Cell Unit Practice Test

Completion
Complete each statement.

1. According to the cell theory, all cells come from existing ____________________.

2. Electrons pass through thin slices of cells or tissues and produce flat, two-dimensional images in ________________ electron microscopy.

3. Depending on whether they have a ____________________, unicellular organisms are classified as either eukaryotes or prokaryotes.

4. The small, dense region indicated in Figure 7–7 by the letter D is called the ________________.

5. Most of the time, the cell’s genetic information is found as threadlike ________________ in the cell’s nucleus.

6. The storage structure indicated in Figure 7–6 by the letter F is a(an) ________________.

7. Unlike smooth endoplasmic reticulum, rough endoplasmic reticulum has ________________ attached to it.
8. In plants, ____________________ capture energy from sunlight and convert it into chemical energy, whereas ____________________ convert chemical energy into compounds that are convenient for the cell to use.

9. The cell takes in food and water and eliminates wastes through its selectively permeable _____________________.

10. Molecules tend to move from an area where they are more concentrated to an area where they are less concentrated. This process is called _____________________.

11. Large molecules, such as glucose, that cannot cross the lipid bilayer can still move across the membrane through a type of passive transport called _____________________.

12. Some materials can move across the cell membrane against a concentration gradient by _____________________.

13. A cell’s relatively constant internal physical and chemical conditions are called _____________________.

14. The cells in a multicellular organism have specific jobs. This is called cell _____________________.

15. The levels of organization in a multicellular organism listed from simplest to most complicated are ____________________, tissues, ____________________, and organ systems.

16. Cells keep only a small amount of ____________________ on hand and regenerate it as needed using energy stored in carbohydrates and other molecules.

17. Organisms, such as hawks and leopards, that obtain energy from the foods they consume are called _____________________.

18. Photosynthesis requires light, water, carbon dioxide, and light absorbing _____________________.

19. If you separate the pigments found in a typical plant cell’s chloroplasts, you will find ____________________, orange, and red pigments.

20. ____________________ are saclike photosynthetic membranes inside chloroplasts.

21. Thylakoids are arranged in stacks known as _____________________.

22. Thylakoids are a ____________________ color because they contain chlorophyll.
23. The area in Figure 8–7 labeled A is called the ____________________.

24. Photosystems I and II are found in the structure labeled ____________________ in Figure 8–7.

25. The electron carrier ______________________ is converted to NADPH during the light-dependent reactions.

26. Photosynthesis uses the energy of sunlight to convert water and carbon dioxide into oxygen and ____________________.

27. A membrane protein called _____________________ allows H+ ions to pass through the thylakoid membrane and into the stroma.

28. The electrons that chlorophyll loses to the electron transport chain are replenished by ____________________ molecules.

29. During the Calvin cycle, molecules of ____________________ supply the carbon component of carbohydrates.

30. In many plants, the rate of photosynthesis ____________________ when the weather becomes very cold.
31. Figure 9–5 shows that the original source of energy for all organisms in an ocean food chain is ________________.

32. The three main stages of cellular respiration are ________________, the Krebs cycle, and ________________.

33. Cellular respiration in nearly all organisms depends on autotrophs performing the process of ________________.

34. Photosynthesis occurs only in plants, algae, and some bacteria. In contrast, ________________ occurs in all eukaryotic cells.

35. Glycolysis rearranges a 6-carbon glucose molecule into two 3-carbon molecules of ________________.

36. Two pyruvic acid molecules going through the Krebs cycle will result in ________________ ATP molecule(s), as well as the energy carriers FADH₂ and NADH.

37. When ________________ pass through ATP synthase, ATP molecules are produced from ADP molecules.

38. The ________________ is a series of carrier proteins that use high-energy electrons to create a buildup of H⁺ ions on one side of the inner mitochondrial membrane.

39. Glycolysis alone nets only ________________ molecules of ATP from each glucose molecule.
40. The pathway labeled B in Figure 9–4 is called ____________________ fermentation.

41. Based on Figure 9–4, ____________________ ATP molecules per glucose molecule are generated through fermentation.

42. In Figure 9–4, only the pathway labeled ____________________ requires oxygen.

43. The body gets rid of lactic acid in a chemical pathway that requires ____________________.

44. A high level of lactic acid in the body is a sign that ____________________ fermentation has occurred.

45. A person who regularly does aerobic exercise probably takes in ____________________ oxygen than a sedentary person.

46. The larger a cell becomes, the ____________________ efficiently it is able to function.

47. During ____________________ reproduction, cells can produce genetically different offspring, whereas during ____________________ reproduction, cells produce genetically identical offspring.

48. The number of sister chromatids in a human body cell that is entering cell division is ____________________.

49. Cell division occurs in two main stages, the first of which is called ____________________.

50. Together, the G1 phase, S phase, and G2 phase are called ____________________.

51. A cell that has 5 chromosomes in the G1 phase will have ________________ chromatids in the G2 phase.
52. The phase of mitosis shown in step C in the Figure 10–7 above is called ________________.

53. Look at Figure 10–8. Once structure A has completely formed, another phase of the cell cycle will start. This phase will be called ________________.

54. The structure labeled A in Figure 10–8 is called the ________________.

55. The process shown in Figure 10–8 occurs only in ________________ cells that are going through cytokinesis.
56. During normal development, the cells between toes and fingers die by ________________, a process of programmed cell death.

57. In all forms of ________________, the diseased cells fail to respond to the signals that regulate growth and the cell cycle.

58. Adult skin cells can no longer become other types of cells because they have already undergone ________________.

59. Embryonic stem cells gathered from the inner cell mass of the blastocyst are called ________________ because they can develop into most, but not all human cell types.

60. Harvesting ________________ stem cells from a willing donor is not as controversial as harvesting techniques that involve the destruction of an embryo.

Short Answer

61. What does the cell theory say?

62. What kinds of microscopes could you use to look at the structure of DNA? Could you study the structure of DNA in a living specimen? Why or why not?

![A Bacterium](image)

Figure 7–8

63. Is the cell in Figure 7–8 above a prokaryote or a eukaryote? What features help you determine your answer?

64. How do prokaryotes and eukaryotes differ?

65. What are two functions of the nucleus?
66. List two functions of the cytoskeleton.

67. Identify each of the cell structures indicated in Figure 7–7. Use these terms: nucleus, mitochondrion, ribosome, cell membrane, smooth endoplasmic reticulum, rough endoplasmic reticulum, nucleolus, Golgi apparatus, cytoplasm.

68. Which structures in the cells shown in Figure 7–9 above are responsible for meeting the cells’ energy needs? Based on the presence or absence of these structures, identify which cell is a plant cell.

69. What advantages do cell walls provide plant cells that contact fresh water?

70. What would happen if a cell’s membrane became impermeable?

71. Define diffusion.

72. Explain, in terms of osmosis, why a raisin placed in a cup of pure water overnight will puff up with water.

73. What would happen to an animal cell with an internal salt concentration of 0.8% if it were placed in a salt solution with a concentration of 0.2%? Why?

74. How are endocytosis and exocytosis similar? How are they different?

75. List the four levels of organization in a multicellular organism in order from simplest to most complex.

76. What happens when a phosphate group is removed from an ATP molecule?
77. What is ATP, and when is energy released from it?

78. What is the difference between an autotroph and a heterotroph? Give an example of each type of organism.

79. Explain how the ultimate source of energy for heterotrophs is the sun even though they cannot make their own food.

80. Examine the food web in Figure 8–9 and identify whether each organism is an autotroph or a heterotroph.

81. A student exposed two plants to only red light and two plants to only green light. Which plants should grow better? Why?

82. Explain the role of electron carriers in photosynthesis and give one example.

83. Write the overall equation for photosynthesis in both symbols and words.

84. Why are six carbon dioxide molecules required to make one glucose molecule?

85. In what ways are photosystems I and II similar?

86. Why is it important that a membrane separate the cellular regions on either side of an ATP synthase molecule in order for the protein to perform its function?

87. What is the role of hydrogen ions in the conversion of ADP to ATP?

88. What does the Calvin cycle do?

89. Describe the relationship between the light-dependent and the light-independent reactions.

90. What are three factors that affect the rate of photosynthesis?
91. What is the relationship between a calorie and a Calorie? If a person eats 2000 calories, how many Calories has he eaten?

92. What is cellular respiration?

93. List the three main stages of cellular respiration in order. Where does each stage take place in the cell?

94. Figure 9–6 shows how energy flows among the sun, plants, animals, and fossil fuels. Which arrow represents cellular respiration? Explain your reasoning.

95. What roles does oxygen play in photosynthesis and in cellular respiration?

96. What happens to a molecule of glucose that undergoes glycolysis?

97. Describe glycolysis in terms of energy input, energy output, and net gain of ATP.

98. Why is the Krebs cycle also known as the citric acid cycle?

99. The electron transport chain uses the energy stored in high-energy electrons to pump H⁺ ions across the inner mitochondrial membrane. Why?

100. What role does oxygen play in the electron transport chain?

101. Give two examples of fermentation in real life.
102. What are the two types of fermentation? How do their products differ?

Figure 9–4

103. Given the inefficiency of two of the pathways shown in Figure 9–4, what advantage could there be to using these pathways to produce energy?

104. Based on Figure 9–4, which pathway is most efficient at producing energy for a cell? Explain your answer.

105. What three sources of ATP does your body use during a long aerobic exercise session?

106. List two problems that growth causes for cells.

107. What effect does cell size have on a cell’s ability to efficiently carry out its activities?

108. Which type of reproduction, sexual or asexual, is best suited for organisms that live in a place where environmental conditions are stable? Explain.

109. How does packaging genetic information into chromosomes help the process of cell division?

110. Explain the difference between chromatids and chromatin.
111. The main events of the cell cycle are labeled A, B, C, and D in Figure 10–3. Name these events. Then, briefly state what happens during each event.

112. Identify each phase of mitosis shown in Figure 10–9 above and the order in which they occur.

113. How are metaphase and anaphase different?

114. Explain the difference between cytokinesis in plant cells and animal cells.

115. The level of cyclins in a cell increases during the M phase of the cell cycle. What might happen to a cell if no cyclins were present during the M phase?

116. How do cancer cells differ from normal cells?

117. Normal cells grown in a petri dish tend to divide until they form a thin layer covering the bottom of the dish. How would you expect cancer cells to behave in this situation?

118. What is differentiation?

119. How are embryonic stem cells different from adult stem cells?
120. Why is harvesting adult stem cells less controversial than harvesting embryonic stem cells?

Other

A student put together the experimental setup shown below. The selectively permeable membrane is permeable to water, but not the solute shown.

![Selectively permeable membrane](Figure 7–10)

121. **Interpret Visuals** Describe the experimental setup shown in Figure 7–10.

122. **Compare and Contrast** How does the solution on Side A of the apparatus shown in Figure 7–10 differ from the solution on Side B?

123. **Predict** Look at Figure 7–10. Describe the movement of water in the experimental setup. What will happen to the concentration of water over time?

124. **Predict** What will the apparatus shown in Figure 7–10 look like when equilibrium is reached?

125. **Predict** Once equilibrium is reached in the apparatus shown in Figure 7–10, will the water molecules continue to move? Explain your answer.

![Figure 7–11]
126. **Interpret Visuals** Which drawing in Figure 7–11, I or II, contains structures that carry out photosynthesis? What is this structure labeled in the diagram?

127. **Compare and Contrast** Look at Figure 7–11. Which structure in drawing I corresponds to structure L in drawing II? What is the name of this structure?

128. **Compare and Contrast** Which three structures are found in drawing II of Figure 7–11 but not in drawing I? What are the names of these structures?

129. **Interpret Visuals** Which organelle is labeled K in Figure 7–11? What is the function of this organelle?

130. **Interpret Visuals** Do the drawings in Figure 7–11 represent prokaryotes or eukaryotes? How do you know?

The experimental setup below shows an osmometer. An osmometer is a device used to measure the amount of osmotic pressure exerted by a liquid passing through a semipermeable membrane. The graph shows one lab group’s results compared with the results of the rest of the class combined. Line A represents the results of the single lab group. Line B represents the data of the rest of the class.

**Figure 7–12**

131. **Compare and Contrast** Look at the graph in Figure 7–12. Compare the lab results of the single lab group with those collected by the rest of the class.

132. **Analyze Data** Which results in the graph in Figure 7–12 are more likely to be accurate, those represented by line A or by line B? Why?

133. **Evaluate and Revise** What could account for the difference in lines A and B in the graph in Figure 7–12?

134. **Predict** Look at the graph in Figure 7–12. How would the results differ if a sucrose solution with twice the concentration of the one used to collect the results represented by line A were used?
135. **Calculate** How might you use the graph in Figure 7–12 to calculate the rate of osmosis observed? What units would you use to report the rate?

A student prepared two beakers with identical sprigs of a water plant as shown below. She placed one beaker in the shade and the other beaker beside a fluorescent lamp. She then systematically changed the distance from the beaker to the lamp. She counted the bubbles given off by the plants in each beaker. Shown here is the graph of the data for the beaker she placed beside the lamp.

![Graph of data for beaker placed beside lamp](image)

136. **Control Variables** In the experiment described in Figure 8–10, which beaker is the student’s control?

137. **Apply Concepts** Look at Figure 8–10. If the student later tested the bubbles collected in the test tube, what would she find they are made of? How do you know?

138. **Interpret Graphs** Look at the graph in Figure 8–10. At what distance from the light source was the greatest number of bubbles produced?

139. **Analyze Data** Look at the graph in Figure 8–10. What do the student’s data show?

140. **Predict** In the experiment described in Figure 8–10, if the lamp were placed closer than 5 centimeters from the water plant, would the plant give off many more bubbles? Why or why not?

A student put together two different experimental setups as shown below.
141. **Design an Experiment** Look at Figure 8–11. What factor is the student varying? What might the student be trying to test?

142. **Control Variables** Suggest an appropriate control for the experiment shown in Figure 8–11.

143. **Predict** In Figure 8–11, assume that the student placed Plant A in indirect sunlight for two days. How would the rate of photosynthesis of this plant compare with that of a plant grown under normal conditions?

144. **Predict** In Figure 8–11, assume that the student placed Plant B in indirect sunlight for two days. How would the rate of photosynthesis of this plant compare with that of a plant grown under normal conditions?

145. **Predict** Review the setups in Figure 8–11. Make a prediction about the effect of carbon dioxide on starch production in plants.
146. **Interpret Visuals** What process is shown in Figure 8–12?

147. **Interpret Visuals** What organelle is shown in Figure 8–12?

148. **Interpret Visuals** Look at Figure 8–12. What are the products of the light-dependent reactions?

149. **Interpret Visuals** What are the products of the Calvin cycle shown in Figure 8–12?

150. **Interpret Visuals** In Figure 8–12, what provides the carbon needed to make sugars?

A scientist set up a respiration chamber as shown below. She placed a mouse in flask B. Into flasks A, C, and D, she poured distilled water mixed with the acid-base indicator phenolphthalein. In the presence of CO$_2$, phenolphthalein turns from pink to clear. She allowed the mouse to stay in the chamber for about an hour.

151. **Infer** Write the equation for cellular respiration. Based on this equation and the setup shown in Figure 9–7, what substance(s) would you expect the mouse in flask B to give off?

152. **Interpret Visuals** What will the mouse require to carry out cellular respiration? Look at the flasks in Figure 9–7. Describe the flow of materials through the flasks. Will the mouse receive fresh air so that it can survive?
153. **Interpret Visuals** Based on Figure 9–7, how will the scientist be able to detect whether the mouse is carrying out cellular respiration?

154. **Apply Concepts** Assume that the scientist set up an identical respiration chamber, except that in this setup she placed a cricket in flask B instead of a mouse. At the end of one hour, she measured the amount of CO₂ given off by the cricket and the mouse. A small amount of CO₂ had been given off by the mouse, but little to no CO₂ had been given off by the cricket. Was the cricket carrying out cellular respiration? Explain these results.

155. **Predict** Assume that the scientist set up an identical respiration chamber, except that in this setup she placed a mouse that had been exercising on a hamster wheel. Then, the scientist measured the amount of CO₂ given off by both mice at the end of 15 minutes. Predict which setup produced the most CO₂. Explain your answer.

![Figure 9–8](image)

**Figure 9–8**

156. **Interpret Visuals** What process does Figure 9–8 show?

157. **Interpret Visuals** Look at Figure 9–8. Where do the electrons moving along the inner membrane come from?

158. **Interpret Visuals** Where do the electrons moving along the inner membrane in Figure 9–8 end up?

159. **Infer** Look at the arrows and H⁺ ions in Figure 9–8. Which direction do most of the H⁺ ions move in? What is the result of this movement?

160. **Interpret Visuals** ATP synthase is an enzyme. Find ATP synthase in Figure 9–8. What reaction does ATP synthase catalyze when an H⁺ ion passes through its channel?

A student poured a solution of bromthymol blue indicator into three test tubes. Then, he placed an aquatic plant in two of the test tubes, as shown below. He placed a stopper on each test tube and placed them all in the dark for 24 hours. Bromthymol blue turns from blue to yellow in the presence of CO₂.
161. **Apply Concepts** Look at Figure 9–9. Which process or processes would you expect the organisms in the test tubes to carry out—cellular respiration, photosynthesis, or both? When would you expect each process to occur?

162. **Infer** What is the purpose of the bromthymol blue in Figure 9–9? How can the student use this indicator to draw conclusions about the processes that the aquatic plants are carrying out? Explain your answer.

163. **Predict** Predict what will happen to the test tubes in Figure 9–9 after 24 hours in the dark.

164. **Predict** Assume that after 24 hours in the dark, the bromthymol blue in test tubes 2 and 3 in Figure 9–9 had turned yellow. The student then placed test tube 3 in a sunny window. He left test tube 2 in the dark. Predict what color the solution in each test tube will be after the next 24 hours.

165. **Apply Concepts** Explain your prediction in question 14 in terms of cellular respiration and/or photosynthesis.
166. **Interpret Visuals** What does Figure 10–10 represent? How do you know if this is an animal cell or a plant cell?

167. **Infer** What is the chromosome number of the cell shown in Figure 10–10?

168. **Infer** Identify the structures labeled X and Y in Figure 10–10.

169. **Apply Concepts** List the correct order for the diagrams in Figure 10–10.

170. **Predict** After the steps shown in Figure 10–10 are arranged in the correct order, what would a diagram of the next step show?

A student placed three cubes of agar that contained the indicator phenolphthalein in a beaker of vinegar. The sides of the cubes were the following lengths: 3 cm, 2 cm, and 1 cm. In the presence of an acid, such as vinegar, phenolphthalein turns from pink to clear. After 10 minutes, the student cut each cube open and measured the distance that the vinegar had diffused into each cube. She then started to complete the data table.

![Image of vinegar and agar cubes](image)

### Comparison of Agar Cubes

<table>
<thead>
<tr>
<th>Cube Size (length in cm)</th>
<th>Surface Area (cm²)</th>
<th>Volume (cm³)</th>
<th>Ratio of Surface Area to Volume</th>
<th>Depth of Diffusion (mm)</th>
<th>Time (minutes)</th>
<th>Rate of Diffusion (mm/minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>54</td>
<td>27</td>
<td></td>
<td></td>
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<td>1</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 10–11**
171. **Design an Experiment** What is the student probably trying to test? What do the cubes in Figure 10–11 probably represent?

172. **Calculate** Look at the data table in Figure 10–11. What are the surface area, volume, and ratio of surface area to volume for the cube that is 2 cm in length?

173. **Compare and Contrast** Compare the cubes in Figure 10–11 with respect to their sizes and their ratios of surface area to volume.

174. **Infer** Look at the experimental setup in Figure 10–11. How will the student know how far the vinegar has diffused into each cube?

175. **Predict** Examine Figure 10–11. In which cube will the vinegar take the longest time to diffuse into the center? In which tube will the vinegar take the shortest time to diffuse into the center?

176. **Interpret Visuals** Look at Figure 10–12. Which diagram shows cancer cells? How do you know?

177. **Compare and Contrast** Explain how cancer cells are different from normal cells. Then, relate these characteristics to the diagram in Figure 10–12 that shows cancer cells.

178. **Predict** Look at the cancer cells shown in Figure 10–12. What can happen if these cells are left untreated?

179. **Apply Concepts** Explain the role that p53 might have had in the growth and division of the cells shown in each diagram in Figure 10–12.

180. **Problem Solving** How might the cancer cells shown in Figure 10–12 be prevented from doing more harm to the organism they are a part of?

**Essay**

181. Summarize three statements from the cell theory. Explain the significance of the cell theory to biology.

182. Describe the cell membrane, cell wall, nucleus, and cytoplasm. Which of these structures are you likely to find in a prokaryotic cell? Eukaryotic cell? Plant cell? Animal cell?
183. Distinguish between microtubules and microfilaments. Describe two functions of each kind of structure.

184. Compare and contrast the structure and function of the cell wall with that of the cell membrane.

185. Why is the cell membrane sometimes compared to mosaic art?

![Figure 7-13](image)

186. The diagrams in Figure 7-13 above show a normal blood cell before and after it is placed in a solution. Describe what could cause the cell to react the way that it did.

187. Imagine a container separated into two compartments by a membrane that is permeable to sugar. Describe what happens when sugar solutions with two different concentrations are placed on opposite sides of the membrane.

188. How do facilitated diffusion and active transport differ? Is osmosis an example of facilitated diffusion or active transport?

189. Compare a cell from a unicellular organism with a cell from a multicellular organism in terms of cell specialization.

190. Discuss the levels of organization in multicellular organisms and explain why these levels are not used to describe unicellular organisms.

191. Compare the storage capacity of ATP and glucose. How does the cell use each of these molecules to store energy?

192. Discuss the relationship between autotrophs and heterotrophs. Do heterotrophs depend on autotrophs for their survival? Explain your answer.

193. Describe how pigments obtain energy from light. Use chlorophyll as an example of the process you describe.

194. Describe the kinds of light that chlorophyll and carotene pigments absorb. What is the advantage for a plant to have more than one kind of pigment?

195. Trace the events that occur in the thylakoid membrane during the light-dependent reactions.
196. What happens to the electrons in a chlorophyll molecule when light shines on it? Does the chlorophyll molecule ever run out of electrons? Explain your answer.

197. Some people informally call the light-dependent reactions the “light reactions” and the light-independent reactions the “dark reactions.” Why is this naming system misleading?

198. Describe the activities that take place in the stroma in (a) bright sunlight and in (b) darkness.

199. Identify three factors that affect the rate of photosynthesis and explain the effect of each.

200. Describe how photosynthesis in CAM plants differs from photosynthesis in more typical plants. Why is it unlikely that you would find a CAM plant in an aquatic environment?

201. What would happen if all the energy in glucose were released in just one step instead of gradually as it is in cellular respiration? How is the gradual process of cellular respiration advantageous to the cell?

202. Compare photosynthesis with cellular respiration.

203. List the main events of glycolysis. How many ATP molecules are produced and consumed by glycolysis? What effect does the presence of oxygen have on the events that follow glycolysis?

204. Describe the main steps and the results of the Krebs cycle.

205. Identify the electron carriers of cellular respiration. Discuss the relationship between the electron carriers and the electron transport chain.

206. Explain how high-energy electrons are used by the electron transport chain to produce ATP.

207. Compare lactic acid fermentation with alcoholic fermentation. Where does each process occur? What are the products of each process?

208. People who suffer from a heart attack often have an increased ratio of lactic acid to pyruvic acid in their hearts. What does this observation say about the availability of oxygen in the heart muscle cells of someone who has had a heart attack? How could you use this information to screen people who might be at risk for a heart attack?

209. Which pathways does the body use to release energy during exercise? Discuss these pathways in terms of a footrace.

210. Why does lactic acid fermentation “kick in” during a sprint race?

211. Relate ratio of surface area to volume to cell growth and cell division.

212. What kinds of problems does growth cause for cells? How does cell division help a cell solve these problems?

213. List and describe the main events of the cell cycle. Illustrate your description with a diagram of the cell cycle.

214. Describe what happens during the four stages of mitosis.
215. Assume that prophase begins with eight chromatids in the nucleus of a cell. When telophase ends, how many chromosomes will be present in each new nucleus? Explain your answer.

216. Discuss the relationship between mitosis and cytokinesis. What would be the result if one happened without the other?

217. Describe how the skin cells near a cut behave. What role does contact with other cells have in the behavior of cells near a cut?

218. Describe how the cell cycle is regulated.

219. Describe how cancer cells are different from other cells. Based on these differences, explain why cancer has been such a difficult condition to cure.

220. Why are some people opposed to stem cell research, and why do others believe it is unethical to not pursue such research? What do you think scientists should do concerning these issues?
Cell Unit Practice Test
Answer Section

COMPLETION

1. ANS: cells
   PTS: 1 DIF: L2 REF: p. 191 OBJ: 7.1.1 State the cell theory.
   STA: UT.BIO.2.3.b TOP: Foundation Edition
   BLM: comprehension
2. ANS: transmission
   PTS: 1 DIF: L2 REF: p. 192
   OBJ: 7.1.2 Describe how the different types of microscopes work.
   TOP: Foundation Edition BLM: comprehension
3. ANS: nucleus
   PTS: 1 DIF: L3 REF: p. 194
   OBJ: 7.1.3 Distinguish between prokaryotes and eukaryotes.
   STA: UT.BIO.2.3.d BLM: synthesis
4. ANS: nucleolus
   PTS: 1 DIF: L1 REF: p. 196
   OBJ: 7.2.1 Describe the structure and function of the cell nucleus.
   STA: UT.BIO.2.3.d TOP: Foundation Edition
   BLM: knowledge
5. ANS: chromosomes
   PTS: 1 DIF: L2 REF: p. 197
   OBJ: 7.2.1 Describe the structure and function of the cell nucleus.
   STA: UT.BIO.2.3.d BLM: comprehension
6. ANS: vacuole or central vacuole
   PTS: 1 DIF: L3 REF: p. 198
   OBJ: 7.2.2 Describe the role of vacuoles, lysosomes, and the cytoskeleton.
   STA: UT.BIO.2.3.d BLM: synthesis
7. ANS: ribosomes
   PTS: 1 DIF: L2 REF: p. 200
   OBJ: 7.2.3 Identify the role of ribosomes, endoplasmic reticulum, and Golgi apparatus in making proteins.
   STA: UT.BIO.2.3.d TOP: Foundation Edition
   BLM: analysis
8. ANS: chloroplasts, mitochondria
   PTS: 1 DIF: L3 REF: p. 202
   OBJ: 7.2.4 Describe the function of the chloroplasts and mitochondria in the cell.
   STA: UT.BIO.2.3.d BLM: synthesis
9. ANS: cell membrane
10. **ANS:** diffusion

11. **ANS:** facilitated diffusion

12. **ANS:** active transport

13. **ANS:** homeostasis

14. **ANS:** specialization

15. **ANS:** cells, organs

16. **ANS:** ATP

17. **ANS:**
   - heterotrophs
   - consumers

18. **ANS:** pigments
chlorophyll

19. **ANS:** green

20. **ANS:** Thylakoids

21. **ANS:** grana

22. **ANS:** green

23. **ANS:** stroma

24. **ANS:** B

25. **ANS:** NADP⁺
27. ANS: ATP synthase

28. ANS: water

29. ANS: carbon dioxide

30. ANS: decreases

31. ANS: the sun

32. ANS: glycolysis, electron transport

33. ANS: photosynthesis

34. ANS: cellular respiration

35. ANS: pyruvic acid
OBJ: 9.2.1 Describe what happens during glycolysis. 
STA: UT.BIO.2.2.b
TOP: Foundation Edition
BLM: knowledge
36. ANS: 2

PTS: 1   DIF: L3   REF: p. 256 | p. 257

OBJ: 9.2.2 Describe what happens during the Krebs cycle. 
STA: UT.BIO.2.2.b
BLM: synthesis
37. ANS: H⁺ ions

PTS: 1   DIF: L3   REF: p. 258

OBJ: 9.2.3 Explain how high-energy electrons are used by the electron transport chain.
STA: UT.BIO.2.2.b
BLM: synthesis
38. ANS: electron transport chain

PTS: 1   DIF: L2   REF: p. 258

OBJ: 9.2.4 Identify how much ATP cellular respiration generates.
STA: UT.BIO.2.2.b | UT.BIO.2.2.c
BLM: comprehension
40. ANS: alcoholic

PTS: 1   DIF: L2   REF: p. 254

OBJ: 9.3.1 Explain how organisms get energy in the absence of oxygen.
STA: UT.BIO.2.2.b
BLM: analysis
41. ANS: 2

PTS: 1   DIF: L1   REF: p. 254 | p. 263

OBJ: 9.3.2 Identify the pathways the body uses to release energy during exercise.
STA: UT.BIO.2.2.b
BLM: knowledge
43. ANS: oxygen

PTS: 1   DIF: L1   REF: p. 265

OBJ: 9.3.2 Identify the pathways the body uses to release energy during exercise.
STA: UT.BIO.2.2.b
BLM: knowledge
44. ANS: lactic acid
45. ANS: more

PTS: 1    DIF: L3    REF: p. 252
OBJ: 9.3.2 Identify the pathways the body uses to release energy during exercise.
STA: UT.BIO.2.2.b
BLM: synthesis

46. ANS: less

PTS: 1    DIF: L1    REF: p. 274
OBJ: 10.1.1 Explain the problems that growth causes for cells.
STA: UT.BIO.2.3.a
BLM: knowledge

47. ANS: sexual, asexual

PTS: 1    DIF: L2    REF: p. 277
OBJ: 10.1.2 Compare asexual and sexual reproduction.
STA: UT.BIO.4.1.b
TOP: Foundation Edition
BLM: comprehension

48. ANS: 92

PTS: 1    DIF: L3    REF: p. 280 | p. 282
OBJ: 10.2.1 Describe the role of chromosomes in cell division.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: synthesis

49. ANS: mitosis

PTS: 1    DIF: L1    REF: p. 282
OBJ: 10.2.2 Name the main events of the cell cycle.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: knowledge

50. ANS: interphase

PTS: 1    DIF: L2    REF: p. 281
OBJ: 10.2.2 Name the main events of the cell cycle.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: comprehension

51. ANS: 10

PTS: 1    DIF: L3    REF: p. 281 | p. 282
OBJ: 10.2.2 Name the main events of the cell cycle.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: synthesis

52. ANS: metaphase

PTS: 1    DIF: L2    REF: p. 282
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: comprehension

53. ANS: G₁ phase, Interphase

PTS: 1    DIF: L3    REF: p. 284
OBJ: 10.2.2 Name the main events of the cell cycle.
STA: UT.BIO.2.3.a
TOP: Foundation Edition
BLM: synthesis

54. ANS: cell plate
Describe the process of cytokinesis.

55. ANS: plant

Describe the process of cytokinesis.

56. ANS: apoptosis

Describe how the cell cycle is regulated.

57. ANS: cancer

Describe the process of differentiation.

58. ANS: pluripotent

Define stem cells and explain their importance.

59. ANS: adult

Identify the possible benefits and issues relating to stem cell research.

60. ANS:

The cell theory says that all living things are composed of cells. It also says that cells are the basic units of structure and function in living things and that new cells come from existing cells.

61. ANS:

DNA is too small to see with a light microscope, so an electron microscope is needed to examine its structure. Electron microscopes cannot be used to look at living specimens, so the structure of DNA cannot be studied in a living specimen.
63. **ANS:**
This cell is a prokaryote. It has a cell wall, indicated by the letter B, and its DNA, indicated by the letter C, is not enclosed in a nucleus.

64. **ANS:**
Prokaryotes are generally simpler and smaller than eukaryotes, whereas eukaryotes enclose their DNA in a nucleus and have other specialized organelles.

65. **ANS:**
The nucleus is the control center of the cell and contains nearly all the cell’s DNA.

66. **ANS:**
The cytoskeleton helps the cell maintain its shape and internal organization. It is also involved in many forms of cell movement.

67. **ANS:**
(A) rough endoplasmic reticulum; (B) cytoplasm; (C) smooth endoplasmic reticulum; (D) nucleolus; (E) nucleus; (F) mitochondrion; (G) Golgi apparatus; (H) ribosome; (I) cell membrane

68. **ANS:**
The structure identified with the letter E is a chloroplast, which captures energy from sunlight and converts it into chemical energy. The structures identified with the letter D are mitochondria, which convert chemical energy into compounds more convenient for the cell to use. The cell with the chloroplasts is a plant cell.
69. **ANS:**
Cell walls protect the plant cells from expanding even under tremendous osmotic pressure.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 211  
**OBJ:** 7.2.5 Describe the function of the cell membrane.  
**STA:** UT.BIO.2.3.d  
**BLM:** synthesis

70. **ANS:**
The cell would die because needed nutrients, such as food and water, could not get inside the cell and wastes would accumulate inside the cell.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 204 | p. 205  
**OBJ:** 7.2.5 Describe the function of the cell membrane.  
**STA:** UT.BIO.2.3.d  
**BLM:** evaluation

71. **ANS:**
Diffusion is the movement of molecules from an area of higher concentration to an area of lower concentration.

**PTS:** 1  
**DIF:** L1  
**REF:** p. 208  
**OBJ:** 7.3.1 Describe passive transport.  
**STA:** UT.BIO.2.3.c  
**TOP:** Foundation Edition  
**BLM:** knowledge

72. **ANS:**
Because the concentration of water in the cup is greater than the concentration of water in the raisin, water will flow from the cup into the raisin.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 208 | p. 210  
**OBJ:** 7.3.1 Describe passive transport.  
**STA:** UT.BIO.2.3.c  
**BLM:** application

73. **ANS:**
The cell would swell and burst, because the 0.2% salt solution is hypotonic with respect to the cell, causing a net movement of water into the cell.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 210 | p. 211  
**OBJ:** 7.3.1 Describe passive transport.  
**STA:** UT.BIO.2.3.c  
**BLM:** synthesis

74. **ANS:**
Both are forms of active transport of large molecules carried out by movements of the cell membrane. Endocytosis involves taking material into the cell, whereas exocytosis involves moving material out of the cell.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 213  
**OBJ:** 7.3.2 Describe active transport.  
**STA:** UT.BIO.2.3.c  
**TOP:** Foundation Edition  
**BLM:** analysis

75. **ANS:**
cell, tissue, organ, organ system

**PTS:** 1  
**DIF:** L1  
**REF:** p. 216  
**OBJ:** 7.4.2 Explain how multicellular organism maintain homeostasis.  
**STA:** UT.BIO.2.3.c  
**TOP:** Foundation Edition  
**BLM:** knowledge

76. **ANS:**
When a phosphate group is removed from ATP, energy that was stored in the bond between phosphate groups is released and ADP is formed.

77. **ANS:**
ATP is the chief energy-storing molecule used by organisms. Energy is released when the bonds between phosphate groups are broken, converting ATP into ADP.

78. **ANS:**
Autotrophs are organisms that can make their own food; one example is grass. Heterotrophs are organisms that get energy by consuming other organisms or organic matter; an example is a rabbit.

79. **ANS:**
Heterotrophs get energy by eating autotrophs and/or other heterotrophs. They obtain the sun’s energy that is stored in the autotrophs they eat or by feeding on animals that eat autotrophs.

80. **ANS:**
Pond plants and phytoplankton are autotrophs. Ducks, turtles, snails, insects, and fish are heterotrophs.

81. **ANS:**
The plants exposed to red light should grow better because chlorophyll absorbs red light well but does not absorb green light well.

82. **ANS:**
Electron carriers accept pairs of high-energy electrons and transfer them, along with their energy, to other molecules. NADP+ is one example of an electron carrier.
83. **ANS:**

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2; \text{carbon dioxide + water} \xrightarrow{\text{light}} \text{sugar + oxygen} \]

**PTS:** 1  
**DIF:** L2  
**REF:** p. 232  
**OBJ:** 8.2.3 State the overall equation for photosynthesis.  
**STA:** UT.BIO.2.1.b | UT.BIO.2.2.b | UT.BIO.2.2.c  
**TOP:** Foundation Edition  
**BLM:** application

84. **ANS:**

Each carbon dioxide molecule contains one carbon atom, and a glucose molecule contains six carbon atoms.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 232  
**OBJ:** 8.2.3 State the overall equation for photosynthesis.  
**STA:** UT.BIO.2.1.b | UT.BIO.2.2.b | UT.BIO.2.2.c  
**BLM:** synthesis

85. **ANS:**

Sample answer: Both are found in the electron transport chain within the thylakoid membranes. They both absorb light and use the light’s energy to excite electrons.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 235 | p. 236  
**OBJ:** 8.3.1 Describe what happens during the light-dependent reactions.  
**STA:** UT.BIO.2.2.b | UT.BIO.2.3.d  
**BLM:** synthesis

86. **ANS:**

The two cellular regions must have a difference in concentration of hydrogen ions in order for ions to flow through the protein and cause it to turn ADP into ATP. Without the membrane separating these regions, there could not be a concentration gradient.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 236 | p. 237  
**OBJ:** 8.3.1 Describe what happens during the light-dependent reactions.  
**STA:** UT.BIO.2.2.b | UT.BIO.2.3.d  
**BLM:** analysis

87. **ANS:**

Hydrogen ions pass through ATP synthase, causing it to spin. As ATP synthase rotates, ADP is converted to ATP.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 236 | p. 237  
**OBJ:** 8.3.1 Describe what happens during the light-dependent reactions.  
**STA:** UT.BIO.2.2.b | UT.BIO.2.3.d  
**TOP:** Foundation Edition  
**BLM:** analysis

88. **ANS:**

The Calvin cycle uses ATP and NADPH from the light-dependent reactions to convert carbon dioxide molecules into high-energy sugars.

**PTS:** 1  
**DIF:** L1  
**REF:** p. 238 | p. 239  
**OBJ:** 8.3.2 Describe what happens during the light-independent reactions.  
**STA:** UT.BIO.2.2.b | UT.BIO.2.3.d  
**TOP:** Foundation Edition  
**BLM:** comprehension

89. **ANS:**

The light-dependent reactions use energy from the sun to produce ATP and NADPH, and the light-independent reactions (Calvin cycle) use ATP and NADPH from the light-dependent reactions to produce high-energy sugars.
 OBJ: 8.3.2 Describe what happens during the light-independent reactions.
STA: UT.BIO.2.2.b | UT.BIO.2.3.d TOP: Foundation Edition
BLM: synthesis
90. ANS:
water, light intensity, temperature

OBJ: 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.
STA: UT.BIO.2.2.b TOP: Foundation Edition
BLM: knowledge
91. ANS:
There are 1000 calories in 1 Calorie. Eating 2000 calories is the same as eating 2 Calories.

OBJ: 9.1.1 Explain where organisms get the energy they need for life processes.
STA: UT.BIO.2.2.b BLM: synthesis
92. ANS:
Cellular respiration is the process that releases energy by breaking down food molecules in the presence of oxygen.

OBJ: 9.1.2 Define cellular respiration.
STA: UT.BIO.2.2.b | UT.BIO.2.2.c TOP: Foundation Edition
BLM: knowledge
93. ANS:
The three stages are as follows: glycolysis (which occurs in the cytoplasm), the Krebs cycle (which occurs in the matrix of the mitochondria), and electron transport (which occurs in the inner mitochondrial membrane).

OBJ: 9.1.3 Compare photosynthesis and cellular respiration.
STA: UT.BIO.2.2.b BLM: analysis
94. ANS:
Arrow B represents cellular respiration, because it shows the flow of energy from plants to animals. Plants produce food (sugars), which animals use to fuel cellular respiration.

OBJ: 9.1.3 Compare photosynthesis and cellular respiration.
STA: UT.BIO.2.2.b BLM: knowledge
95. ANS:
Photosynthesis releases oxygen into the atmosphere as a product, whereas cellular respiration uses oxygen as a reactant to release energy from food.

OBJ: 9.2.1 Describe what happens during glycolysis.
STA: UT.BIO.2.2.b TOP: Foundation Edition
BLM: knowledge
96. ANS:
During glycolysis, the bonds of glucose are broken and rearranged to produce 2 molecules of pyruvic acid.
Glycolysis requires an initial input of 2 ATP molecules and produces an output of 4 ATP molecules, for a net gain of 2 ATP molecules.

Citric acid is the first compound formed in the process.

The movement of H\(^+\) ions back across the inner mitochondrial membrane through ATP synthase converts ADP into ATP.

Oxygen is the final electron acceptor in the electron transport chain, which means that it is needed to get rid of low-energy electrons and H\(^+\) ions.

Sample answer: Lactic acid fermentation occurs in the muscles, and alcoholic fermentation occurs in rising bread dough.

Alcoholic fermentation produces carbon dioxide, alcohol, and NAD\(^+\), whereas lactic acid fermentation produces lactic acid and NAD\(^+\).

Pathway A and pathway B can both take place when there is no oxygen. When cells run out of oxygen, they can still produce some energy, even though they do so inefficiently.
9.3.1 Explain how organisms get energy in the absence of oxygen.

Sample answer: Cellular respiration, shown in pathway C, is most efficient, because it produces the most ATP using the same amount of glucose as the other two pathways.

9.2.4 Identify how much ATP cellular respiration generates.

The body uses ATP that is already present in the muscle cells, ATP released from lactic acid fermentation, and ATP released from cellular respiration.

9.3.2 Identify the pathways the body uses to release energy during exercise.

As a cell grows larger, more demands are placed on its DNA, and the cell has more trouble moving enough nutrients and wastes across the cell membrane.

10.1.1 Explain the problems that growth causes for cells.

A large cell carries out its activities less efficiently than a small one does.

10.1.2 Compare asexual and sexual reproduction.

Because the offspring of asexual reproduction are genetically identical to parents, they have the characteristics that help them survive in the conditions in which the parent cells survived. They might not have characteristics to survive should the conditions change.

10.2.1 Describe the role of chromosomes in cell division.

Packaging genetic material into chromosomes helps the cell separate the DNA precisely during cell division. If the genetic material was spread out into smaller pieces, some of the material might get lost more easily when the cell divided into two cells.
Chromatids are two identical DNA strands joined by a centromere, and chromatin is the material (DNA and proteins) that makes up chromosomes.

PTS: 1  DIF: L3  REF: p. 280 | p. 282
OBJ: 10.2.1 Describe the role of chromosomes in cell division.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: synthesis

11. ANS:
A: G₁ phase, cell growth; B: S phase, DNA replication; C: G₂ phase, preparation for mitosis; D: M phase, cell division (mitosis and cytokinesis).

PTS: 1  DIF: L2  REF: p. 281 | p. 282
OBJ: 10.2.2 Name the main events of the cell cycle.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: analysis

12. ANS:
1 is anaphase. 2 is prophase. 3 is interphase (or G₂ phase). 4 is telophase. 5 is metaphase.
They occur in the following order: 3, 2, 5, 1, and 4 (or: 2, 5, 1, 4, 3).

PTS: 1  DIF: L3  REF: p. 280 | p. 282
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: analysis

13. ANS:
In metaphase the sister chromatids are still attached to one another and are found in the middle of the cell, whereas in anaphase the sister chromatids have separated and are beginning to move to opposite sides of the cell.

PTS: 1  DIF: L2  REF: p. 280 | p. 282
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: analysis

14. ANS:
In plant cells, a cell plate forms in the cytoplasm midway between each new nucleus. The cell plate gradually develops into a separating membrane, and a cell wall begins to appear in the cell plate. In animal cells, there is no cell plate. The cell membrane is drawn inward until the cytoplasm is pinched into two nearly equal parts.

PTS: 1  DIF: L3  REF: p. 284
OBJ: 10.2.4 Describe the process of cytokinesis.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: synthesis

15. ANS:
A cell that lacked cyclins would probably not undergo mitotic division, and then it would continue to grow, have DNA overload, and exchange materials inefficiently until it dies.

PTS: 1  DIF: L3  REF: p. 286
OBJ: 10.3.1 Describe how the cell cycle is regulated.
STA: UT.BIO.2.3.a  TOP: Foundation Edition
BLM: evaluation

16. ANS:
Cancer cells do not respond to the signals that control the growth of normal cells. As a result, cancer cells form tumors and can spread throughout the body.
Cancer cells are not constrained by crowding and would probably continue to grow after forming a thin layer covering the bottom of the petri dish.

Differentiation is the process by which cells become specialized.

Embryonic stem cells come from embryos and are pluripotent, whereas adult stem cells come from adults and are only multipotent.

Harvesting adult stem cells do not generally harm the donor, whereas harvesting embryonic stem cells usually destroys the embryo.

The experimental setup shows a solution with differing concentrations of solute separated by a selectively permeable membrane. The membrane is permeable to water but not the solute.

The solution on Side A has fewer solute particles than the solution on Side B. Both solutions have the same amount of water, so the solution on Side A is hypotonic compared to the solution on Side B.

The membrane is permeable to water so water can cross the membrane in both directions. Over time, there will be a net movement of water toward Side B, which has a higher concentration of solute particles.
124. **ANS:**

At equilibrium, Side A will have less water than Side B and the concentration of solute molecules will be equal on either side of the selectively permeable membrane.

125. **ANS:**

Yes, the water molecules will continue to move across the membrane; however, there will not be a net movement from one side to the other.

126. **ANS:**

Drawing II—a plant cell—contains the structure described (a chloroplast). The structure is labeled N.

127. **ANS:**

Structure I. They both represent the cell membrane.

128. **ANS:**

Structures J, N, and O. Structure J is the cell wall, structure N is a chloroplast, and structure O is a vacuole.

129. **ANS:**

The organelle labeled K is the nucleus. The nucleus stores DNA and directs the activities of the cell.

130. **ANS:**

Both drawings represent eukaryotes, as shown by the presence of a nucleus.
131. ANS:
Line A shows that the single group’s results are quite different from the results of the rest of the class. Over a half-hour period, the lab group found that the solution traveled 25 mm, whereas the rest of the class found a distance of only 12 mm over the same period of time. The distance traveled in the lab group’s data also kept increasing, whereas the class’ data leveled out at about 10 minutes.

OBJ: 7.3.1 Describe passive transport.  STA: UT.BIO.2.3.c  
TOP: Foundation Edition  BLM: analysis

132. ANS:
The rest of the class’s results (line B) are more likely to be accurate because they represent a larger sample size.

OBJ: 7.3.1 Describe passive transport.  STA: UT.BIO.2.3.c  
BLM: evaluation

133. ANS:
The lab group (line A) might have used a more concentrated solution of sucrose or a membrane with a different permeability.

OBJ: 7.3.1 Describe passive transport.  STA: UT.BIO.2.3.c  
BLM: evaluation

134. ANS:
The more concentrated the solution, the longer distance the solution will travel over the same period of time. Thus, a more concentrated solution would produce a longer distance.

OBJ: 7.3.1 Describe passive transport.  STA: UT.BIO.2.3.c  
BLM: synthesis

135. ANS:
The rate of osmosis could be calculated by dividing the distance traveled by time. The units would be mm/min.

OBJ: 7.3.1 Describe passive transport.  STA: UT.BIO.2.3.c  
BLM: analysis

136. ANS:
The beaker she placed in the shade is the control.

PTS: 1  DIF: L2  REF: p. 240  
OBJ: 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.  STA: UT.BIO.2.2.b  
TOP: Foundation Edition  BLM: application

137. ANS:
The bubbles are probably oxygen gas, which is a product of photosynthesis.

PTS: 1  DIF: L2  REF: p. 232  
OBJ: 8.2.3 State the overall equation for photosynthesis.  STA: UT.BIO.2.1.b | UT.BIO.2.2.b | UT.BIO.2.2.c  
TOP: Foundation Edition
ANS: The student’s data show that as the water plant gets closer to the light, the water plant gives off more bubbles.

PTS: 1 DIF: L2 REF: p. 240
OBJ: 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.
STA: UT.BIO.2.2.b TOP: Foundation Edition
BLM: analysis

ANS: Sample answer: Probably not; the graph shows that the effect is leveling off. Also, we know that light intensity increases the rate of photosynthesis up to a certain point and then levels off.

PTS: 1 DIF: L3 REF: p. 240
OBJ: 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.
STA: UT.BIO.2.2.b BLM: evaluation

ANS: The student is varying the concentration of carbon dioxide in the environment of two similar plants. The student is probably trying to test the effect of carbon dioxide concentration on plants.

PTS: 1 DIF: L2 REF: p. 232
OBJ: 8.2.3 State the overall equation for photosynthesis.
STA: UT.BIO.2.1.b | UT.BIO.2.2.b | UT.BIO.2.2.c TOP: Foundation Edition
BLM: analysis

ANS: The student might set up a similar geranium plant under a bell jar with a tube that allows air to enter and leave the plant’s environment freely.

PTS: 1 DIF: L3 REF: p. 232
OBJ: 8.2.3 State the overall equation for photosynthesis.
STA: UT.BIO.2.1.b | UT.BIO.2.2.b | UT.BIO.2.2.c BLM: evaluation

ANS: Plant A is being grown with a carbon dioxide absorbant. A plant grown in an environment with depleted carbon dioxide would not be able to carry out the Calvin cycle—its rate of photosynthesis would likely be slower than that of a plant grown under normal conditions. Photosynthesis may even stop all together.

PTS: 1 DIF: L3 REF: p. 239
OBJ: 8.3.2 Describe what happens during the light-independent reactions.
STA: UT.BIO.2.2.b | UT.BIO.2.3.d BLM: evaluation

ANS: This plant has been in a carbon-dioxide-rich environment. It will probably have a higher rate of photosynthesis than a plant under normal conditions because carbon dioxide is plentiful.

PTS: 1 DIF: L3 REF: p. 239
Plants require carbon dioxide to produce starches. A higher concentration of carbon dioxide surrounding a plant can increase the production of starches. If the area surrounding a plant is depleted of carbon dioxide, a plant may not be able to produce any starches.

**Oxygen gas, ATP, and NADPH** are the products of the light-dependent reactions.

Sample answer: The equation for cellular respiration is $6\text{O}_2 + C_6\text{H}_{12}\text{O}_6 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Energy}$. The mouse should give off CO$_2$ and H$_2$O.
Sample answer: The mouse requires oxygen and sugar from food (glucose) to carry out cellular respiration. Fresh air containing oxygen flows in through the tubes from outside the flasks into flasks B, C, and D. Air mixed with whatever the mouse gives off flows from flask B into flask A. The mouse receives fresh air and should be able to survive in the chamber for the duration of the experiment.

PTS: 1   DIF: L2   REF: p. 251   OBJ: 9.1.2 Define cellular respiration.

Sample answer: If the mouse is carrying out cellular respiration, it will give off CO$_2$. The CO$_2$ will flow into flask A, and the phenolphthalein in flask A will change from pink to clear.

PTS: 1   DIF: L2   REF: p. 251   OBJ: 9.1.2 Define cellular respiration.

Sample answer: The cricket, like all living organisms, is carrying out cellular respiration. However, the mouse is larger than the cricket and gives off more CO$_2$ than the cricket. After one hour, the cricket probably has not given off enough CO$_2$ to measure. If the scientist allows the experiment to continue for several hours, she will see that more CO$_2$ is given off by the cricket over time.

PTS: 1   DIF: L3   REF: p. 251   OBJ: 9.1.2 Define cellular respiration.

Sample answer: The mouse that had been exercising should give off more CO$_2$ because this mouse will be breathing more heavily. This mouse might even have an oxygen debt to repay, which means it is making up for the oxygen and energy it used up during the exercise.

PTS: 1   DIF: L2   REF: p. 265   OBJ: 9.3.2 Identify the pathways the body uses to release energy during exercise.

The figure shows the electron transport chain.

PTS: 1   DIF: L1   REF: p. 258   OBJ: 9.2.3 Explain how high-energy electrons are used by the electron transport chain.

The electrons come from NADH and FADH$_2$, electron carriers that come from the Krebs cycle.

PTS: 1   DIF: L1   REF: p. 258   OBJ: 9.2.2 Describe what happens during the Krebs cycle.

They join with 4 H$^+$ and O$_2$ to form water molecules.
The H\(^+\) ions are mostly moving into the intermembrane space. This movement causes the intermembrane space to become positively charged with respect to the matrix. This sets up the gradient needed to generate ATP from ADP using ATP synthase.

Sample answer: When exposed to light, the aquatic plants will carry out both cellular respiration and photosynthesis. After a time in the dark, the plants will carry out only cellular respiration.

The purpose of the indicator is to detect the presence of carbon dioxide. The plants will give off oxygen and take in carbon dioxide when they are carrying out photosynthesis. They will give off carbon dioxide and take in oxygen when they are carrying out cellular respiration. If the plants produce more carbon dioxide in cellular respiration than they are able to use, the indicator will change from blue to yellow. If the plants produce and consume the same amount of carbon dioxide, no new carbon dioxide will be produced and the indicator will not change color.
Sample answer: The plant in test tube 2 remained in the dark and was not able to carry out photosynthesis, so it did not use up carbon dioxide. The carbon dioxide keeps the bromthymol blue yellow. However, the plant in test tube 3 was in the light, where it could carry out photosynthesis. This plant used up the carbon dioxide, and without carbon dioxide the color of the bromthymol blue turned back to blue.

165. ANS:

PTL: 1 DIF: L3 REF: p. 253
OBJ: 9.1.3 Compare photosynthesis and cellular respiration. STA: UT.BIO.2.2.b
BLM: synthesis

It shows various stages of mitosis in an animal cell. We know this is an animal cell because of the presence of centrioles and the shape of the cells.

166. ANS:

PTL: 1 DIF: L2 REF: p. 282 | p. 284
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a
BLM: application

167. ANS:

Four

PTL: 1 DIF: L2 REF: p. 282
OBJ: 10.2.1 Describe the role of chromosomes in cell division.
STA: UT.BIO.2.3.a
BLM: application

168. ANS:

X is a centriole; Y is a spindle fiber.

PTL: 1 DIF: L1 REF: p. 282
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a
BLM: knowledge

169. ANS:

D, A, C, B

PTL: 1 DIF: L2 REF: p. 282 | p. 283
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a
BLM: application

170. ANS:

The next step would be cytokinesis. It would show two daughter cells forming. Also accept interphase or G₁.

PTL: 1 DIF: L2 REF: p. 284
OBJ: 10.2.3 Describe what happens during the four phases of mitosis.
STA: UT.BIO.2.3.a
BLM: analysis

171. ANS:

The student is varying the size of the cubes and testing how far a solution can diffuse into each cube; thus, she is probably testing the effect of size on the diffusion of materials into each cube. The cubes probably represent cells.
ANS:

Surface area = length \times width \times the number of sides = 2 \times 2 \times 6 = 24 \text{ cm}^2. \quad \text{Volume} = length \times width \times height = 2 \times 2 \times 2 = 8 \text{ cm}^3. \quad \text{Ratio of surface area to volume} = 24/8 = 3:1.

ANS:

Students should conclude that the largest cube has the smallest ratio of surface area to volume, and the smallest cube has the largest ratio of surface area to volume.

ANS:

Wherever the vinegar soaks into the cube, it will turn the phenolphthalein clear. Thus, the student can cut each cube in half and measure the amount of each cube that has changed from pink to clear.

ANS:

The vinegar will take the longest amount of time to diffuse to the center of the 3 cm cube. It will take the shortest amount of time to reach the center of the 1 cm sides.

ANS:

Diagram A shows cancer cells because it shows cells that are not growing in a controlled way. They have formed a tumor.

ANS:

Cancer cells do not respond to the signals that control the growth of most cells. As a result, cancer cells form masses (tumors). These signals include growth factors that stimulate cell division at a proper rate and signals that prevent excessive growth so that tissues do not disrupt each other. Diagram A shows cells that have divided until they have formed a tumor. These cells are dividing more quickly than normal cells do. They have started disrupting adjacent cells.
They can break loose from the mass they are now a part of and spread throughout the body, disrupting normal activities, forming secondary tumors, and causing serious medical problems.

179. **ANS:**
Diagram A: These cells might have a defect in the p53 gene, which has allowed the cells to multiply more quickly and chaotically than the normal cells. Diagram B: These cells probably have a healthy copy of the p53 gene, which has stopped the cell cycle until the genetic material in these cells has been properly replicated.

180. **ANS:**
Students may suggest removing the cancerous cells in hopes of preventing their continued division, growth, and spread throughout the body, treating them with radiation or chemicals that will destroy the cells, etc.

**ESSAY**

181. **ANS:**
The cell theory states that all living things are composed of cells. It also says that cells are the basic units of structure and function in living things, and that new cells come from existing cells. The cell theory is significant to biology because all living thing are made of cells. Differences in the structure and function of different life forms are reflected in differences in their cell structures.

182. **ANS:**
The cell membrane is a thin, flexible barrier around the cell. The cell wall is a strong layer that surrounds the cell membrane in some cells. The nucleus is a large structure found in some cells. It contains the cell’s genetic material and controls the cell’s activities. The fluid portion of the cell outside the nucleus (if present), is the cytoplasm. All cells have a cell membrane and cytoplasm. Only eukaryotes have a nucleus. Animal cells do not have a cell wall, but plant cells and some prokaryotes do.

183. **ANS:**
Microtubules are hollow tubes of protein that help maintain the shape of a cell. Microtubules also make up cilia and flagella, which function in cell movement. Microfilaments are long, thin fibers that are narrower than microtubules. Microfilaments function in the movement and support of the cell.
The cell wall lies outside the cell membrane of many cells, including those of plants, algae, and fungi. It supports and protects the cell and often allows water, oxygen, carbon dioxide, and other materials to pass through it. Most cell walls are rigid and made of carbohydrates and proteins. In contrast, the cell membrane is a thin, flexible membrane made of a lipid bilayer with proteins that run through it and carbohydrate chains attached to proteins poking out on the outer surface of the cell membrane. Like the cell wall, the cell membrane provides protection and support to the cell and allows materials to pass through it. In fact, the cell membrane regulates the movement of materials into and out of the cell.

Like a piece of mosaic art, which is made of different tiles, the cell membrane is made up of many different kinds of molecules. The background is a lipid bilayer. Within this bilayer are proteins that form channels and pumps that help move materials from one side of the membrane to the other. Carbohydrates on the outer surface of the membrane act like chemical identification cards and allow cells to identify one another.

When a normal red blood cell is placed in a hypertonic solution, one that has a higher solute concentration than inside the cell, there is a net movement of water out of the cell. The cell will shrink due to osmotic pressure.

When sugar solutions of different concentrations are on opposite sides of a semipermeable membrane, the sugar molecules on both sides of the membrane flow across the membrane. However, there is a net flow of sugar molecules from the more concentrated solution into the less concentrated solution, until the concentrations are equal. Once equilibrium is reached, roughly equal numbers of molecules move in each direction across the membrane.

Facilitated diffusion involves the movement of molecules across a membrane through protein channels. The molecules move from an area of high concentration to an area of lower concentration. Facilitated diffusion does not require additional energy. Active transport is the movement of particles across the cell membrane using energy. Molecules can move from an area of low concentration to an area of higher concentration in active transport. Osmosis is an example of facilitated diffusion.
189. **ANS:**
The cell from the unicellular organism carries out all the life processes of the organism. It is not specialized. The cell from the multicellular organism is specialized and carries out only certain functions in the organism, while relying on other cells in the multicellular organism to complete other life processes.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 214 | p. 215  
**OBJ:** 7.4.2 Explain how multicellular organism maintain homeostasis.  
**STA:** UT.BIO.2.3.c  
**TOP:** Foundation Edition  
**BLM:** analysis

190. **ANS:**
The levels of organization in a multicellular organism include cells, tissues, organs, and organ systems. Similar cells are grouped into tissues; tissues that work together form organs; a group of organs that work together make up an organ system. Unicellular organisms cannot have cell specialization. Instead, all of the activities of the organism must be carried out by the single cell.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 214 | p. 217  
**OBJ:** 7.4.2 Explain how multicellular organism maintain homeostasis.  
**STA:** UT.BIO.2.3.c  
**TOP:** Foundation Edition  
**BLM:** analysis

191. **ANS:**
A glucose molecule can store more than 90 times the energy of an ATP molecule. Glucose is used by cells to store large amounts of energy for long periods of time. In contrast, ATP is used to store smaller amounts of energy that will be used in the next few seconds. Cells can regenerate ATP from ADP as needed by using the energy from glucose.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 227  
**OBJ:** 8.1.1 Describe the role of ATP in cellular activities.  
**STA:** UT.BIO.2.1.a  
**TOP:** Foundation Edition  
**BLM:** analysis

192. **ANS:**
Heterotrophs depend on autotrophs to harvest energy from the sun. This energy is then passed on to heterotrophs in the form of food. Without autotrophs, the sun’s energy would not be available to heterotrophs and heterotrophs would eventually die out.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 228  
**OBJ:** 8.1.2 Explain where plants get the energy they need to produce food.  
**STA:** UT.BIO.2.2.a  
**TOP:** Foundation Edition  
**BLM:** synthesis

193. **ANS:**
When light shines on a pigment, the pigment absorbs energy from that light. When the pigment chlorophyll absorbs light, much of the energy is transferred directly to electrons in the chlorophyll molecule, raising the energy levels of these electrons. This energy is then passed on in the reactions of photosynthesis.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 231  
**OBJ:** 8.2.1 Explain the role of light and pigments in photosynthesis.  
**STA:** UT.BIO.2.2.b | UT.BIO.2.3.d  
**TOP:** Foundation Edition  
**BLM:** analysis

194. **ANS:**
Chlorophyll absorbs light especially well in the red and blue regions of the visible light spectrum (reflecting green). Carotenoids absorb light in the blue-green parts of the visible spectrum (reflecting yellow, orange, and red). Having more than one kind of pigments increases the range of light from which a plant can harvest energy.

**ANS:**

Electrons in the pigments in photosystem II absorb energy from light. These high-energy electrons then move through the electron transport chain to photosystem I. H⁺ ions move from the stroma into the inner thylakoid membrane. NADP⁺ becomes NADPH. The charge and concentration difference on either side of the thylakoid membrane provides the energy to make ATP via ATP synthase.

**ANS:**

When energy from sunlight is absorbed by the electrons in chlorophyll, the electrons increase their energy level and move through the electron transport chain to photosystem I. The electrons in chlorophyll are replenished by water molecules. Enzymes in the inner surface of the thylakoid membrane break up each water molecule into 2 electrons, 2 H⁺ ions, and half an O₂ molecule. The electrons from water replace those that chlorophyll loses to the electron transport chain.

**ANS:**

The reactions that take place within the photosystems and electron transport chain require light in order to take place. ATP synthesis is dependent on the products of these reactions. Thus, the nickname “light reactions” for these reactions is not misleading. However, the light-independent reactions can take place under both light and dark conditions. They do not require darkness, so it is misleading to call them dark reactions.

(a) Sample answer: In bright sunlight, the Calvin cycle occurs in the stroma. During the Calvin cycle, the products of the light-dependent reactions (ATP and NADPH) are used to convert molecules of CO₂ into high-energy sugars. (b) Sample answer: In darkness, the Calvin cycle also occurs in the stroma. During the Calvin cycle, the products of the light-dependent reactions (ATP and NADPH) are used to convert molecules of CO₂ into high-energy sugars. If the plant has been in the dark for a long period of time, there may not be enough ATP and NADPH from the light-dependent reactions to continue the Calvin cycle.
199. **ANS:**
Three of the factors that affect the rate of photosynthesis are light intensity, temperature, and water. The rate of photosynthesis increases with light intensity up to a certain point, then levels off. Photosynthesis slows at extreme temperatures and usually has an optimal temperature for each kind of plant. A lack of water also slows down photosynthesis.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 240  
**OBJ:** 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.  
**STA:** UT.BIO.2.2.b  
**BLM:** comprehension

200. **ANS:**
CAM plants do not take in carbon dioxide through their leaves all the time, as do other plants. Instead, CAM plants take it in only at night, when temperatures are cooler. Their leaves close up during the day so that water is not lost to the warm air. Aquatic plants are not at risk from drying out during the warm day, because they live in water. Therefore, they do not need to close their leaves during the day to prevent water loss.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 241  
**OBJ:** 8.3.3 Identify factors that affect the rate at which photosynthesis occurs.  
**STA:** UT.BIO.2.2.b  
**BLM:** analysis

201. **ANS:**
If the energy in glucose were released in just one step, most of the energy would be lost as heat. The gradual process of cellular respiration allows the cell to control the release of energy into packages of ATP that can be used more efficiently for cell activities.

**PTS:** 1  
**DIF:** L3  
**REF:** p. 250  
**OBJ:** 9.1.2 Define cellular respiration.  
**STA:** UT.BIO.2.2.b \ UT.BIO.2.2.c  
**BLM:** synthesis

202. **ANS:**
Sample answer: Photosynthesis and cellular respiration are opposite processes. The reactants of photosynthesis are the products of cellular respiration. The products of photosynthesis are the reactants of cellular respiration. Whereas photosynthesis generates sugars, cellular respiration uses up sugars. Photosynthesis removes carbon dioxide from and releases oxygen into the atmosphere, while cellular respiration uses oxygen and gives off carbon dioxide.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 253  
**OBJ:** 9.1.3 Compare photosynthesis and cellular respiration.  
**STA:** UT.BIO.2.2.b  
**TOP:** Foundation Edition  
**BLM:** analysis

203. **ANS:**
Sample answer: Glycolysis is the breakdown of glucose into 2 molecules of pyruvic acid, producing 4 ATP molecules. An initial input of 2 ATP molecules is required to start glycolysis; thus, there is a net gain of 2 ATP molecules. This process produces 2 high-energy electrons, which are passed to NAD⁺ to form NADH. If oxygen is present, glycolysis leads to the Krebs cycle and the electron transport chain. If oxygen is not present, glycolysis is followed by the rest of fermentation.

**PTS:** 1  
**DIF:** L2  
**REF:** p. 254 | p. 262  
**OBJ:** 9.2.1 Describe what happens during glycolysis.  
**STA:** UT.BIO.2.2.b  
**TOP:** Foundation Edition  
**BLM:** synthesis

204. **ANS:**
Sample answer: During the Krebs cycle, pyruvic acid is broken down into carbon dioxide in a series of energy-extracting reactions. Coenzyme A forms acetyl-CoA, which later becomes citric acid. Citric acid is then broken down, CO₂ is released, and electrons are transferred to energy carriers. One molecule of pyruvic acid gives 4 molecules of NADH, 1 molecule of FADH₂, and 1 molecule of ATP.
Sample answer: The electron carriers of cellular respiration are NAD$^+$ and FAD. These molecules accept high-energy electrons (thus becoming NADH and FADH$_2$) and move to the electron transport chain. The energy stored in these electron carriers is transferred to the electron transport chain. The electron transport chain, in turn, uses the energy to move hydrogen ions across the inner mitochondrial membrane, which creates a charge difference across the membrane.

High-energy electrons from the Krebs cycle are passed from one carrier protein to the next in the electron transport chain. The movement of these electrons through the electron transport chain powers the pumping of hydrogen ions across the inner mitochondrial membrane. The buildup of H$^+$ ions in the inner mitochondrial space creates a charge difference across the inner mitochondrial membrane. When the ions move back across the membrane through the protein ATP synthase, the protein converts ADP into ATP.

Lactic acid fermentation occurs in animal muscle cells and in some microorganisms. Lactic acid fermentation converts glucose into lactic acid. Alcoholic fermentation takes place in many organisms, including yeast cells. Unlike lactic acid fermentation, alcoholic fermentation produces alcohol and carbon dioxide. Both types of fermentation result in 2 ATP molecules.

Lactic acid is an indication that lactic acid fermentation is occurring in muscle cells. Lactic acid fermentation occurs only in the absence of oxygen. Thus, the heart cells with more lactic acid may not have been receiving enough oxygen, a factor that could contribute to the occurrence of a heart attack. The level of lactic acid could be measured in certain parts of the heart as an indication of risk of heart attack.

Sample answer: The first few seconds of a race are powered by the ATP that the muscle cells already have on hand. Then, the muscle cells begin producing ATP by lactic acid fermentation—this would be around the 50-meter mark of the race. After about 90 seconds, however, cellular respiration is the only way to generate a continuing supply of ATP.
During brief periods of intense activity, muscle cells may use oxygen faster than it can be supplied by the body. When the oxygen supply gets very low, the electron transport chain cannot function because oxygen serves as its final electron acceptor. This forces the Krebs cycle to stop. In this anaerobic situation, the muscle cells can produce ATP only by means of lactic acid fermentation.

During growth, a cell’s volume increases more rapidly than does its surface area, causing its ratio of surface area to volume to decrease with increasing size. As a cell’s ratio of surface area to volume decreases, it becomes more difficult for a cell to move needed materials in and wastes out. Thus, a normal growing cell will usually divide into two daughter cells before it becomes too large.

As a cell grows, it functions less efficiently because it places more demands on its DNA and it is less able to move materials to their proper destinations quickly. Cell division results in two daughter cells. Each cell has its own copy of the parent cell’s DNA and has a smaller size that allows it to efficiently exchange materials.

Interphase consists of the G₁ phase, S phase, and the G₂ phase. During the G₁ phase, the cell grows; during the S phase, the DNA replicates; during the G₂ phase, the cell prepares for mitosis. The M phase or cell division includes mitosis and cytokinesis.

Prophase: the chromatin condenses into chromosomes, the centrioles separate (in animal cells), and the nuclear membrane breaks down; metaphase: the chromosomes line up across the midline of the cell and each chromosome is attached to a spindle fiber and centromere; anaphase: sister chromatids separate into individual chromosomes; telophase: chromosomes move to opposite sides of the dividing cell, and two new nuclear envelopes form.
When telophase ends, each new nucleus will contain four chromosomes. The eight chromosomes form from the replication of four chromosomes. When mitosis is over, the chromatids have separated at their centromeres to form eight chromosomes, half of which move to each nucleus.

Mitosis is the division of the nucleus. Cytokinesis is the division of the cytoplasm. If mitosis occurred without cytokinesis, the cell would contain two nuclei and twice the DNA. If cytokinesis occurred without mitosis, one of the new cells would lack DNA and a nucleus altogether.

Cells at the edges of the cut are stimulated to divide rapidly, producing new cells, and healing the wound. When the cut is almost completely healed, the rate of cell division slows down. Thus, when the cells on either side of the cut are no longer in contact with one another, they divide to fill in the gap. Once the cells are in contact with one another, the cut is healed, and the cells resume their normal growth rate.

The cell cycle is regulated by signals both inside and outside a cell. Internal regulators include proteins that make sure a cell does not divide until after its DNA has been copied faithfully. They also include proteins that prevent a cell from dividing if all its chromosomes are not attached to the spindle. External controls include growth factors that stimulate cell division and molecules on the surfaces of cells that inhibit growth so that cells do not disrupt each other’s growth.

Unlike normal cells, cancer cells do not respond to normal controls on growth and division. By dividing uncontrollably, cancer cells form tumors and spread throughout the body. A cure for cancer includes a way to both prevent cancer cells from dividing uncontrollably and to allow normal cells to continue dividing normally. Finding a way to stop the cell cycle in some cells, but not interfere with the cell cycle in other cells, has made it difficult to cure cancer.
Some people are opposed to stem cell research because the harvesting of embryonic stem cells can cause the destruction of embryos. They feel that embryos are entitled to the same rights as adults. People who believe that stem cell research should continue argue that embryos do not have the same rights as fully formed humans and that scientists must do all they can to save lives. They feel that it is unethical to restrict research. Student answers should include their own opinion on the subject.

PTS: 1  DIF: L3  REF: p. 297
OBJ: 10.4.3 Identify the possible benefits and issues relating to stem cell research.
STA: UT.BIO.4.2.d  TOP: Foundation Edition
BLM: evaluation