CHAPTER 13
HOW CELLS OBTAIN ENERGY FROM FOOD

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The Breakdown and Utilization of Sugars and Fats

13-1 Glycolysis is an anaerobic process used to catabolize glucose. What does it mean for this process to be anaerobic?

(a) No oxygen is required.
(b) No oxidation occurs.
(c) It takes place in the lysosome.
(d) Glucose is broken down by the addition of electrons.

13-2 Which of the following stages in the breakdown of the piece of toast you had for breakfast generates the most ATP?

(a) the digestion of starch to glucose
(b) glycolysis
(c) the citric acid cycle
(d) oxidative phosphorylation

13-3 The advantage to the cell of the gradual oxidation of glucose during cellular respiration compared with its combustion to CO_2 and H_2O in a single step is that _____.

(a) more free energy is released for a given amount of glucose oxidized
(b) no energy is lost as heat
(c) energy can be extracted in usable amounts
(d) more CO_2 is produced for a given amount of glucose oxidized

13-4 The final metabolite produced by glycolysis is _____.

(a) acetyl CoA
(b) pyruvate
(c) 3-phosphoglycerate
(d) glyceraldehyde 3-phosphate

13-5 Glycolysis generates more stored energy than it expends. What is the net number of activated carrier molecules produced in this process (number and type of molecules produced minus the number of those molecules used as input)?

(a) 6 ATP, 2 NADH
(b) 4 ATP, 4 NADH
(c) 2 ATP, 2 NADH
(d) 4 ATP, 2 NADH

13-6 Which of the following steps or processes in aerobic respiration include the production of carbon dioxide?

(a) breakdown of glycogen
(b) glycolysis
(c) conversion of pyruvate to acetyl CoA
(d) oxidative phosphorylation

13-7 In step 4 of glycolysis, a six-carbon sugar (fructose 1,6-bisphosphate) is cleaved to produce two three-carbon molecules (dihydroxyacetone phosphate and glyceraldehyde 3-phosphate). Which enzyme catalyzes this reaction?

(a) aldolase
(b) phosphoglucose isomerase
(c) enolase
(d) triose phosphate isomerase

13-8 On a diet consisting of nothing but protein, which of the following is the most likely outcome?

(a) loss of weight because amino acids cannot be used for the synthesis of fat
(b) muscle gain because the amino acids will go directly into building muscle
(c) tiredness because amino acids cannot be used to generate energy
(d) excretion of more nitrogenous (ammonia-derived) wastes than with a more balanced diet

13-9 Figure Q13-9 represents a cell lining the gut. Draw numbered labeled lines to indicate exactly where inside a cell the following processes take place.

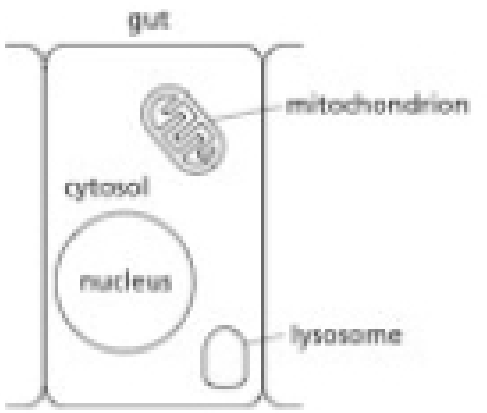
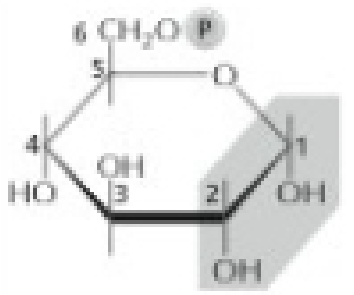
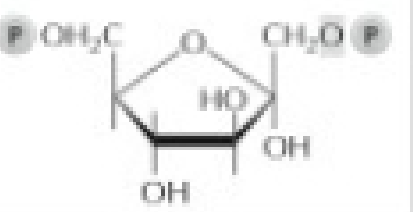
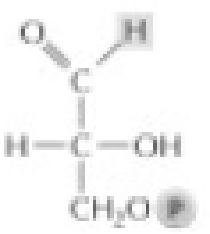
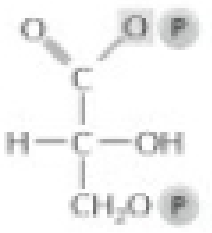
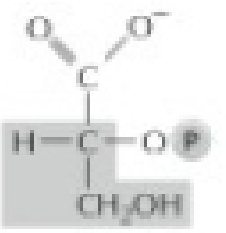
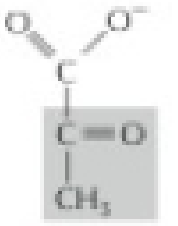


Figure Q13-9

1. glycolysis
2. citric acid cycle
3. conversion of pyruvate to activated acetyl groups
4. oxidation of fatty acids to acetyl CoA
5. glycogen breakdown
6. release of fatty acids from triacylglycerols
7. oxidative phosphorylation

13-10 Fill in the spaces in the table below. For steps 1, 4, 5, and 8, name the correct substrates, enzyme, or products. For all the other steps, name the enzyme and draw the missing structure.

	substrate	enzyme	product(s)
STEP 1	glucose	hexokinase	
STEP 2			
STEP 3			
STEP 4		aldolase	dihydroxyacetone phosphate, glyceraldehyde 3-phosphate
STEP 5		triose phosphate isomerase	
STEP 6			
STEP 7			
STEP 8	3-phosphoglycerate	phosphoglycerate mutase	
STEP 9			
STEP 10