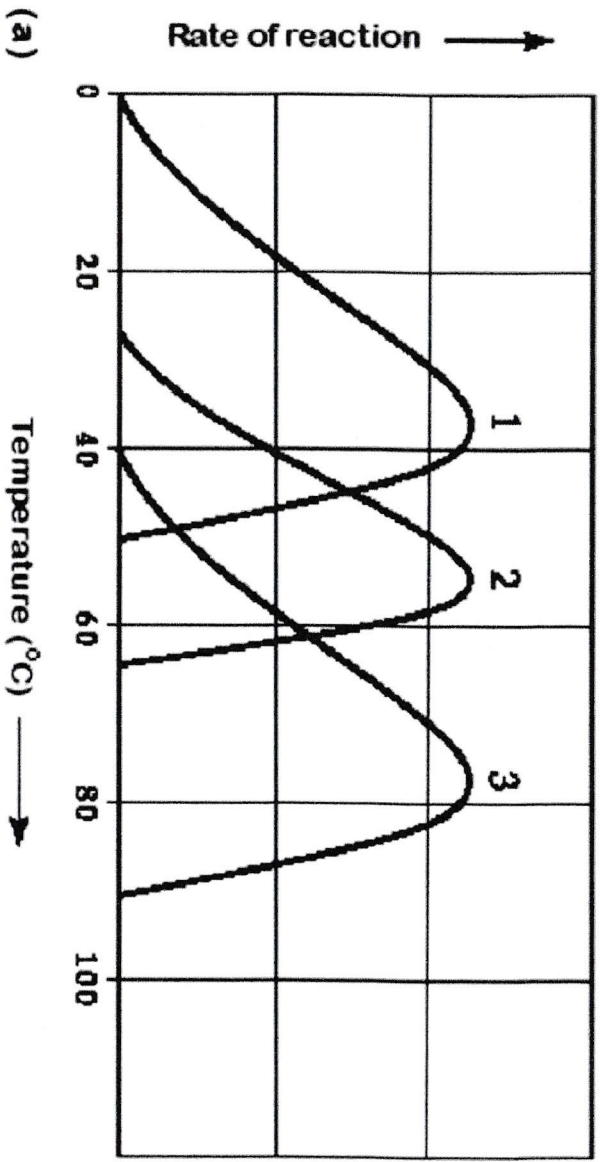


Figure 6.3 Activity of various enzymes (a) at various temperatures and (b) at various pH.

- 19) Which curves on the graphs in Figure 6.3 may represent the temperature and pH profiles of an enzyme taken from a bacterium that lives in a mildly alkaline hot spring at temperatures of  $70^{\circ}\text{C}$  or higher?
- A) curves 2 and 5
  - B) curves 1 and 5
  - C) curves 3 and 5
  - D) curves 2 and 4
  - E) curves 3 and 4
- 19) \_\_\_\_\_

- 20) Which temperature and pH profile curves on the graphs in Figure 6.3 were most likely generated from analysis of an enzyme from a human stomach, where conditions are strongly acid? 20) \_\_\_\_\_
- A) curves 2 and 4
  - B) curves 1 and 4
  - C) curves 2 and 5
  - D) curves 3 and 4
  - E) curves 1 and 5
- 21) Changing a single amino acid in a protein consisting of 433 amino acids would 21) \_\_\_\_\_
- A) always alter the primary and tertiary structure of the protein but never alter its function.
  - B) sometimes alter the primary and tertiary structure of the protein but always alter its function.
  - C) always alter the primary structure of the protein but never alter its tertiary structure or function.
  - D) always alter the primary structure of the protein and sometimes alter its tertiary structure or function.
- 22) As a youngster, you drive a nail in the trunk of a young tree that is 3 meters tall. The nail is about 1.5 meters from the ground. Fifteen years later, you return and discover that the tree has grown to a height of 30 meters. About how many meters above the ground is the nail? 22) \_\_\_\_\_
- A) 0.5
  - B) 1.5
  - C) 3.0
  - D) 15.0
  - E) 28.5
- 23) Suppose George Washington completely removed the bark from around the base of a cherry tree but was stopped by his father before cutting the tree down. The leaves retained their normal appearance for several weeks, but the tree eventually died. The tissue(s) that George left functional was/were the 23) \_\_\_\_\_
- A) phloem.
  - B) companion and sieve-tube members.
  - C) xylem.
  - D) cortex.
  - E) cork cambium.
- 24) Several tomato plants are growing in a small garden plot. If soil water potential were to drop significantly on a hot summer afternoon, which of the following would most likely occur? 24) \_\_\_\_\_
- A) Transpiration would increase.
  - B) The uptake of CO<sub>2</sub> would be enhanced.
  - C) Stomatal apertures would decrease.
  - D) The leaves would become more turgid.
- 25) How many peptide bonds are present in a polypeptide that contains 45 amino acids? 25) \_\_\_\_\_
- A) 44
  - B) 90
  - C) 45
  - D) 46
- 26) Which of the following are pyrimidines? 26) \_\_\_\_\_
- A) adenine and thymine
  - B) cytosine and uracil
  - C) adenine and guanine
  - D) cytosine and guanine

The following question(s) are based on the reaction  $A + B \rightarrow C + D$  shown in Figure 6.4.

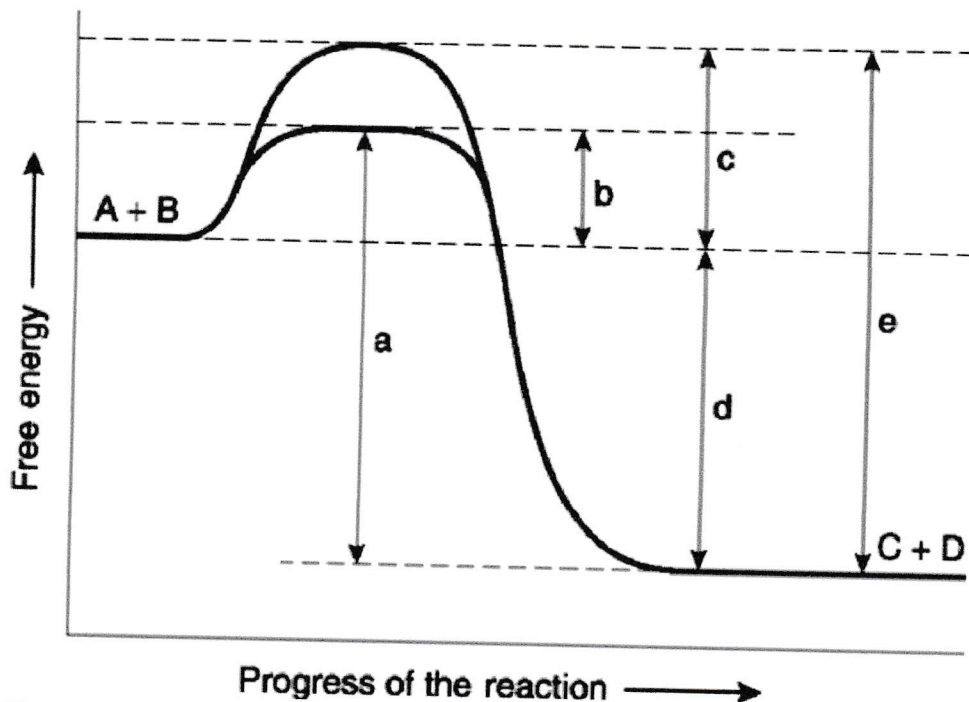


Figure 6.4

- 27) Which of the following best describes the forward reaction in Figure 6.4? 27) \_\_\_\_\_  
 A) exergonic,  $\Delta G < 0$  B) exergonic,  $\Delta G > 0$   
 C) endergonic,  $\Delta G > 0$  D) endergonic,  $\Delta G < 0$
- 28) Which of the following in Figure 6.4 would be the same in either an enzyme-catalyzed or a noncatalyzed reaction? 28) \_\_\_\_\_  
 A) a B) b C) c D) d E) e
- 29) There are 20 different amino acids. What makes one amino acid different from another? 29) \_\_\_\_\_  
 A) different side chains (R groups) attached to the carboxyl carbon  
 B) different side chains (R groups) attached to the amino groups  
 C) different asymmetric carbons  
 D) different side chains (R groups) attached to an  $\alpha$  carbon
- 30) Why are the vertebrate sex hormones estradiol and testosterone considered to be lipids? 30) \_\_\_\_\_  
 A) They are made of fatty acids.  
 B) They are essential components of cell membranes.  
 C) Their carbon skeletons are composed of primarily C-C and C-H bonds.  
 D) They are hydrophilic compounds.
- 31) Which of the following large biological molecules will self-assemble into a bilayer when mixed with water? 31) \_\_\_\_\_  
 A) triacylglycerols B) phospholipids C) cellulose D) proteins



The following question(s) are based on the reaction  $A + B \rightarrow C + D$  shown in Figure 6.4.

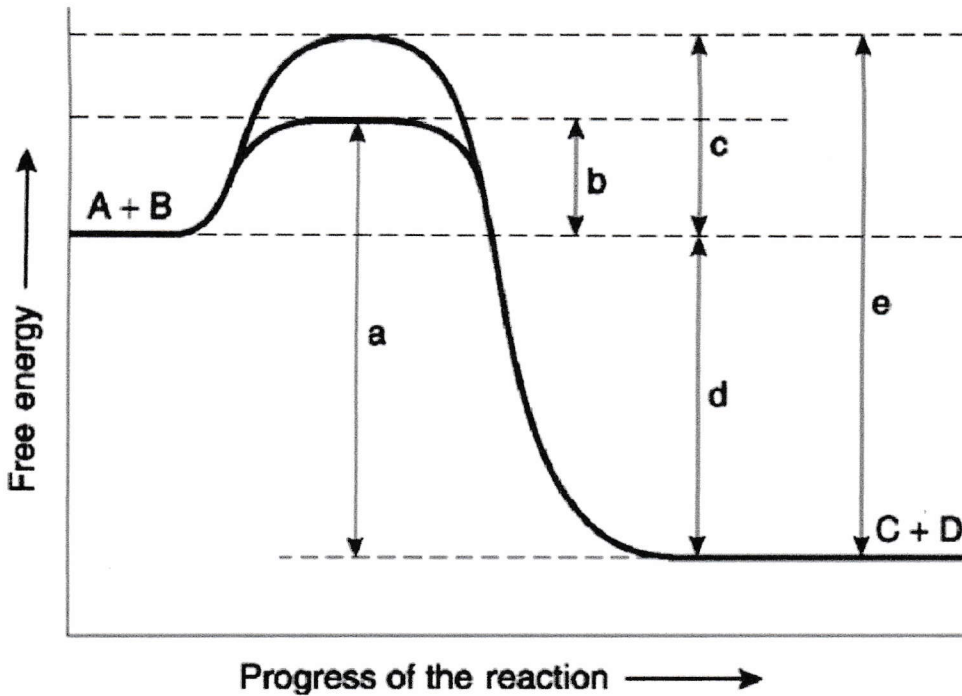


Figure 6.4

- 32) Which of the following represents the activation energy required for the enzyme-catalyzed reaction in Figure 6.4? 32) \_\_\_\_\_  
 A) a                      B) b                      C) c                      D) d                      E) e
- 33) Which of the following represents the activation energy needed for the enzyme-catalyzed reverse reaction,  $C + D \rightarrow A + B$ , in Figure 6.4? 33) \_\_\_\_\_  
 A) a                      B) b                      C) c                      D) d                      E) e
- 34) Which of the following represents the activation energy required for a noncatalyzed reaction in Figure 6.4? 34) \_\_\_\_\_  
 A) a                      B) b                      C) c                      D) d                      E) e
- 35) Which of the following statements regarding lipids is true? 35) \_\_\_\_\_  
 A) They are insoluble in water.  
 B) They are made from glycerol and amino acids.  
 C) They generally contain nitrogen.  
 D) A gram of lipid stores less energy than a gram of carbohydrate.
- 36) Which two functional groups are always found in amino acids? 36) \_\_\_\_\_  
 A) ketone and amino                                      B) hydroxyl and carboxyl  
 C) carboxyl and amino                                    D) carbonyl and amino

Please use the following information to answer the question(s) below.

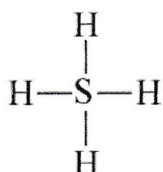
Succinate dehydrogenase catalyzes the conversion of succinate to fumarate. The reaction is inhibited by malonic acid, which resembles succinate but cannot be acted upon by succinate dehydrogenase. Increasing the ratio of succinate to malonic acid reduces the inhibitory effect of malonic acid.

37) Based on this information, which of the following is correct? 37) \_\_\_\_\_

- A) Succinate dehydrogenase is the enzyme, and malonic acid is the substrate.
- B) Succinate is the substrate, and fumarate is the product.
- C) Fumarate is the product, and malonic acid is a noncompetitive inhibitor.
- D) Malonic acid is the product, and fumarate is a competitive inhibitor.
- E) Succinate dehydrogenase is the enzyme, and fumarate is the substrate.

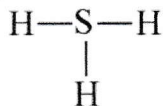
38) If an atom of sulfur (atomic number 16) were allowed to react with atoms of hydrogen (atomic number 1), which of the following molecules would be formed? 38) \_\_\_\_\_

A)



B) S-H

C)



D) H-S-H

E) H = S = H

In west Texas, cotton has become an important crop in the last several decades. However, in this hot, dry part of the country there is little rainfall, so farmers irrigate their cotton fields. They must also regularly fertilize the cotton fields because the soil is very sandy. Figure 29.1 shows the record of annual productivity (measured in kilograms of cotton per hectare of land) since 1960 in a west Texas cotton field. Use these data to answer the following question(s).

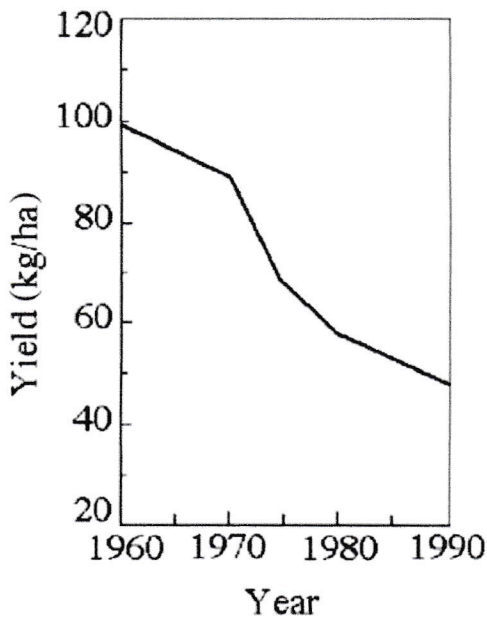


Figure 29.1

- 39) Based on the information provided in Figure 29.1, what is the most likely cause of the decline in productivity? 39) \_\_\_\_\_
- A) The farmer used the wrong kind of fertilizer.
  - B) The soil water potential has become more negative due to salination.
  - C) The cotton is developing a resistance to the fertilizer and to irrigation water.
  - D) Water has accumulated in the soil due to irrigation.
- 40) If you were the county agriculture agent, what would be the best advice you could give the farmer who owns the field under study in Figure 29.1? 40) \_\_\_\_\_
- A) Continue to irrigate, but stop fertilizing the field and rely on organic nutrients in the soil.
  - B) Continue to fertilize, but stop irrigating the field and rely on rainfall.
  - C) Plant a variety of cotton that requires less water and can tolerate salinity.
  - D) Continue to fertilize and irrigate, but add the nitrogen-fixing bacteria *Rhizobium* to the irrigation water until the productivity increases.