Name Date

Topic 1.2 Highlights

What are different ways that living things reproduce asexually?

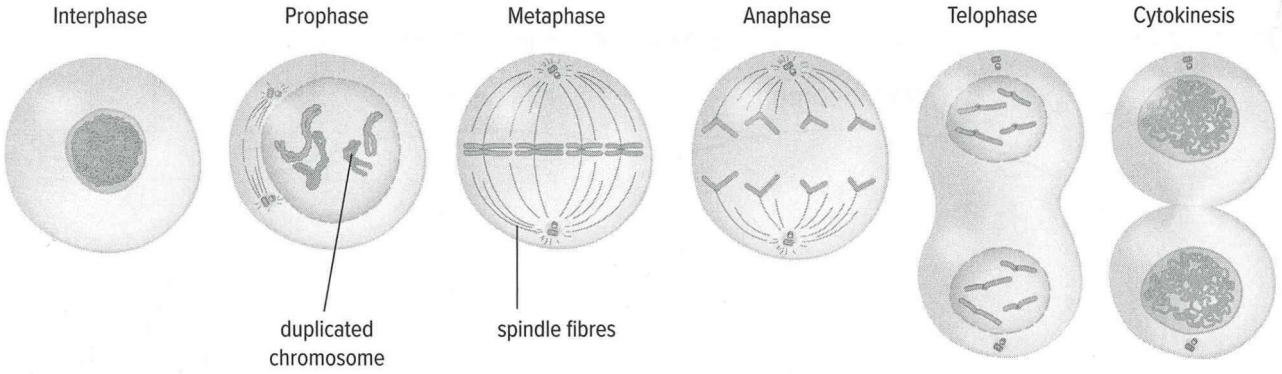
Use with textbook pages 20–35.

Binary Fission

In **binary fission**, a *parent cell* splits into two identical *daughter cells* that have the same genetic material as the parent. Binary fission is a form of asexual reproduction that occurs in bacteria. Refer to Figure 1.7 on page 23 to see what happens during binary fission. What steps are involved in this process?

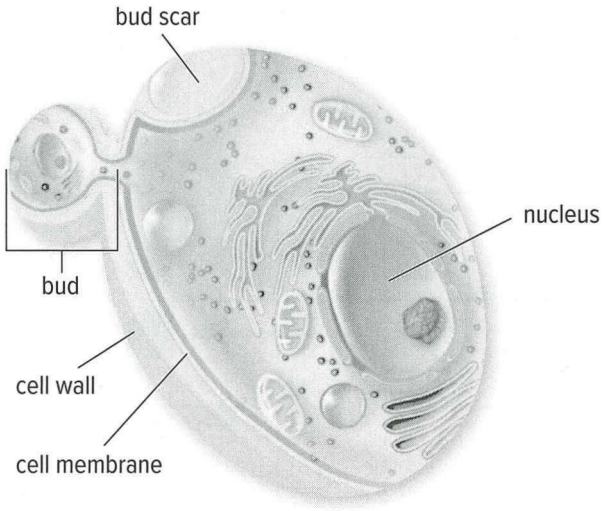
Cell Cycle

Eukaryotic cells reproduce to replace damaged or older cells. They do this through the cell cycle, which is divided into two stages: the growth and development stage and the division stage. The pie chart in Figure 1.10 on page 27 of the textbook shows the relative amount of time a cell spends in each phase during its life. The growth and development stage is called **interphase**. During this phase, the cell grows bigger, the organelles increase in number, and DNA is duplicated in preparation for cell division. The division stage includes mitosis and cytokinesis. **Mitosis** is the division of the nucleus, while **cytokinesis** is the division of the cytoplasm. Mitosis has four phases: prophase, metaphase, anaphase, and telophase. During **prophase**, the nuclear membrane disappears and DNA condenses further into chromosomes. Spindle fibres start to form. These spindle fibres move the chromosomes to the middle of the cell in **metaphase**. During **anaphase**, the spindle fibres pull the chromosomes to the two ends of the cell. The chromosomes have reached the two ends of the cell in **telophase** and the nuclear membrane forms around each complete set of chromosomes. The cell then undergoes cytokinesis, where the cytoplasm splits in half. The end product is two new daughter cells that are identical to the parent cell and to each other. The figure below shows interphase, the phases of mitosis, and cytokinesis.



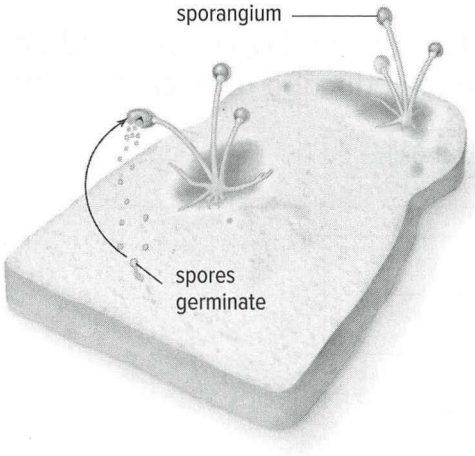
Budding

In **budding**, a small **bud** grows from the parent cell and then detaches itself. This new independent cell will grow to the size of the parent cell. This type of asexual reproduction occurs in yeast cells. The figure below shows a yeast cell dividing by budding.



Spore Formation

Moulds and mushrooms reproduce asexually by forming **spores** that are genetically identical to the parent. The figure below shows a *sporangium* releasing some spores that will eventually grow and develop under favourable conditions.



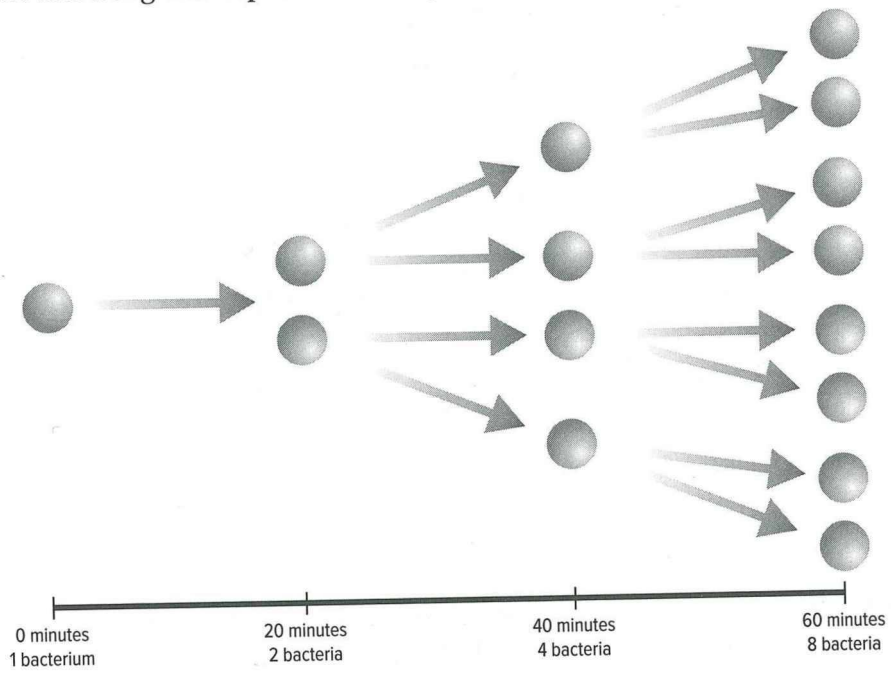
Vegetative Propagation

Plants can use **vegetative propagation** to reproduce asexually from the roots, stems, or leaves. The new plants are identical **clones** of the parent plant. Refer to Figure 1.13 on page 31 of the textbook for some examples of vegetative propagation. People use a variety of artificial vegetative propagation techniques to produce plants with desired characteristics. These techniques are described in Table 1.1 on pages 32 and 33 of the textbook.

Binary Fission

Use with textbook pages 22–23.

Use the diagram showing the reproduction of bacterial cells to answer questions 1 to 5.



1. What type of asexual reproduction is shown above? Binary Fission

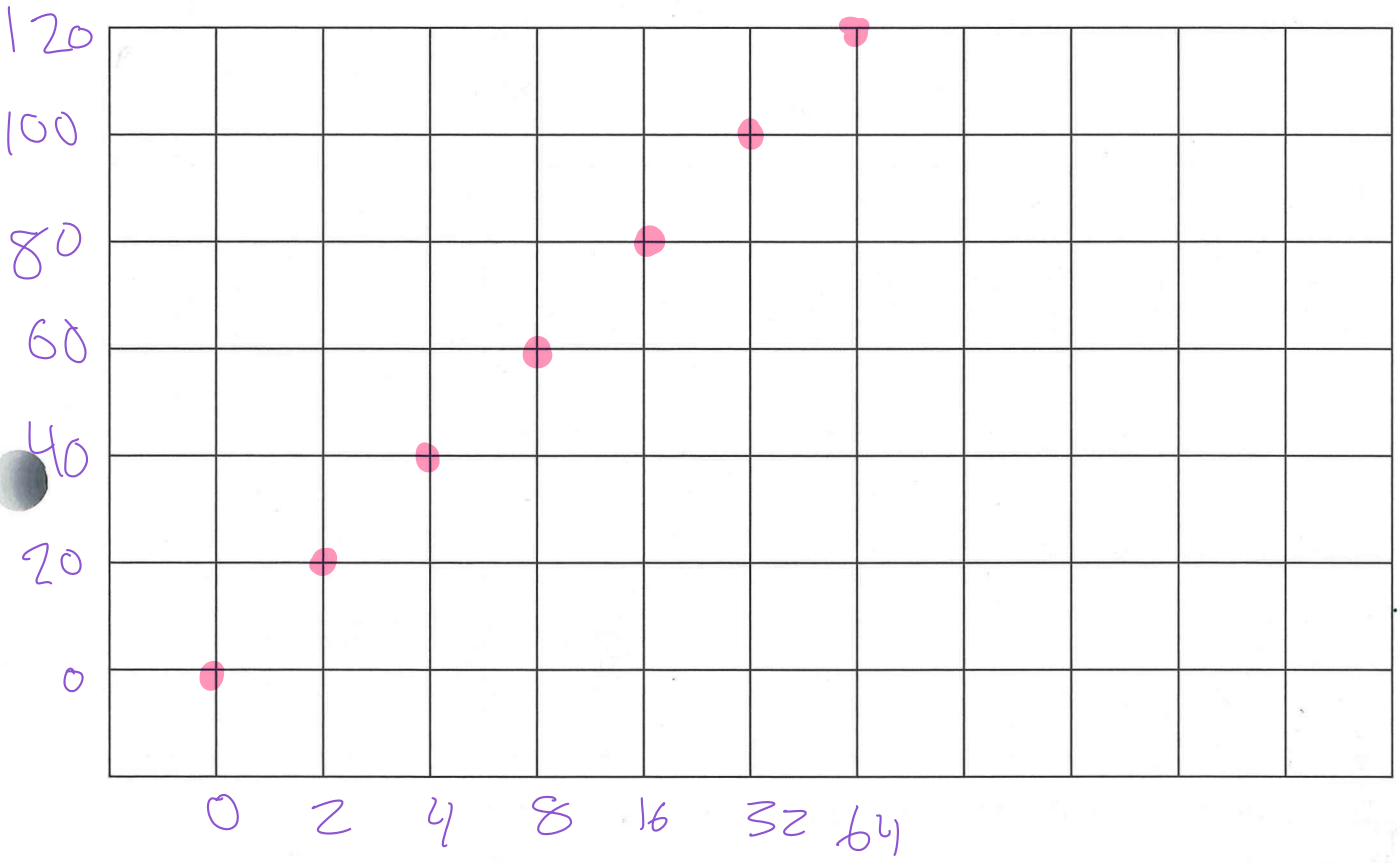
2. Bacteria double every 20 minutes under favourable conditions. Complete the following table to display the reproduction data shown in the diagram.

Time (min)	Number of Bacterial Cells
0	1
20	2
40	4
60 (1 h)	8
80	16
100	32
120 (2 h)	64
140	128
160	256
180 (3 h)	512

3. Use the table on the previous page to graph the data for the first 120 minutes. What variable would go on the x-axis? What variable would go on the y-axis?

y - minutes

x - number of bacterial cells



4. Describe how the graph represents the growth of the bacterial population.

That is doubles itself.

5. Based on the reproduction rate, how many bacterial cells would you expect after

a) 12 hours? 1440

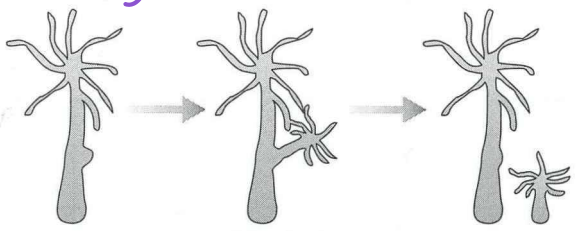
b) 24 hours? 2880

Binary Fission, Budding, and Spore Formation

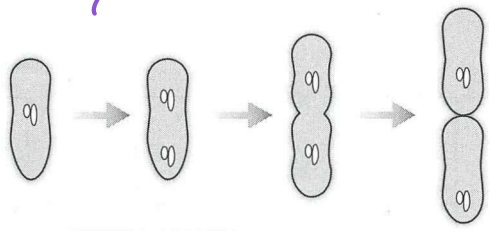
Use with textbook pages 22–30.

1. Identify the type of asexual reproduction shown in each diagram.

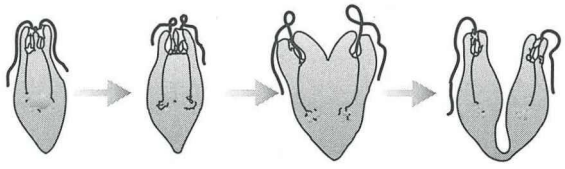
a) Budding



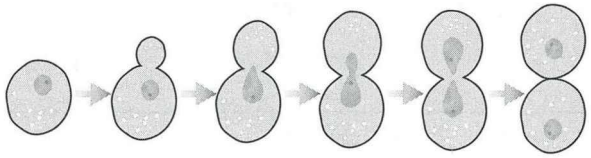
d) binary



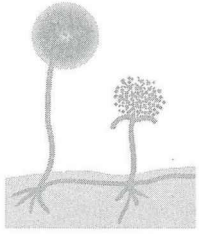
b) _____



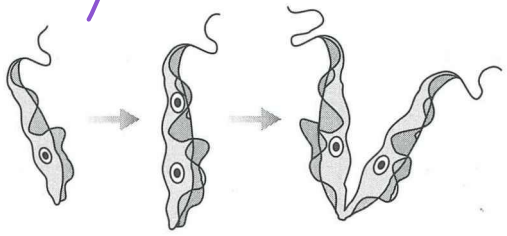
e) budding



c) spores



f) binary



2. Identify the type of asexual reproduction described in each scenario.

a) The aquatic cell of *Planctomycetes* forms a bud, which eventually becomes a new cell that swims. budding

b) A unicellular green algae, *Micrasterias furcata*, divides into two equal halves forming two new cells. binary fission

c) An amoeba grows to a certain size and then its nucleus and cytoplasm divide. This results in two amoebas. budding

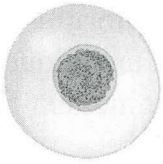
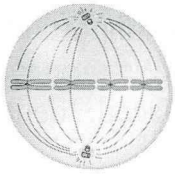
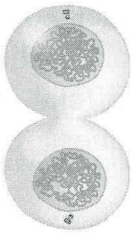
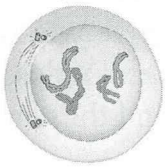
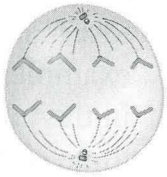
d) *Amanita muscaria* releases spores from under its iconic red cap with white warts, producing more of these poisonous B.C. toadstools.

spores

Cell Cycle and Mitosis

Use with textbook pages 25–27.

1. Label each diagram with the corresponding stage of the cell cycle: anaphase, cytokinesis, interphase, metaphase, prophase, telophase.

a) Telophase	b) interphase	c) metaphase	d) cytokinesis	e) prophase	f) Anaphase
					

2. Which stage of the cell cycle is each of the following statements describing? Choose from the following list of terms: anaphase, cytokinesis, interphase, metaphase, prophase, telophase.

a) DNA is copied interphase

b) cytoplasm divides cytokinesis

c) spindle fibres form prophase

d) cell grows and develops interphase

e) nuclear membrane disappears prophase

f) number of organelles increases interphase

g) DNA condenses into chromosomes prophase

h) stage that makes up most of the life of the cell interphase

i) stage where the cell carries out its life function cytokinesis

j) chromosomes line up across the middle of the cell
metaphase

k) nuclear membrane reappears around the chromosomes
telophase

l) duplicated chromosomes have reached the opposite ends of the cell
telophase

m) duplicated chromosomes are pulled apart to the opposite ends of the cell
anaphase

Vegetative Propagation

Use with textbook pages 31–33.

1. Previewing Text Features

Before reading the text on pages 31 to 33 of the textbook, preview the *text features* such as headings, subheadings, and main body text. Examine Table 1.1 on pages 32 and 33. Look at the title of each column and the heading for each row. Some of the text features give you clues about the most important ideas for this Concept. For example, six examples of artificial vegetative propagation techniques are discussed in the table and these techniques are boldfaced. Identify some text features on these three pages.

Splitting, Grafting, Cutting, Simple layering, air layering, tissue culture.

2. Making Study Notes on Index Cards

Making study notes on index cards for Table 1.1 on pages 32 and 33 will help you focus on the main ideas. Write your notes in your own words. Write each boldfaced word in Table 1.1 on a separate index card. On each index card, include

- the name of the artificial vegetative propagation technique,
- a sentence describing the technique,
- a list of the plants used,
- some uses for the technique.

3. Visualizing

Visualizing means forming an image in your mind based on the text that you are reading.

Look at each of the diagrams provided in Table 1.1. Look for details that make the image make sense to you. Once you have formed a final image in your mind, make a sketch of each propagation technique on your index card. Your sketch will reinforce the concepts in your study notes.

1.2 Assessment

Match each term on the left with the best description on the right. Each description may be used only once.

Term	Description
1. A clone	A. identical copy of a cell
2. C spore	B. series of events that make up the life cycle of a cell
3. D budding	C. structure released by a sporangium during asexual reproduction
4. B cell cycle	D. type of asexual reproduction where a bud forms from the parent
5. F binary fission	E. type of asexual reproduction where plants grow from parts of its roots, stems, or leaves
6. E vegetative propagation	F. type of asexual reproduction where the parent cell splits into two identical daughter cells

Circle the letter of the best answer for questions 7 to 23.

7. In which of the following methods of reproduction are the parent cells genetically identical to the daughter cells?

I	budding
II	binary fission
III	spore formation

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

8. What do budding, binary fission, and spore formation have in common?

A. They require two parent cells.

B. They require only one parent cell.

C. They produce only one daughter cell.

D. They are all forms of sexual reproduction.

9. Which of the following methods do bacteria that cause tooth decay use to reproduce?

A. budding

B. binary fission

C. spore formation

D. vegetative propagation

10. What are the end products of binary fission?

A. two independent daughter cells that are identical to each other

B. one daughter cell that is genetically different from the parent cell

C. two independent daughter cells that are different from each other

D. two daughter cells that are genetically different from the parent cell

11. Yeast reproduce by

A. budding.

B. binary fission.

C. spore formation.

D. vegetative propagation.

12. During budding, what is usually formed?

A. a bud from the daughter cell

B. new DNA from the parent cell

C. an outgrowth from the parent cell

D. new stems and roots from the parent cell

13. Which method does mould use to produce more mould on a piece of cheese?

A. budding

B. binary fission

C. spore formation

D. vegetative propagation

14. Which of the following describes when spores will grow and divide?

A. when they are encased in a sporangium

B. when they are in an environment with harsh conditions

C. when they are in an environment with favourable conditions

D. when leaves from the existing plant provide nutrients for the spores

15. Which of the following types of reproduction involve the cell cycle?

I	budding
II	binary fission
III	spore formation

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

16. Daffodil and tulip bulbs are planted in the fall. In the spring, these flowers grow from the bulbs. This is an example of

A. budding.

B. binary fission.

C. spore formation.

D. vegetative propagation.

17. How are potato tubers and strawberry runners similar?

A. They are not clones of the parent plant.

B. They are like stems that produce new plants.

C. They are used by plants to reproduce sexually.

D. They are like leaves that develop the roots of the new plant.

18. Which of the following techniques takes a section of the root and joins it to another plant?

A. cutting

B. grafting

C. splitting

D. air layering

19. The cell cycle consists of which of the following?

I	mitosis
II	interphase
III	cytokinesis

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

20. During which phase of mitosis do the chromosomes line up in the middle of the cell?

A. telophase

B. anaphase

C. prophase

D. metaphase

21. Copies of DNA are made during

A. prophase.

B. anaphase.

C. telophase.

D. interphase.

22. Which of the following occurs during anaphase?

A. spindle fibres form

B. nuclear membrane disappears

C. chromosomes are pulled to the opposite ends of the cell

D. nuclear membrane reappears around the two new sets of chromosomes

23. The cytoplasm is divided to produce two new cells during

A. prophase.

B. anaphase.

C. interphase.

D. cytokinesis.

24. Complete the following spider map for the phases of mitosis. Describe what happens during each phase of mitosis.