Chapter 9

Cellular Respiration: Harvesting Chemical Energy

Multiple-Choice Questions

1) What is the term for metabolic pathways that release stored energy by breaking down complex molecules?
   A) anabolic pathways
   B) catabolic pathways
   C) fermentation pathways
   D) thermodynamic pathways
   E) bioenergetic pathways

   Answer:  B
   Topic:  Concept 9.1
   Skill:  Knowledge/Comprehension

2) When electrons move closer to a more electronegative atom, what happens?
   A) Energy is released.
   B) Energy is consumed.
   C) The more electronegative atom is reduced.
   D) The more electronegative atom is oxidized.
   E) A and C are correct.

   Answer:  E
   Topic:  Concept 9.1
   Skill:  Knowledge/Comprehension

3) Which of the following statements describes the results of this reaction?
   C₆H₁₂O₆ + 6 O₂ → 6 CO₂ + 6 H₂O + Energy
   A) C₆H₁₂O₆ is oxidized and O₂ is reduced.
   B) O₂ is oxidized and H₂O is reduced.
   C) CO₂ is reduced and O₂ is oxidized.
   D) C₆H₁₂O₆ is reduced and CO₂ is oxidized.
   E) O₂ is reduced and CO₂ is oxidized.

   Answer:  A
   Topic:  Concept 9.1
   Skill:  Knowledge/Comprehension

4) When a molecule of NAD+ (nicotinamide adenine dinucleotide) gains a hydrogen atom (not a hydrogen ion) the molecule becomes
   A) hydrogenated.
   B) oxidized.
   C) reduced.
   D) redoxed.
   E) a reducing agent.

   Answer:  C
   Topic:  Concept 9.1
   Skill:  Knowledge/Comprehension
5) Which of the following statements describes NAD⁺?
A) NAD⁺ is reduced to NADH during both glycolysis and the citric acid cycle.
B) NAD⁺ has more chemical energy than NADH.
C) NAD⁺ is reduced by the action of hydrogenases.
D) NAD⁺ can donate electrons for use in oxidative phosphorylation.
E) In the absence of NAD⁺, glycolysis can still function.

Answer: A
Topic: Concept 9.1
Skill: Knowledge/Comprehension

6) Where does glycolysis takes place?
A) mitochondrial matrix
B) mitochondrial outer membrane
C) mitochondrial inner membrane
D) mitochondrial intermembrane space
E) cytosol

Answer: E
Topic: Concept 9.1
Skill: Knowledge/Comprehension

7) The ATP made during glycolysis is generated by
A) substrate-level phosphorylation.
B) electron transport.
C) photophosphorylation.
D) chemiosmosis.
E) oxidation of NADH to NAD⁺.

Answer: A
Topic: Concept 9.1
Skill: Knowledge/Comprehension

8) The oxygen consumed during cellular respiration is involved directly in which process or event?
A) glycolysis
B) accepting electrons at the end of the electron transport chain
C) the citric acid cycle
D) the oxidation of pyruvate to acetyl CoA
E) the phosphorylation of ADP to form ATP

Answer: B
Topic: Concept 9.1
Skill: Knowledge/Comprehension

9) Which process in eukaryotic cells will proceed normally whether oxygen (O₂) is present or absent?
A) electron transport
B) glycolysis
C) the citric acid cycle
D) oxidative phosphorylation
E) chemiosmosis

Answer: B
Topic: Concept 9.1
Skill: Knowledge/Comprehension

10) An electron loses potential energy when it
A) shifts to a less electronegative atom.
B) shifts to a more electronegative atom.
C) increases its kinetic energy.
D) increases its activity as an oxidizing agent.
E) attaches itself to NAD⁺.

Answer: B

Topic: Concept 9.1
Skill: Knowledge/Comprehension

11) Why are carbohydrates and fats considered high energy foods?
A) They have a lot of oxygen atoms.
B) They have no nitrogen in their makeup.
C) They can have very long carbon skeletons.
D) They have a lot of electrons associated with hydrogen.
E) They are easily reduced.

Answer: D

Topic: Concept 9.1
Skill: Knowledge/Comprehension

Refer to Figure 9.1 to answer the following questions.

Figure 9.1 illustrates some of the steps (reactions) of glycolysis in their proper sequence. Each step is lettered. Use these letters to answer the questions.

A. 
\[ \text{Glucose} \rightarrow 2 \text{ATP, 2 ADP} \rightarrow \text{Fructose-1, 6-bisphosphate} \]

B. 
\[ \text{Fructose-1, 6-bisphosphate} \rightarrow 2 \text{Glyceraldehyde-3-phosphate} \]

C. 
\[ 2 \text{Glyceraldehyde-3-phosphate} \rightarrow 2 \text{NAD, 2 NADH, 1, 3-Bisphosphoglycerate} \]

D. 
\[ 2 \text{ADP, 2 ATP} \rightarrow 2 \text{PGA} \]

E. 
\[ 2 \text{ADP, 2 ATP} \rightarrow 2 \text{H₂O, 2 Pyruvate} \]

Figure 9.1

12) Which step shows a split of one molecule into two smaller molecules?

Answer: B

Topic: Concept 9.2
Skill: Application/Analysis
13) In which reaction does an intermediate pathway become oxidized?

Answer: C
Topic: Concept 9.2
Skill: Application/Analysis

14) Which step involves an endergonic reaction?

Answer: A
Topic: Concept 9.2
Skill: Application/Analysis

15) Which step consists of a phosphorylation reaction in which ATP is the phosphate source?

Answer: A
Topic: Concept 9.2
Skill: Application/Analysis

16) Substrate-level phosphorylation accounts for approximately what percentage of the ATP formed during glycolysis?
A) 0%
B) 2%
C) 10%
D) 38%
E) 100%

Answer: E
Topic: Concept 9.2
Skill: Application/Analysis

17) During glycolysis, when glucose is catabolized to pyruvate, most of the energy of glucose is
A) transferred to ADP, forming ATP.
B) transferred directly to ATP.
C) retained in the pyruvate.
D) stored in the NADH produced.
E) used to phosphorylate fructose to form fructose-6-phosphate.

Answer: C
Topic: Concept 9.2
Skill: Knowledge/Comprehension

18) In addition to ATP, what are the end products of glycolysis?
A) CO₂ and H₂O
B) CO₂ and pyruvate
C) NADH and pyruvate
D) CO₂ and NADH
E) H₂O, FADH₂, and citrate

Answer: C
Topic: Concept 9.2
Skill: Knowledge/Comprehension

19) The free energy for the oxidation of glucose to CO₂ and water is -686 kcal/mole and the free energy for the reduction of NAD⁺ to NADH is +53 kcal/mole. Why are only two molecules of NADH formed during glycolysis when it appears that as many as a dozen could be formed?
A) Most of the free energy available from the oxidation of glucose is used in the production of ATP in glycolysis.
B) Glycolysis is a very inefficient reaction, with much of the energy of glucose released as heat.
C) Most of the free energy available from the oxidation of glucose remains in pyruvate, one of the products of glycolysis.
D) There is no CO$_2$ or water produced as products of glycolysis.
E) Glycolysis consists of many enzymatic reactions, each of which extracts some energy from the glucose molecule.

Answer: C
Topic: Concept 9.2
Skill: Synthesis/Evaluation

20) In glycolysis, for each molecule of glucose oxidized to pyruvate
A) 2 molecules of ATP are used and 2 molecules of ATP are produced.
B) 2 molecules of ATP are used and 4 molecules of ATP are produced.
C) 4 molecules of ATP are used and 2 molecules of ATP are produced.
D) 2 molecules of ATP are used and 6 molecules of ATP are produced.
E) 6 molecules of ATP are used and 6 molecules of ATP are produced.

Answer: B
Topic: Concept 9.2
Skill: Knowledge/Comprehension

21) A molecule that is phosphorylated
A) has been reduced as a result of a redox reaction involving the loss of an inorganic phosphate.
B) has a decreased chemical reactivity; it is less likely to provide energy for cellular work.
C) has been oxidized as a result of a redox reaction involving the gain of an inorganic phosphate.
D) has an increased chemical reactivity; it is primed to do cellular work.
E) has less energy than before its phosphorylation and therefore less energy for cellular work.

Answer: D
Topic: Concept 9.2
Skill: Synthesis/Evaluation

22) Which kind of metabolic poison would most directly interfere with glycolysis?
A) an agent that reacts with oxygen and depletes its concentration in the cell
B) an agent that binds to pyruvate and inactivates it
C) an agent that closely mimics the structure of glucose but is not metabolized
D) an agent that reacts with NADH and oxidizes it to NAD$^+$
E) an agent that blocks the passage of electrons along the electron transport chain

Answer: C
Topic: Concept 9.2
Skill: Application/Analysis

23) Why is glycolysis described as having an investment phase and a payoff phase?
A) It both splits molecules and assembles molecules.
B) It attaches and detaches phosphate groups.
C) It uses glucose and generates pyruvate.
D) It shifts molecules from cytosol to mitochondrion.
E) It uses stored ATP and then forms a net increase in ATP.

Answer: E
Topic: Concept 9.2
Skill: Knowledge/Comprehension

Use the following information to answer the next questions.
In the presence of oxygen, the three-carbon compound pyruvate can be catabolized in the citric acid cycle. First, however, the pyruvate 1) loses a carbon, which is given off as a molecule of CO₂, 2) is oxidized to form a two-carbon compound called acetate, and 3) is bonded to coenzyme A.

24) These three steps result in the formation of
A) acetyl CoA, O₂, and ATP.
B) acetyl CoA, FADH₂, and CO₂.
C) acetyl CoA, FAD, H₂, and CO₂.
D) acetyl CoA, NADH, H⁺, and CO₂.
E) acetyl CoA, NAD⁺, ATP, and CO₂.

Answer: D
Topic: Concept 9.3
Skill: Application/Analysis

25) Why is coenzyme A, a sulfur containing molecule derived from a B vitamin, added?
A) because sulfur is needed for the molecule to enter the mitochondrion
B) in order to utilize this portion of a B vitamin which would otherwise be a waste product from another pathway
C) to provide a relatively unstable molecule whose acetyl portion can readily bind to oxaloacetate
D) because it drives the reaction that regenerates NAD⁺
E) in order to remove one molecule of CO₂

Answer: C
Topic: Concept 9.3
Skill: Synthesis/Evaluation

26) How does pyruvate enter the mitochondrion?
A) active transport
B) diffusion
C) facilitated diffusion
D) through a channel
E) through a pore

Answer: A
Topic: Concept 9.3
Skill: Knowledge/Comprehension

27) During cellular respiration, acetyl CoA accumulates in which location?
A) cytosol
B) mitochondrial outer membrane
C) mitochondrial inner membrane
D) mitochondrial intermembrane space
E) mitochondrial matrix

Answer: E
Topic: Concept 9.3
Skill: Knowledge/Comprehension

28) How many carbon atoms are fed into the citric acid cycle as a result of the oxidation of one molecule of pyruvate?
A) 2
B) 4
C) 6
Refer to Figure 9.2, showing the citric acid cycle, as a guide to answer the following questions.

Figure 9.2

29) Starting with one molecule of isocitrate and ending with fumarate, what is the maximum number of ATP molecules that could be made through substrate-level phosphorylation?
   A) 1
   B) 2
   C) 11
   D) 12
   E) 24

Answer:  A
Topic:  Concept 9.3
Skill:  Application/Analysis

30) Carbon skeletons for amino acid biosynthesis are supplied by intermediates of the citric acid cycle. Which intermediate would supply the carbon skeleton for synthesis of a five-carbon amino acid?
   A) succinate
   B) malate
   C) citrate
   D) \( \alpha \)-ketoglutarate
   E) isocitrate

Answer:  D
Topic:  Concept 9.3
Skill:  Application/Analysis

31) How many molecules of carbon dioxide (CO\(_2\)) would be produced by five turns of the citric acid cycle?
   A) 2
   B) 5
32) How many reduced dinucleotides would be produced with four turns of the citric acid cycle?
A) 1 FADH$_2$ and 4 NADH
B) 2 FADH$_2$ and 8 NADH
C) 4 FADH$_2$ and 12 NADH
D) 1 FAD and 4 NAD$^+$
E) 4 FAD$^+$ and 12 NAD$^+$

Answer: C
Topic: Concept 9.3
Skill: Application/Analysis

33) Starting with citrate, which of the following combinations of products would result from three turns of the citric acid cycle?
A) 1 ATP, 2 CO$_2$, 3 NADH, and 1 FADH$_2$
B) 2 ATP, 2 CO$_2$, 1 NADH, and 3 FADH$_2$
C) 3 ATP, 3 CO$_2$, 3 NADH, and 3 FADH$_2$
D) 3 ATP, 6 CO$_2$, 9 NADH, and 3 FADH$_2$
E) 38 ATP, 6 CO$_2$, 3 NADH, and 12 FADH$_2$

Answer: D
Topic: Concept 9.3
Skill: Application/Analysis

34) Carbon dioxide (CO$_2$) is released during which of the following stages of cellular respiration?
A) glycolysis and the oxidation of pyruvate to acetyl CoA
B) oxidation of pyruvate to acetyl CoA and the citric acid cycle
C) the citric acid cycle and oxidative phosphorylation
D) oxidative phosphorylation and fermentation
E) fermentation and glycolysis

Answer: B
Topic: Concept 9.3
Skill: Knowledge/Comprehension

35) For each molecule of glucose that is metabolized by glycolysis and the citric acid cycle, what is the total number of NADH + FADH$_2$ molecules produced?
A) 4
B) 5
C) 6
D) 10
E) 12

Answer: E
Topic: Concept 9.3
Skill: Knowledge/Comprehension
36) A young animal has never had much energy. He is brought to a veterinarian for help and is sent to the animal hospital for some tests. There they discover his mitochondria can use only fatty acids and amino acids for respiration, and his cells produce more lactate than normal. Of the following, which is the best explanation of his condition?
A) His mitochondria lack the transport protein that moves pyruvate across the outer mitochondrial membrane.
B) His cells cannot move NADH from glycolysis into the mitochondria.
C) His cells contain something that inhibits oxygen use in his mitochondria.
D) His cells lack the enzyme in glycolysis that forms pyruvate.
E) His cells have a defective electron transport chain, so glucose goes to lactate instead of to acetyl CoA.

Answer: A
Topic: Concept 9.3
Skill: Synthesis/Evaluation

37) Cellular respiration harvests the most chemical energy from which of the following?
A) substrate-level phosphorylation
B) chemiosmotic phosphorylation
C) converting oxygen to ATP
D) transferring electrons from organic molecules to pyruvate
E) generating carbon dioxide and oxygen in the electron transport chain

Answer: B
Topic: Concept 9.3
Skill: Knowledge/Comprehension

38) During aerobic respiration, electrons travel downhill in which sequence?
A) food → citric acid cycle → ATP → NAD+
B) food → NADH → electron transport chain → oxygen
C) glucose → pyruvate → ATP → oxygen
D) glucose → ATP → electron transport chain → NADH
E) food → glycolysis → citric acid cycle → NADH → ATP

Answer: B
Topic: Concept 9.3
Skill: Application/Analysis

39) Where are the proteins of the electron transport chain located?
A) cytosol
B) mitochondrial outer membrane
C) mitochondrial inner membrane
D) mitochondrial intermembrane space
E) mitochondrial matrix

Answer: C
Topic: Concept 9.4
Skill: Knowledge/Comprehension

40) Which of the following describes the sequence of electron carriers in the electron transport chain, starting with the least electronegative?
A) ubiquinone (Q), cytochromes (Cyt), FMN, Fe•S
B) cytochromes (Cyt), FMN, ubiquinone, Fe•S
C) Fe•S, FMN, cytochromes (Cyt), ubiquinone
D) FMN, Fe•S, ubiquinone, cytochromes (Cyt)
E) cytochromes (Cyt), Fe•S, ubiquinone, FMN

Answer: D
Topic: Concept 9.4
Skill: Knowledge/Comprehension
41) During aerobic respiration, which of the following directly donates electrons to the electron transport chain at the lowest energy level?
   A) NAD⁺  
   B) NADH  
   C) ATP  
   D) ADP + Pi  
   E) FADH₂

   Answer: E
   Topic: Concept 9.4  
   Skill: Knowledge/Comprehension

42) The primary role of oxygen in cellular respiration is to
   A) yield energy in the form of ATP as it is passed down the respiratory chain.  
   B) act as an acceptor for electrons and hydrogen, forming water.  
   C) combine with carbon, forming CO₂.  
   D) combine with lactate, forming pyruvate.  
   E) catalyze the reactions of glycolysis.

   Answer: B
   Topic: Concept 9.4  
   Skill: Knowledge/Comprehension

43) Inside an active mitochondrion, most electrons follow which pathway?
   A) glycolysis → NADH → oxidative phosphorylation → ATP → oxygen  
   B) citric acid cycle → FADH₂ → electron transport chain → ATP  
   C) electron transport chain → citric acid cycle → ATP → oxygen  
   D) pyruvate → citric acid cycle → ATP → NADH → oxygen  
   E) citric acid cycle → NADH → electron transport chain → oxygen

   Answer: E
   Topic: Concept 9.4  
   Skill: Knowledge/Comprehension

44) During oxidative phosphorylation, H₂O is formed. Where does the oxygen for the synthesis of the water come from?
   A) carbon dioxide (CO₂)  
   B) glucose (C₆H₁₂O₆)  
   C) molecular oxygen (O₂)  
   D) pyruvate (C₃H₃O₃⁻)  
   E) lactate (C₃H₅O₃⁻)

   Answer: C
   Topic: Concept 9.4  
   Skill: Knowledge/Comprehension

45) In chemiosmotic phosphorylation, what is the most direct source of energy that is used to convert ADP + Pi to ATP?
   A) energy released as electrons flow through the electron transport system  
   B) energy released from substrate-level phosphorylation  
   C) energy released from ATP synthase pumping hydrogen ions from the mitochondrial matrix  
   D) energy released from movement of protons through ATP synthase  
   E) No external source of energy is required because the reaction is exergonic.
46) Energy released by the electron transport chain is used to pump H+ ions into which location?
A) cytosol
B) mitochondrial outer membrane
C) mitochondrial inner membrane
D) mitochondrial intermembrane space
E) mitochondrial matrix

Answer: D

47) The direct energy source that drives ATP synthesis during respiratory oxidative phosphorylation is
A) oxidation of glucose to CO$_2$ and water.
B) the thermodynamically favorable flow of electrons from NADH to the mitochondrial electron transport carriers.
C) the final transfer of electrons to oxygen.
D) the difference in H$^+$ concentrations on opposite sides of the inner mitochondrial membrane.
E) the thermodynamically favorable transfer of phosphate from glycolysis and the citric acid cycle intermediate molecules of ADP.

Answer: D

48) Where is ATP synthase located in the mitochondrion?
A) cytosol
B) electron transport chain
C) outer membrane
D) inner membrane
E) mitochondrial matrix

Answer: D

49) Each time a molecule of glucose (C$_6$H$_{12}$O$_6$) is completely oxidized via aerobic respiration, how many oxygen molecules (O$_2$) are required?
A) 1
B) 2
C) 6
D) 12
E) 38

Answer: C

50) Approximately how many molecules of ATP are produced from the complete oxidation of two molecules of glucose (C$_6$H$_{12}$O$_6$) in cellular respiration?
A) 2
B) 4
51) Approximately what percentage of the energy of glucose (C₆H₁₂O₆) is transferred to storage in ATP as a result of the complete oxidation of glucose to CO₂ and water in cellular respiration?

A) 2%
B) 4%
C) 10%
D) 25%
E) 40%

Answer: E
Topic: Concept 9.4
Skill: Knowledge/Comprehension

52) What is proton-motive force?
A) the force required to remove an electron from hydrogen
B) the transmembrane proton concentration gradient
C) movement of hydrogen into the intermembrane space
D) movement of hydrogen into the mitochondrion
E) the addition of hydrogen to NAD⁺

Answer: B
Topic: Concept 9.4
Skill: Knowledge/Comprehension

52) In liver cells, the inner mitochondrial membranes are about 5 X the area of the outer mitochondrial membranes, and about 17 X that of the cell's plasma membrane. What purpose must this serve?
A) It allows for increased rate of glycolysis.
B) It allows for increased rate of the citric acid cycle.
C) It increases the surface for oxidative phosphorylation.
D) It increases the surface for substrate-level phosphorylation.
E) It allows the liver cell to have fewer mitochondria.

Answer: C
Topic: Concept 9.4
Skill: Application/Analysis

Use the following to answer the following questions.

Exposing inner mitochondrial membranes to ultrasonic vibrations will disrupt the membranes. However, the fragments will reseal "inside out." These little vesicles that result can still transfer electrons from NADH to oxygen and synthesize ATP. If the membranes are agitated still further however, the ability to synthesize ATP is lost.

53) After the first disruption, when electron transfer and ATP synthesize still occur, what must be present?
A) all of the electron transport proteins as well as ATP synthase
B) all of the electron transport system and the ability to add CoA to acetyl groups
C) the ATP synthase system is sufficient
D) the electron transport system is sufficient
E) plasma membranes like those bacteria use for respiration

Answer: A
Topic: Concept 9.4
Skill: Application/Analysis

54) After the second agitation of the membrane vesicles, what must be lost from the membrane?
A) the ability of NADH to transfer electrons to the first acceptor in the electron transport chain
B) the prosthetic groups like heme from the transport system
C) cytochromes
D) ATP synthase, in whole or in part
E) the contact required between inner and outer membrane surfaces

Answer: D
Topic: Concept 9.4
Skill: Application/Analysis

55) It should be possible to reconstitute the abilities of the vesicles if which of the following is added?
A) cytochromes
B) extra NADH
C) a second membrane surface
D) more electrons
E) intact ATP synthase

Answer: E
Topic: Concept 9.4
Skill: Application/Analysis
56) Which of the following most accurately describes what is happening along this chain?
A) Chemiosmosis is coupled with electron transfer.
B) Each electron carrier alternates between being reduced and being oxidized.
C) ATP is generated at each step.
D) Energy of the electrons increases at each step.
E) Molecules in the chain give up some of their potential energy.

Answer: B
Topic: Concept 9.4
Skill: Application/Analysis

57) What happens at the end of the chain?
A) The 2 original electrons combine with NAD$^+$.
B) The 2 original electrons combine with oxygen.
C) 4 electrons combine with oxygen and protons.
D) 4 electrons combine with hydrogen and oxygen atoms.
E) 1 electron combines with oxygen and hydrogen.

Answer: C
58) Which of the following describes ubiquinone?
A) a protein in the electron transport chain
B) a small hydrophobic coenzyme
C) a substrate for synthesis of FADH
D) a vitamin needed for efficient glycolysis
E) an essential amino acid

Answer: B

59) The ATP made during fermentation is generated by which of the following?
A) the electron transport chain
B) substrate-level phosphorylation
C) chemiosmosis
D) oxidative phosphorylation
E) aerobic respiration

Answer: B

60) In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of
A) ATP, CO₂, and ethanol (ethyl alcohol).
B) ATP, CO₂, and lactate.
C) ATP, NADH, and pyruvate.
D) ATP, pyruvate, and oxygen.
E) ATP, pyruvate, and acetyl CoA.

Answer: A

61) In alcohol fermentation, NAD⁺ is regenerated from NADH during which of the following?
A) reduction of acetaldehyde to ethanol (ethyl alcohol)
B) oxidation of pyruvate to acetyl CoA
C) reduction of pyruvate to form lactate
D) oxidation of NAD⁺ in the citric acid cycle
E) phosphorylation of ADP to form ATP

Answer: A

62) When muscle cells are oxygen deprived, the heart still pumps. What must the heart cells be able to do?
A) derive sufficient energy from fermentation
B) continue aerobic metabolism when skeletal muscle cannot
C) transform lactate to pyruvate again
D) remove lactate from the blood
E) remove oxygen from lactate

Answer: B
Topic: Concept 9.5
Skill: Synthesis/Evaluation

63) Phosphofructokinase is an allosteric enzyme that catalyzes the conversion of fructose-6-phosphate to fructose-1,6-bisphosphate, an early step of glycolysis. In the presence of oxygen, an increase in the amount ATP in a cell would be expected to
A) inhibit the enzyme and thus slow the rates of glycolysis and the citric acid cycle.
B) activate the enzyme and thus slow the rates of glycolysis and the citric acid cycle.
C) inhibit the enzyme and thus increase the rates of glycolysis and the citric acid cycle.
D) activate the enzyme and increase the rates of glycolysis and the concentration of citrate.
E) inhibit the enzyme and thus increase the rate of glycolysis and the concentration of citrate.

Answer: A
Topic: Concept 9.6
Skill: Knowledge/Comprehension

64) Where do the catabolic products of fatty acid breakdown enter into the citric acid cycle?
A) pyruvate
B) malate or fumarate
C) acetyl CoA
D) α-ketoglutarate
E) succinyl CoA

Answer: C
Topic: Concept 9.6
Skill: Knowledge/Comprehension

65) What is the reducing agent in the following reaction?
Pyruvate + NADH + H⁺ → Lactate + NAD⁺
A) oxygen
B) NADH
C) NAD⁺
D) lactate
E) pyruvate