DATE: NAME: CLASS:

UNIT 2

Unit 2 Summary

BLM 2-1

Goal • Use this summary to review the concepts in Unit 2, Reproduction.

Chapter 4 The nucleus controls the functions of life.

- Chromosomes found within the nucleus contain the genes that store the information to make proteins. (4.1)
- Genetic information determines the traits that are passed on from parents to offspring. (4.1)
- Proteins control the activities of cells. (4.1)
- A gene mutation is a change in the information stored in the nucleus. (4.2)
- Gene mutations can have a positive, negative, or neutral effect on the individual. (4.2)
- Mutations can occur when DNA is being replicated, or they can be caused by mutagens. (4.2)
- Mutagens can be produced in nature or by human activity. (4.2)
- Gene therapy attempts to correct gene mutations. (4.2)

Chapter 5 Mitosis is the basis of asexual reproduction.

- There are three stages to the cell cycle: interphase, mitosis, and cytokinesis. (5.1)
- There are four phases to mitosis: prophase, metaphase, anaphase, and telophase. (5.1)
- Checkpoint proteins instruct the nucleus whether or not to proceed through the cell cycle. (5.1)
- An error in a checkpoint protein can cause diseases such as cancer, which is the result of uncontrolled cell division. (5.1)
- Asexual reproduction requires only one parent, and the resulting offspring are genetically identical to the parent. (5.2)
- Types of asexual reproduction include: binary fission, budding, fragmentation, vegetative reproduction, and spore formation. (5.2)
- Asexual reproduction can produce large numbers of offspring with a relatively low input of energy, but these offspring do not have the genetic variability to withstand drastic changes in their environment. (5.2)

Chapter 6 Meiosis is the basis of sexual reproduction.

- Meiosis produces gametes with half the number of chromosomes as body cells. (6.1)
- The process of meiosis creates variation in organisms because genetic information is shuffled during meiosis I. (6.1)
- The three stages of sexual reproduction are mating, fertilization, and development. (6.2)
- For sexually reproducing plants and animals, a sperm cell and an egg cell may meet either by internal or external fertilization. (6.2)
- The early development of an organism takes place during a stage called embryonic development. (6.2)
- The reproductive systems are the only structural differences between males and females. (6.3)
- The understanding of genetics continues to grow, building with each new discovery and as new tools become available. (6.4)
- Genetic variations can be advantageous, neutral, or detrimental, such as with Down and Allderdice syndromes. (6.4)

DATE: NAME: CLASS:

UNIT 2

Steps of Mitosis

BLM 2-10

Goal • Identify the phases of mitosis.

What to Do

Name each phase of mitosis. Then draw and describe what is happening in each phase.

Phase 1: _____ Drawing Description: _____ _____ _____	Phase 2: _____ Drawing Description: _____ _____ _____
Phase 3: _____ Drawing Description: _____ _____ _____	Phase 4: _____ Drawing Description:_____ _____ _____

DATE: NAME: CLASS:

UNIT 2

Cell Growth and Division

BLM 2-11

Goal • Review your understanding of the phases of the cell cycle.

What to Do

Write the name of the stage of the animal cell cycle that corresponds to each event described below. You may use some cycles more than once.

1. Nuclear membranes form around each mass of chromosomes. _____
2. Pairs of single-stranded chromosomes separate and move toward opposite ends of the cell. _____
3. A copy of each chromosome is made. _____
4. Cell membrane pinches together and the cytoplasm of the cell divides. _____
5. The nuclear membrane disappears. _____
6. Daughter cells form. _____
7. Double-stranded chromosomes line up in the centre of the cell. _____
8. It makes up most of a cell's life. _____

Short Answer Question

9. In mitosis, how many cells form from the original cell? _____

DATE: NAME: CLASS:

UNIT 2

Conduct an Investigation 5-1C, Observing the Cell Cycle in Plant Cells

BLM 2-12

Goal • Use these pages to complete Conduct an Investigation 5-1C, Observing the Cell Cycle in Plant Cells.

Question

What is the frequency of the events of the cell cycle in an onion root tip?

Procedure

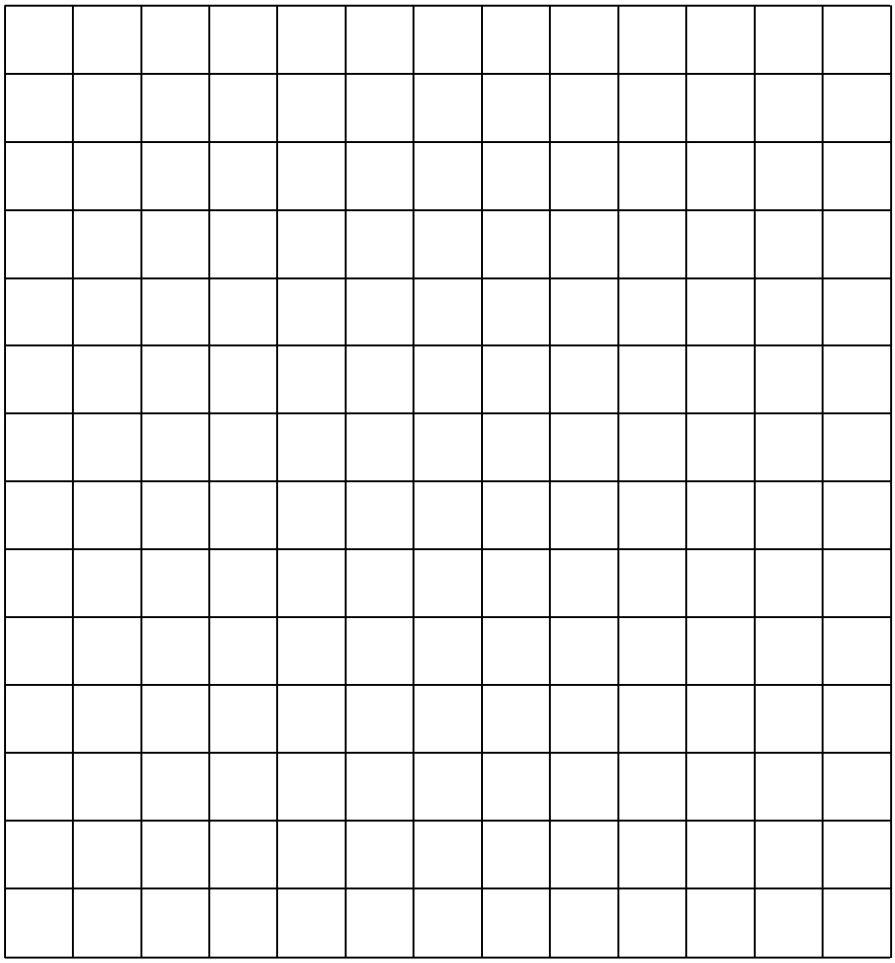
1. Follow steps 3 to 5 on page 148 of *Discovering Science 9*. Draw your observations in the boxes below.

Prophase	**Metaphase**
Anaphase	**Telophase**
Cytokinesis	**Interphase**

2. Follow steps 7 to 13 on pages 148 and 149 of *Discovering Science 9* to complete the chart below.

Cell Cycle Event	Group Data		Class Data	
	Frequency (number of cells)	Percentage	Frequency (number of cells)	Percentage
Prophase				
Metaphase				
Anaphase				
Telophase				
Cytokinesis				
Interphase				
Totals				

3. Plot a bar graph using the class data percentages.



4. Clean up and put away the equipment you have used.

Analyze

1. Which event of the cell cycle occurs most frequently? _____

2. How can you tell that the cell cycle is a continuous process?

_____

_____

3. (a) Which event of the cell cycle takes the longest period of time? _____
   (b) Explain how you made your decision.

_____

_____

4. Are your group's results in this investigation different from the rest of the class? If so, how could you explain this?

_____

_____

_____

Conclude and Apply

1. Suppose that you were told that the cell cycle lasts 16 h. Use your class data percentages to estimate the length of each of the six events in this 16 h cycle.

_____

_____

_____

2. Many scientific and medical careers involve examining cells in great detail. Find out about and summarize what a technician in a medical laboratory does. Begin your research at www.discoveringscience9.ca.

_____

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2

Find out Activity 5-2A, Asexual Reproduction in Duckweed

BLM 2-13

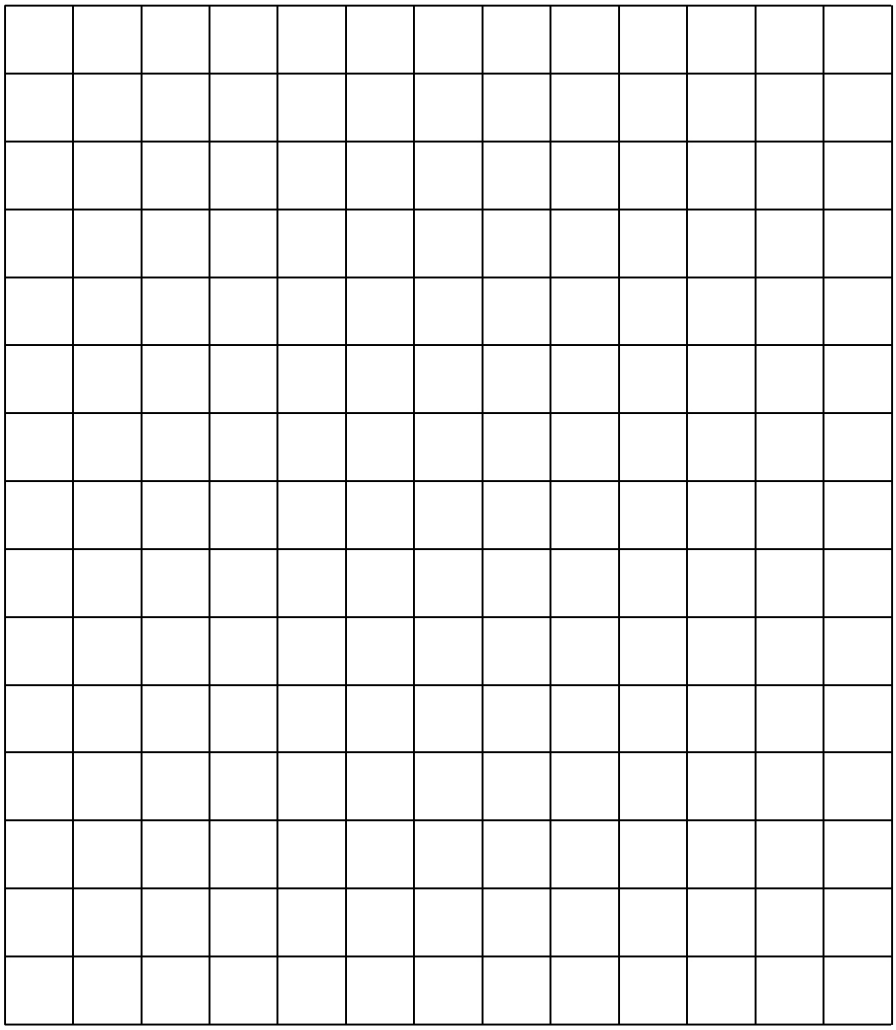
Goal • Use these pages to complete Find Out Activity 5-2A, Asexual Reproduction in Duckweed.

What to Do

1. Follow steps 1 to 4 on page 153 of *Discovering Science 9*. Use the table below to record your observations.

Day	Number of Plants	
	Sample A	Sample B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

2. At the end of two weeks, construct a line graph showing the number of plants that were growing each day. Use two separate lines to compare the numbers of plants growing in the two containers.



What Did You Find Out?

1. Describe the difference between the parent and offspring plants.

_____

_____

_____

2. How do you think the genetic material in the offspring compares with that of the parent?

_____

_____

_____

3. What was the purpose of setting up one container with distilled water?

_____

_____

_____

4. Which container showed the greater number of new plants? _____
Why?

_____

_____

_____

DATE: NAME: CLASS:

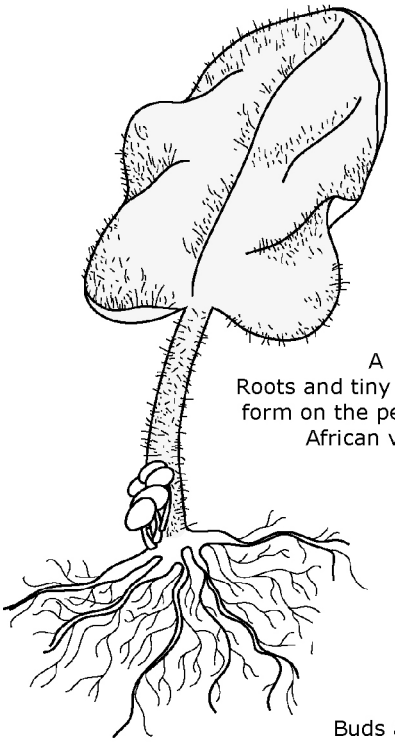
UNIT 2

New Plants from Cuttings

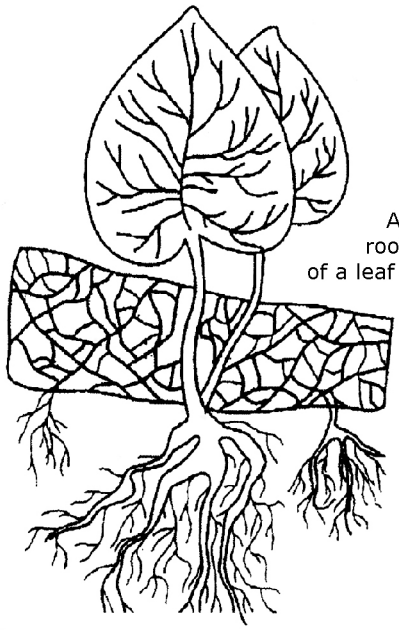
BLM 2-14

(Enrichment)

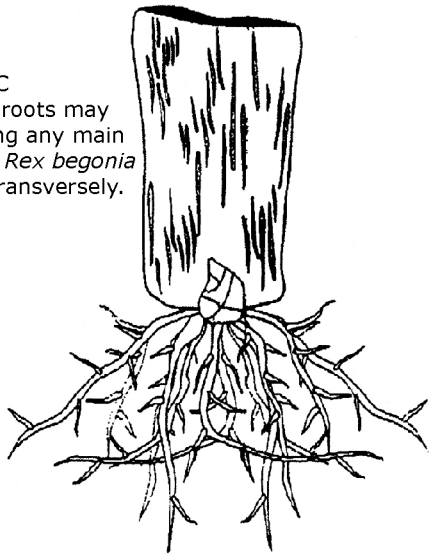
Goal • Learn how to make new plants from cuttings.



A
Roots and tiny new plants form on the petiole of an African violet



B
A bud and copious roots start at the base of a leaf cutting of a *Sansevieria.*



C
Buds and roots may appear along any main vein when a *Rex begonia* leaf is cut transversely.

DATE: NAME: CLASS:

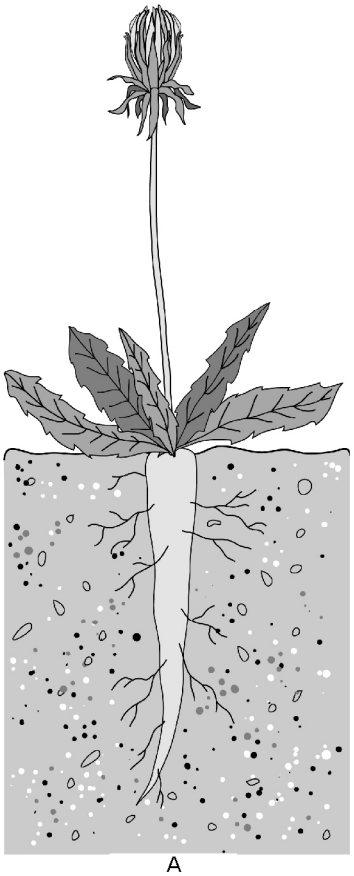
UNIT 2

New Plants from Roots

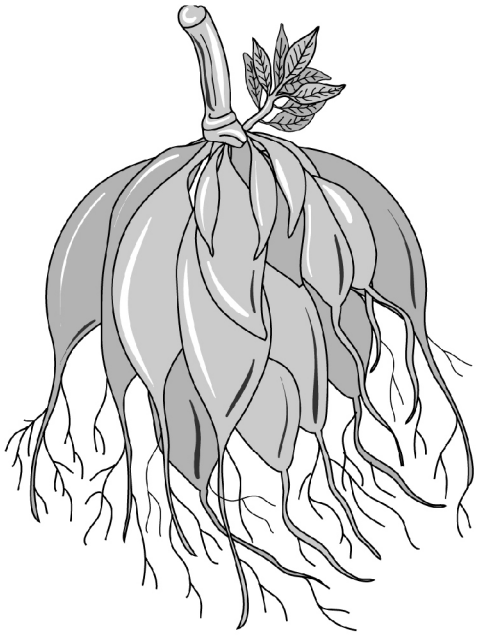
BLM 2-15

(Enrichment)

Goal • Learn how to make new plants from roots.



A
fleshy tap root
of a dandelion



B
clustered fleshy
roots of a dahlia

DATE: NAME: CLASS:

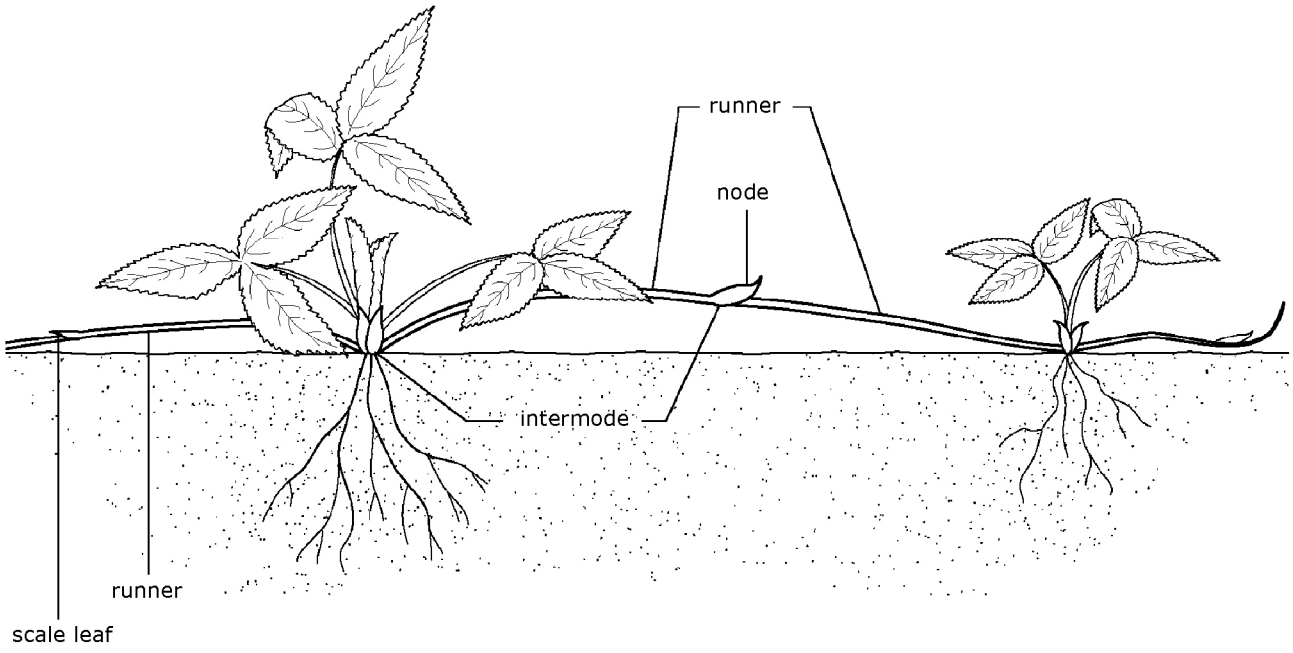
UNIT 2

New Plants from Stems

BLM 2-16

(Enrichment)

Goal • Learn how to make new plants from stems.



Strawberry plants reproduce by runners or stems.

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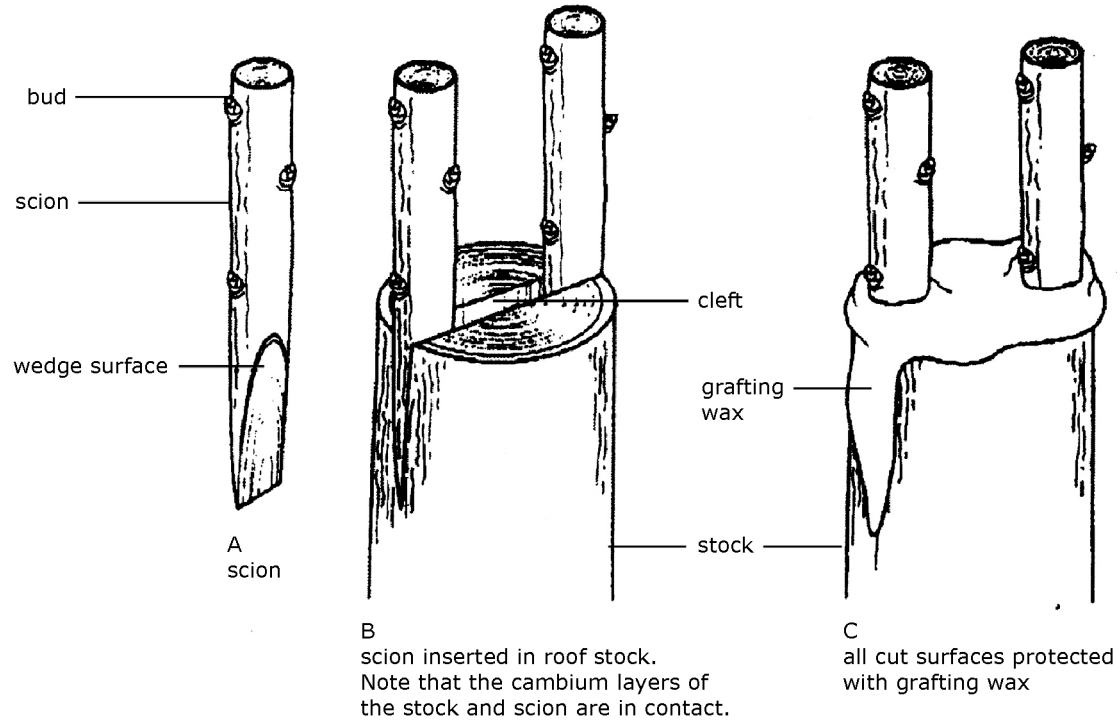
UNIT 2

New Plants from Grafting

BLM 2-17

(Enrichment)

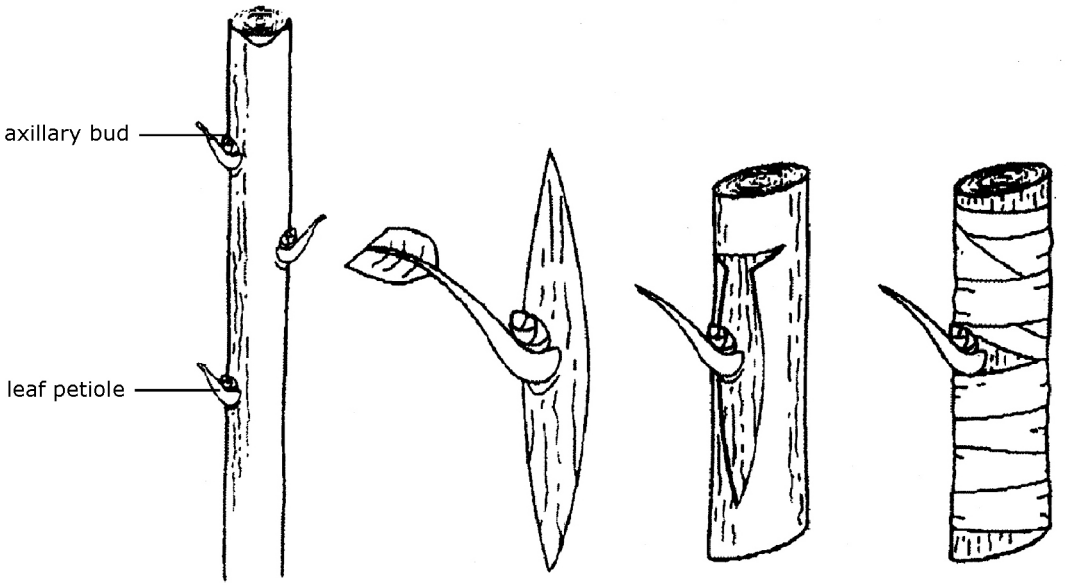
Goal • Learn how to make new plants from grafting.



A
scion

B
scion inserted in roof stock.
Note that the cambium layers of the stock and scion are in contact.

C
all cut surfaces protected with grafting wax



A
mature wood with buds

B
bud cut out and ready for grafting

C
bud inserted into T-shaped incision cut through bark of stock

D
bud bound in place

DATE: NAME: CLASS:

UNIT 2

Core Lab Conduct an Investigation 5-2B, Determining the Best Conditions for Yeast Reproduction

BLM 2-18

Goal • Use these pages to complete Core Lab Conduct an Investigation 5-2B, Determining the Best Conditions for Yeast Reproduction.

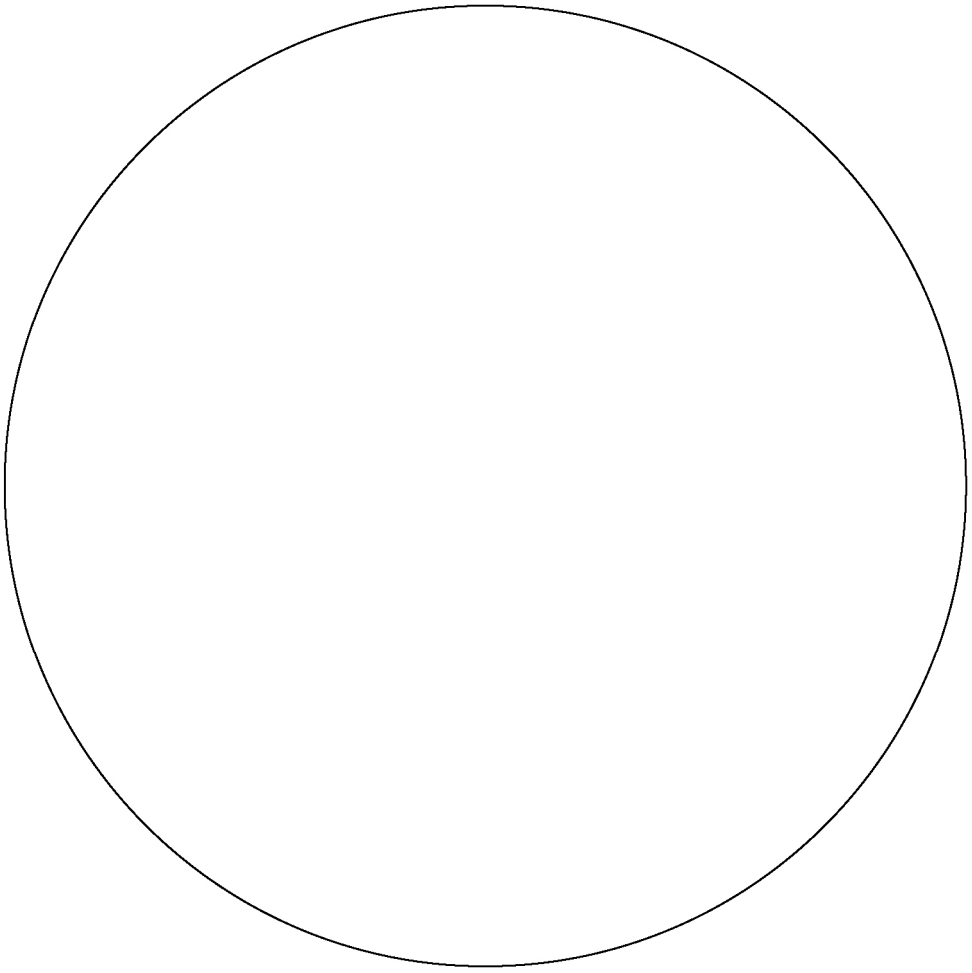
Question

What are the optimum conditions for yeast reproduction?

Procedure

Part 1 Observing Budding in Yeast

Follow steps 1 to 6 on page 162 of *Discovering Science 9*. Draw your observations in the circle below.



Part 2 Observing the Effect of Nutrients

Follow steps 7 to 15 on page 162 of *Discovering Science 9*. Record your observations in the table below.

Flask	Conditions	Fermentation Observed	Carbon Dioxide Produced (balloon circumference in centimetres)
A	0 g sucrose		
B	5 g sucrose		
C	30 g sucrose		
D	50 g sucrose		

Part 3 Observing the Effect of pH

Follow steps 16 to 25 on pages 162 and 163 of *Discovering Science 9*. Record your observations in the table below.

Flask	Conditions	Fermentation Observed	Carbon Dioxide Produced (balloon circumference in centimetres)
E	40°C + pH 3		
F	40°C + pH 5		
G	40°C + pH 7		
H	40°C + pH 10		

Analyze

1. Describe what you saw that indicated yeast reproduction.

_____

_____

2. Which flasks showed the greatest rate of yeast reproduction?

_____

3. Compare the contents of the flasks at the beginning of Part 2 and at the end of Part 2. Were they the same? _____
   Explain.

   _____

   _____

4. Compare the contents of the flasks at the beginning of Part 3 and at the end of Part 3. Were they the same? _____
   Explain.

   _____

   _____

5. What conditions were the least favourable for reproduction?

   _____

   _____

   _____

6. Describe the controls that were used in this investigation.

   _____

   _____

   _____

Conclude and Apply

1. Design an experiment to test the effect of temperature on yeast. Write out a list of materials and a procedure. If time permits, your teacher may allow you to carry out your experiment.
   Materials

Procedure

_____

_____

_____

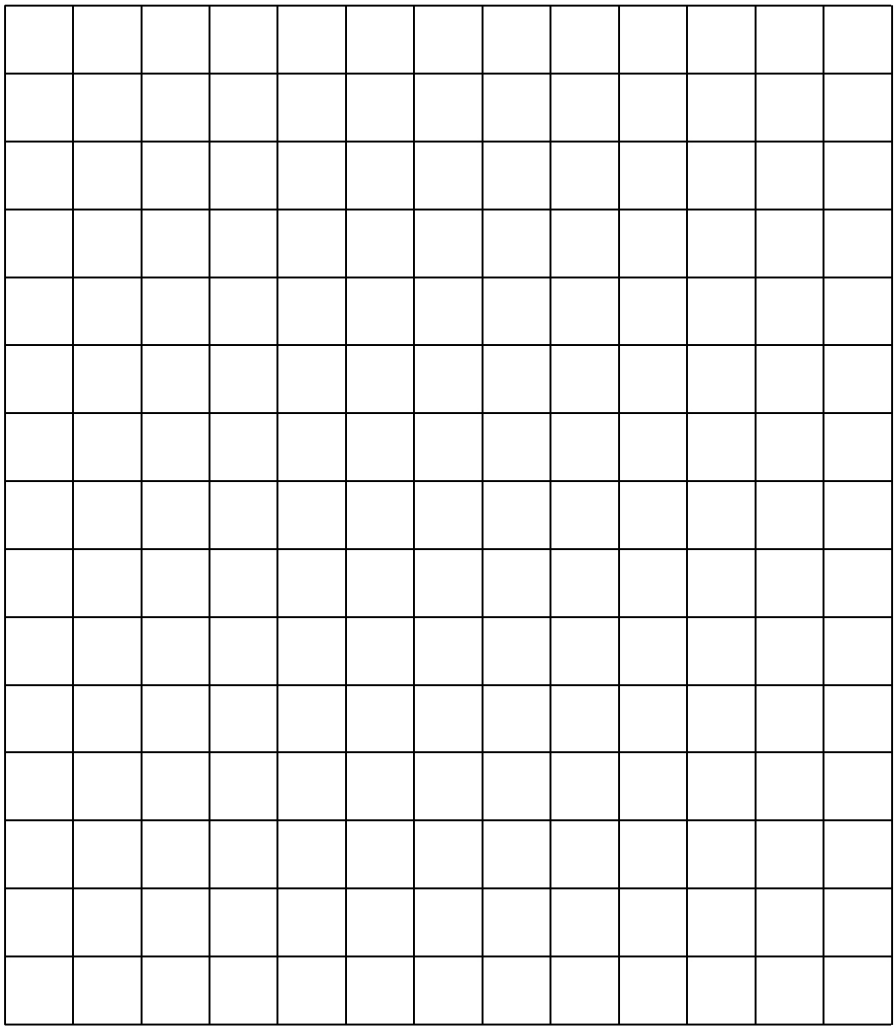
_____

_____

DATE: NAME: CLASS:

BLM 2-18 continued

2. Draw bar graphs to compare the balloon circumference with changing nutrient concentration. On the same graph, using different colours, draw bar graphs comparing the balloon circumference with changes in pH.



3. If a baker wanted to maximize the rising of a batch of bread, what suggestions would you give the baker?

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2

Chapter 5 Review

BLM 2-19

Goal • Check your understanding of Chapter 5.

What to Do

Circle the letter of the best answer.

1. Which of the following is the correct order of the three stages of the cell cycle?
   A. cytokinesis, replication, interphase
   B. interphase, cytokinesis, mitosis
   C. interphase, mitosis, cytokinesis
   D. interphase, replication, cytokinesis

2. What is the purpose of DNA replication?
   A. to make an identical copy of the DNA
   B. to pair new bases with bases on the original DNA
   C. to separate the contents of the cell's nucleus
   D. to separate the DNA strands

3. Which of the following is the correct order of the stages of mitosis?
   A. anaphase, metaphase, prophase, telophase
   B. anaphase, prophase, metaphase, telophase
   C. prophase, metaphase, anaphase, telophase
   D. telophase, anaphase, metaphase, prophase

4. How does the cell cycle differ in plants and animals?
   A. In animals, a cell plate forms between the daughter cells.
   B. In animals, the daughter cells are not identical to the parent.
   C. In plants, a cell plate forms between the daughter cells.
   D. In plants, the daughter cells are not identical to the parent.

5. Which of the following correctly describes cancer cell growth?
   A. Cancer cell growth is highly controlled.
   B. Cancer cells are unspecialized.
   C. Cancer cells cannot move to new locations.
   D. Cancer cells have no nucleus.

6. Which of the following organisms is correctly matched with its method of asexual reproduction?
   A. bacteria, budding
   B. bacteria, spores
   C. hydra, binary fission
   D. sea star, fragmentation

7. If a certain type of cell divided once every hour, how many cells would be produced after 8 h?
   A. 16 cells
   B. 32 cells
   C. 64 cells
   D. 256 cells

8. Which of the following is a disadvantage of asexual reproduction?
   A. Energy is not required to find a mate.
   B. Large colonies are produced.
   C. Many offspring are produced.
   D. Offspring are genetic clones.

9. What advantage does spore production have over other asexual methods of reproduction?
   A. All plants can produce spores.
   B. Spore production has no advantages.
   C. Spores can be carried long distances by wind, so the new individual can grow far away from the parent.
   D. Spores do not require moisture to grow.

10. What occurs during interphase?
    A. Chromosomes pair up at the centre of the cell.
    B. The cell grows. DNA and organelles are duplicated.
    C. The cell rests.
    D. The cell splits into two separate cells.

Match each Term on the left with the best Descriptor on the right.
Each Descriptor may be used only once.

Term	Descriptor
_____ 11. budding	A. the stage in which DNA creates a copy of itself
_____ 12. cytokinesis	B. the stage in which the cell carries out its functions in the organism
_____ 13. fragmentation	C. the process by which DNA creates a copy of itself
_____ 14. interphase	D. when a small piece of an organism breaks off and develops into a new organism
_____ 15. mitosis	E. the stage in which the two nuclei separate into two daughter cells
_____ 16. replication	F. when part of a cell pushes outward to form an outgrowth as part of asexual reproduction
_____ 17. vegetative reproduction	G. when special cells in a plant divide repeatedly to form structures that eventually develop into a new plant

Short Answer Questions

18. Why is the cell cycle necessary for life?

_____

_____

_____

19. (a) How are fragmentation and budding similar?

_____

_____

(b) How are fragmentation and budding different?

_____

_____

20. Explain the advantages of asexual reproduction.

_____

_____

_____

21. Explain the disadvantages of asexual reproduction.

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2

Unit 2 Key Terms

BLM 2-2

Goal • Review the Unit 2 Key Terms.

Chapter 4	Chapter 5	Chapter 6
chromosome	asexual reproduction	cervix
DNA (deoxyribonucleic acid)	binary fission	complete metamorphosis
gene	budding	embryo
gene mutation	cell cycle	fertilization
heredity	cytokinesis	fetus
mutagen	fragmentation	gametes
nucleus	interphase	genetic diversity
trait	mitosis	genome
	replication	incomplete metamorphosis
	spore	karyotype
	vegetative reproduction	meiosis
		metamorphosis
		ovary
		oviduct/fallopian tube
		ovules
		penis
		pollen
		pollination
		reproductive system
		scrotum
		sexual reproduction
		stem cell
		syndrome
		testes
		urethra
		uterus
		vagina
		vas deferens
		zygote

DATE: NAME: CLASS:

UNIT 2

How Variation Occurs in Meiosis

BLM 2-20

Goal • Review your understanding of how variation occurs in meiosis.

What to Do

Complete the flow chart to connect ideas about variation in meiosis.

As cells begin meiosis, they contain pairs of double-stranded chromosomes.
One of each pair is from one _____, and the other is from the other parent.

↓

Meiosis has two stages.

Meiosis I

Pairs of double-stranded chromosomes line up at the cell's equator.

↓

One _____ chromosome travels to each end of the cell. The cell divides.

Each new cell contains different genetic information than the parent cell did because

_____

_____

_____

↓

Meiosis II

Double-stranded chromosomes line up at the cell's equator. The chromosomes separate, and one strand travels to each end of the cell. The cell divides. One cell has produced _____ daughter cells. They contain only some of the genetic information in the parent because

_____

_____

DATE: NAME: CLASS:

UNIT 2 **Gametes** BLM 2-21

Goal • Review your understanding of gametes.

What to Do

Use the terms to complete the sentences. Terms may be used more than once. You will not need to use every term.

body cells, *chromosomes*, *sexual reproduction*, *egg cells*, *gametes*, *meiosis*, *mitosis*, *sperm cells*

1. Organisms produce _____ through mitosis.

2. The main job of _____ is to join together to produce a new organism.

3. In humans, _____ have 46 chromosomes.

4. Gametes are the only cells that are not produced by _____.

5. _____ are the female gametes.

6. _____ are the male gametes.

7. _____ contain the instructions that tell a cell how to develop.

Short Answer Question

8. Describe the relationship between chromosome numbers in body cells and gametes.

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2 # Mitosis and Meiosis **BLM 2-22**

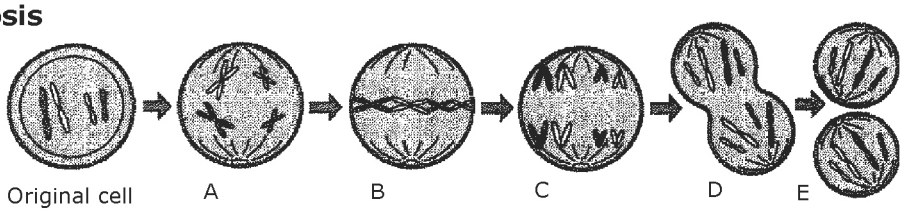
Goal • Review your understanding of mitosis and meiosis.

What to Do

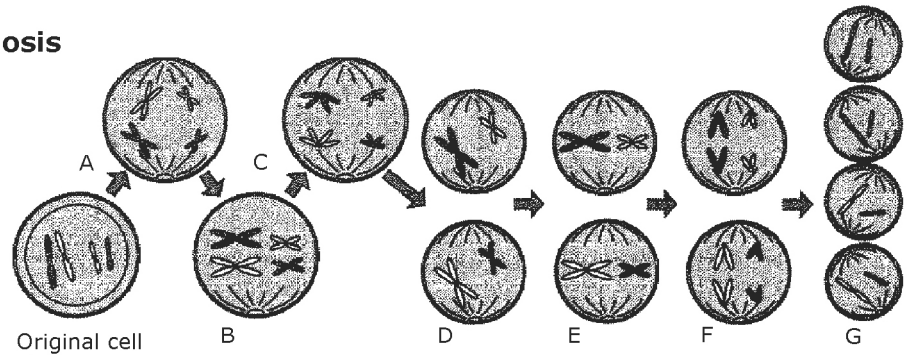
Mitosis and Meiosis are two different processes. These statements highlight some of the differences between mitosis and meiosis and some of the similarities.

Match each of the following descriptions with the corresponding event in the diagram. Write the letter that applies in each blank. Each letter should be used once.

Mitosis



Meiosis



_____ 1. In meiosis, the chromosomes separate but strands remain joined. In mitosis, strands separate.

_____ 2. In meiosis, pairs of single-stranded chromosomes separate.

_____ 3. Chromosomes double in both mitosis and meiosis.

_____ 4. Mitosis is complete, but another division is about to take place in meiosis. The chromosomes line up along the centre of the cell.

_____ 5. Chromosomes are still double-stranded in meiosis, but not in mitosis.

_____ 6. Chromosomes line up in pairs in meiosis but not in mitosis.

_____ 7. These cells have half the genetic information of their parent cells.

Short Answer Question

8. Compare the number of chromosomes at the end of mitosis and meiosis for an organism that has 20 chromosomes in every body cell.

_____

_____

_____

DATE: NAME: CLASS:

Cell Reproduction

Goal • Review your understanding of mitosis and meiosis.

What to Do

Read each statement below. If the statement is true, write "T" on the line in front of the statement. If it is false, write "F" and rewrite the statement to make it true.

____ 1. Gametes have twice as many chromosomes as body cells.

_____

____ 2. Zygotes are produced by the union of sperm and egg cells.

_____

____ 3. Meiosis may form egg cells.

_____

____ 4. Gametes are formed during mitosis.

_____

____ 5. Only a zygote with the full number of chromosomes can function as the offspring's first body cell.

_____

____ 6. Four new cells are formed from each parent cell in meiosis.

_____

____ 7. There are two cell divisions during mitosis.

_____

____ 8. If a cell with six chromosomes undergoes mitosis, each new cell will also have six chromosomes.

_____

_____

DATE: NAME: CLASS:

UNIT 2

Gamete Summary

BLM 2-24

Goal • Summarize what you understand about gametes.

What to Do

What kind of human cell has each of the following traits? Place a check mark (✓) in the correct column.

Trait	Sperm Cell	Egg Cell	Both Sperm Cells and Egg Cells
1. has a tail			
2. has 23 chromosomes			
3. involved in fertilization			
4. formed in testes			
5. is able to move			
6. produced by meiosis			
7. formed in ovaries			
8. has a food reserve			
9. forms a zygote			

Short Answer Question

10. Describe how a zygote is produced.

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2

Compare the Results of Meiosis and Mitosis

BLM 2-25

Goal • Compare the results of mitosis and meiosis.

What to Do

Complete the table to compare meiosis and mitosis for a cell that has **four** chromosomes.

Question	Meiosis	Mitosis
1. What type of cell results from this process?		
2. How many chromosome pairs are in the original cell?		
3. How many chromosomes are in each new cell at the end of cell division?		
4. How many chromosome pairs are in each new cell at end of cell division?		

Short Answer Questions

5. Compare the location and arrangement of chromosomes in the cell during metaphase I in meiosis and metaphase in mitosis.

_____

_____

6. Compare the location and arrangement of chromosomes in the cell during anaphase I in meiosis and anaphase in mitosis.

_____

_____

7. How do the end results of meiosis and mitosis differ?

_____

_____

8. Predict what would happen if gametes were produced by mitosis rather than meiosis.

_____

_____

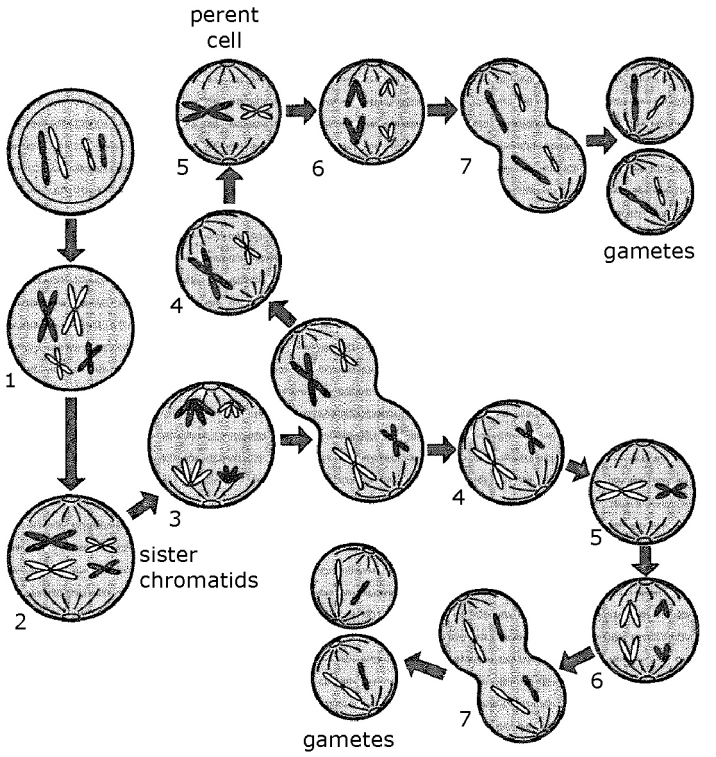
DATE: NAME: CLASS:

UNIT 2 # Meiosis **BLM 2-26**

Goal • Review the key events in meiosis.

What to Do

Use the diagram to answer the questions.



1. In step 1, each chromosome doubles itself, forming two identical copies in a double strand.
   How many double-stranded chromosomes are there? _____

2. The double-stranded chromosomes come together in matching pairs in step 2. Where do they line up?
   _____
   _____

3. The pairs of double-stranded chromosomes separate in step 3.
   Are the chromosomes that have been pulled to each pole all the same or are they different?
   _____

4. In step 4, the first division of meiosis has occurred and the cell has formed two new cells. Is the genetic information in each cell the same or different?
   _____

5. In step 5, the chromosomes again line up along the centre of each new cell. How does this step differ from step 2?
   _____
   _____

6. In step 6, the single-stranded chromosomes separate and move to opposite ends of the cell. Is the genetic information on the chromosomes at each end of the cell the same or different?
   _____

7. The cells divide in step 7.
   (a) How many new cells are formed by meiosis? _____
   (b) Compared to the parent cell, how many chromosomes does a new cell have? _____

DATE: NAME: CLASS:

UNIT 2

The Male Reproductive System

BLM 2-27

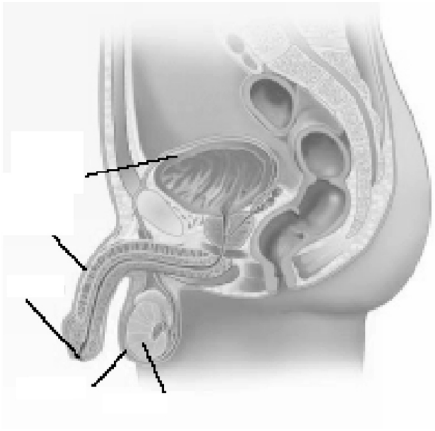
Goal • Review the structures and function of the male reproductive system.

What to Do

Match each structure in the male reproductive system with its function.

Structure	Function
_____1. penis	A. produce sperm (male gametes) by meiosis and release hormones
_____2. scrotum	B. muscular tubes in which sperm mix with fluids to form semen as the sperm are moved from the testes to the urethra. Can house sperm for several months.
_____3. testes	C. contains the urethra for the delivery of sperm
_____4. urethra	D. protects the testes, maintaining them at a cooler temperature than the body core
_____5. vas deferens	E. opening through which sperm leave the body

6. Label the diagram.



DATE: NAME: CLASS:

UNIT 2

The Female Reproductive System

BLM 2-28

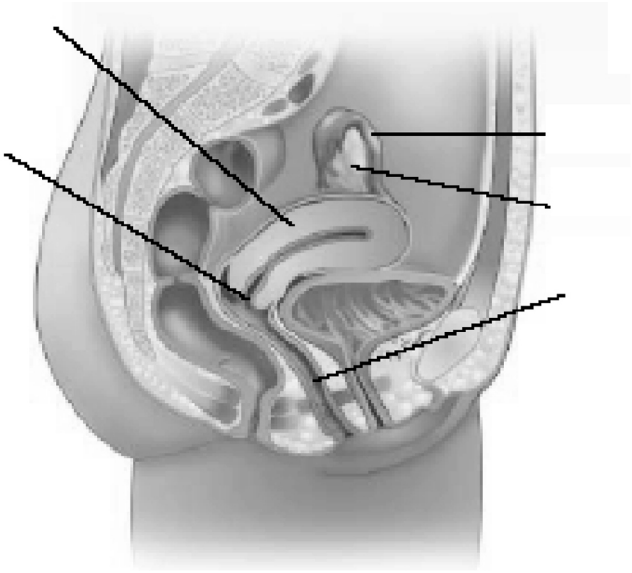
Goal • Review the structures and function of the female reproductive system.

What to Do

Match each structure in the female reproductive system with its function.

Structure	Function
_____1. cervix	A. location of fertilization. Connect the ovaries to the uterus, although not physically connected to the ovaries.
_____2. ovaries	B. Sperm travel through this opening on the way to the uterus. Dilates (opens) to allow the baby to leave the body during childbirth.
_____3. oviducts/fallopian tubes	C. protects and nourishes the zygote during development. Connects the oviducts to the cervix.
_____4. uterus	D. Sperm are deposited here, their first stop on the way to the egg. Opening through which the baby leaves the body, or through which unfertilized eggs leave the body.
_____5. vagina	E. produce eggs (female gametes) by meiosis and release hormones

6. Label the diagram.



DATE: NAME: CLASS:

UNIT 2

Chapter 6 Review

BLM 2-29

Goal • Check your understanding of Chapter 6.

What to Do

Circle the letter of the best answer.

1. Which of the following is the correct order in sexual reproduction?
   A. fertilization, meiosis, gamete, embryo
   B. gamete, fertilization, meiosis, embryo
   C. gamete, meiosis, fertilization, embryo
   D. meiosis, gamete, fertilization, embryo

2. Which of the following is an example of complete metamorphosis?
   A. a genetic disorder
   B. a human embryo that will change significantly before birth
   C. an insect larva that does not resemble its parent
   D. cloning

3. How are mitosis and meiosis II similar?
   A. double-stranded chromosomes separate and move to opposite poles
   B. identical daughter cells are produced
   C. single-stranded chromosomes separate and move to opposite poles
   D. the number of chromosomes is doubled

4. Which of the following is only true for mitosis?
   A. cells divide twice
   B. gamete cells are produced
   C. genetically different cells are produced
   D. genetically identical cells are produced

5. For a mutation to be inherited, it must occur in which of the following types of cells?
   A. cancer cell
   B. gamete cell
   C. muscle cell
   D. skin cell

6. Cow body cells have 60 chromosomes. How many chromosomes will be in one egg cell after meiosis II?
   A. 15 chromosomes
   B. 30 chromosomes
   C. 60 chromosomes
   D. 120 chromosomes

7. What is the main advantage of sexual reproduction?
   A. Fewer offspring are produced.
   B. The embryo is protected from dehydration.
   C. The offspring are genetically different from the parents.
   D. Very little energy is required to find a mate.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
_____ 8. fetus	A. produces sperm and release hormones
_____ 9. ovaries	B. muscular tubes in which sperm mix with fluids
_____ 10. testes	C. opening through which sperm leave the body
_____ 11. urethra	D. produces eggs and release hormones
_____ 12. uterus	E. protects and nourishes the zygote
_____ 13. vagina	F. location where sperm are deposited and where the baby leaves the body
_____ 14. vas deferens	G. an embryo that is at least eight weeks old

Short Answer Questions

15. Explain how the events of sexual reproduction produce variation in a species.

_____

_____

16. Explain the role moisture plays in sexual reproduction in mosses.

_____

_____

17. Explain the role parents play in sexual reproduction in most mammals.

_____

_____

18. What signs might help a woman determine that she is pregnant?

_____

_____

DATE: NAME: CLASS:

UNIT 2

Chapter 4 Key Terms

BLM 2-2A

Goal • Review the Key Terms in Chapter 4.

Key Terms

chromosome
DNA (deoxyribonucleic acid)
gene
gene mutation
heredity
mutagen
nucleus
trait

1. Work in a small group. Choose three key terms and write a riddle about each one. Other group members should write riddles about three different key terms.

2. Ask other group members to guess the answers to your riddles while you guess the answers to theirs. Together, check the answers, and revise the riddles as needed.

For example:
I am the process where patterns of traits are passed on from an individual to its offspring.
What am I? _____

Riddle 1: _____

_____

What am I? _____

Riddle 2: _____

_____

What am I? _____

Riddle 3: _____

_____

What am I? _____

DATE: NAME: CLASS:

UNIT 2

Chapter 5 Key Terms

BLM 2-2B

Goal • Review the Key Terms in Chapter 5.

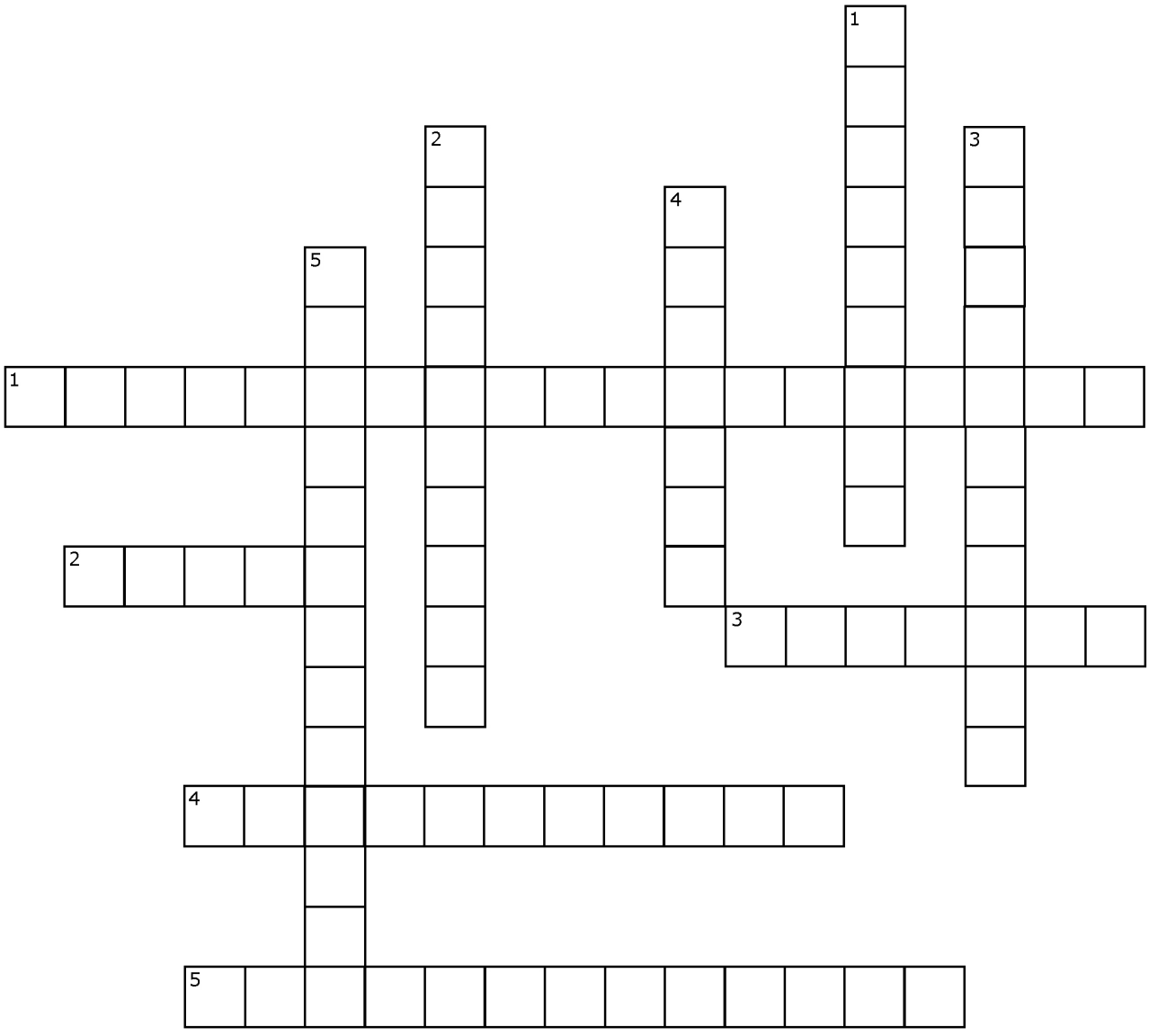
Create a list of 10 key terms from the descriptions below. Then use the key terms to complete the crossword puzzle.

Across	Key Term
1. the process where only one parent is required to produce offspring, which look identical to the parent and to each other	
2. a reproductive cell that grows into a new individual by mitosis	
3. the process where part of a yeast cell pushes outward to form an outgrowth or bud that then pinches off from the parent cell to become a yeast cell, identical to the parent cell	
4. the process that separates the two nuclei into two daughter cells	
5. the process where a single parent cell replicates its genetic material and divides into two equal parts	

Down	Key Term
1. the process where the life of the cell is divided into three stages	
2. the longest stage in the cell cycle where the cell carries out its various functions within the organism	
3. the phase in which DNA copies or makes a "replica" of itself	
4. the process in which the contents of a cell's nucleus divide, resulting in two daughter nuclei, each with the same number and kinds of chromosomes as the original cell	
5. the process in which an organism breaks apart as a result of injury and each fragment then develops into a clone of its parent	

DATE: NAME: CLASS:

BLM 2-2B continued



DATE: NAME: CLASS:

UNIT 2

Chapter 6 Key Terms

BLM 2-2C

Goal • Review the Key Terms in Chapter 6.

Match each key term in the left column with its definition in the right column. Write the missing definition for part C2.

Key Term	Definition
_____ 1. cervix	A. the process where an egg cell is penetrated by a sperm cell, and the genetic information of both male and female gametes combines
_____ 2. complete metamorphosis	B. the only organ system in the body that differs between males and females
_____ 3. embryo	C. a picture prepared by cutting and pasting chromosomes taken from body cells during mitosis
_____ 4. fertilization	D. the opening through which sperm travel on the way to the uterus, and which dilates (opens) to allow the baby to leave the body during childbirth
_____ 5. fetus	E. a process requiring two parents that produces offspring that are genetically different from each other, from either parent, and from any other member of their species
_____ 6. gametes	F. a particular disease or disorder with a specific group of symptoms that occur together
_____ 7. genetic diversity	G. a change in the individual's form
_____ 8. genome	H. the process where the wingless, wormlike larva (called a grub or a caterpillar) is completely different from the adult
_____ 9. incomplete metamorphosis	I. a zygote that has undergone mitosis and cell division
_____ 10. karyotype	J. an embryo at eight weeks of development, with bone cells forming

_____ 11. meiosis	K. a process that involves subtle changes through three life stages: egg, nymph, and adult
_____ 12. metamorphosis	L. protects the testes, maintaining them at a cooler temperature than the body core
_____ 13. ovaries	M. consists of the full set of genetic material that makes up an organism
_____ 14. oviducts/fallopian tubes	N. protects and nourishes the zygote during development, and connects the oviducts to the cervix
_____ 15. ovules	O. the process that occurs in sex cells and that produces gametes with half the number of chromosomes as body cells
_____ 16. penis	P. a cell that receives half its chromosomes from its female parent and half from its male parent
_____ 17. pollen	Q. muscular tubes in which sperm mix with fluids to form semen as the sperm are moved from the testes to the urethra
_____ 18. pollination	R. cells that have the potential to become many different types of cells
_____ 19. reproductive system	S. structures that carry the sperm cells in a protective case to the ovules
_____ 20. scrotum	T. specialized cells necessary for reproduction
_____ 21. sexual reproduction	U. contains the urethra for delivery of sperm
_____ 22. stem cells	V. the transfer of male gametes from the male reproductive part of a plant to the female reproductive part of a plant
_____ 23. syndrome	W. the result of sexual reproduction, which randomly sorts, or shuffles, DNA
_____ 24. testes	X. the area where sperm are deposited, which is their first stop on the way to the egg, and the opening through which the baby leaves the body, or through which unfertilized eggs leave the body

_____ 25. urethra	Y. produce eggs (female gametes) by meiosis and release hormones
_____ 26. uterus	Z. the location of fertilization where ovaries are connected to the uterus, although they are not physically connected to the ovaries
_____ 27. vagina	A2. produce sperm (male gametes) by meiosis and release hormones
_____ 28. vas deferens	B2. opening through which sperm leave the body
_____ 29. zygote	C2.

DATE: NAME: CLASS:

UNIT 2

Making Predictions about Mutations

BLM 2-3

Goal • Use this page to make predictions about mutations.

What to Do

Predict the meaning of each term in the table. Give an example if possible.
Read pages 124 to 129 of *Discovering Science 9*. Confirm or correct your predictions.

Term	Before Reading What I Think the Term Means/Example	After Reading What the Term Means/Example
Mutagen		
Environmental Mutagen		
Mutagens that result from human activity		
Gene therapy		

DATE: NAME: CLASS:

UNIT 2

Making a Decision for Genetown Stakeholder List

BLM 2-30 (Enrichment)

Goal • Use this page to determine your stakeholder position for the Unit 2 Project, Making a decision in Genetown.

What to Do

Choose one of the following roles to represent.

1. A patient who had unsuccessful stem cell treatment.
2. An entrepreneur who wants to open a national umbilical cord bank and is willing to help fund this project.
3. A 40-year-old person afflicted with Parkinson's disease.
4. A couple who have a child afflicted with leukemia. They have stored embryos at the in vitro clinic and they are hopeful that stem cell research will cure their afflicted child.
5. The child and caregiver of parents who both have Alzheimer's disease.
6. A representative of a drug company that wants to use stem cells to test drugs.
7. A high school student who became a paraplegic following a skiing accident.
8. A person who has heart cell damage following a heart attack.
9. A politician who is looking out for public safety over economic gains.
10. A member of the National Bioethics Society who questions if everyone will have equal access to stem cell treatment.
11. A Right to Life advocate who believes that an embryo should receive the same respect before birth as it would if already born.
12. A couple who spent thousands of dollars for successful in vitro fertilization treatments. They now have two children but they have a lot of debts and would be willing to sell their remaining frozen embryos.
13. A local resident who is afraid that the research company is going to manufacture an army of human clones.
14. A somatic cell nuclear transfer specialist.

15. A doctor from the provincial children's hospital.

16. A concerned citizen who believes that this overseas company will obtain embryos illegally.

17. A religious leader.

18. A researcher from the nearby university college who is studying the development of humans from fertilized egg to adult.

19. The director of the in vitro fertilization clinic in the city.

20. The largest financial investor in Stem Cells Now.

21. A director of the biotechnology department of the university college who hopes to attract world leaders in stem cell research to the province and to Genetown.

22. A Genetown taxpayer.

23. A local mall owner.

24. The mayor who will conduct the meeting.

25. A town council member who will listen to the viewpoints, then meet to vote and decide on the future of Stem Cells Now in Genetown.

26. A town council member who will listen to the viewpoints, then meet to vote and decide on the future of Stem Cells Now in Genetown.

27. A town council member who will listen to the viewpoints, then meet to vote and decide on the future of Stem Cells Now in Genetown.

28. A patient who had a successful stem cell treatment.

29. An unemployed but skilled worker who could work for Stem Cells Now.

30. A construction contractor who would build the Stem Cells Now building.

DATE: NAME: CLASS:

UNIT 2

Presentation Organizer

BLM 2-31

Goal • Prepare for a formal presentation to a committee.

What to Do

Use this page to organize your arguments.

My role _____

Props I will use _____

Arguments I will present

Argument	Support for my argument

DATE: NAME: CLASS:

UNIT 2

Debate Procedures

BLM 2-32

Goal • Review and use the process of a formal debate.

Think About It

A formal debate has an orderly step-by-step procedure that is followed by people who take opposing or contradictory views of issues presented as resolutions. There can be four speakers, two for the resolution and two against. A debate chair introduces the resolution, rules, speakers, and the order in which the speakers present their views. The debate chair also announces the winner after taking a vote to determine which side supported its points better.

Speaker	Time	Job
Speaker #1 for the resolution	3 min	• clarifies the resolution or issue • supports the resolution • often introduces a plan showing how the resolution could be implemented
Speaker #1 against the resolution	3 min	• challenges the definitions, points, and evidence given by Speaker #1 for the resolution • offers points against the resolution • sums up why Speaker #1 was wrong or misguided and why the negative position is preferred
Speaker #2 for the resolution	3 min	• counters the points given by Speaker #1 against the resolution • supports the good points made by Speaker #1 for the resolution • makes new points
Speaker #2 against the resolution	3 min	• makes new points • counters specific points supporting the resolution • clarifies the position against the resolution
		BREAK FOR UP TO THREE MINUTES
Speaker against the resolution	2 min	• points out where speakers for the resolution have failed to prove their points • sums up the points made by the team against the resolution
Speaker for the resolution	2 min	• points out why the resolution must succeed • makes a final review of the position for the resolution

DATE: NAME: CLASS:

UNIT 2

Unit 2 Test

BLM 2-33

Goal • Test your understanding of Unit 2, Reproduction.

What to Do

Circle the letter of the best answer.

1. Why do skin cells function differently than muscle cells?
   A. different genes are made in muscle cells
   B. different proteins are made in skin cells
   C. they have different DNA
   D. they have different genes

2. Which of the following best describes the process of pollination?
   A. a method of asexual reproduction
   B. a stage in the sexual reproduction of insects
   C. brings the male and female gametes of plants together
   D. always requires insects

3. Which type of organism reproduces asexually by binary fission?
   A. amoeba
   B. potatoes
   C. sea stars
   D. yeast

4. What is a mutagen?
   A. a change to one or more genes on a chromosome
   B. a chemical that causes genes to change
   C. a substance or factor that can cause mutations in DNA
   D. an organism whose DNA has been altered

5. People with Down syndrome have
   A. 45 chromosomes in their karyotype
   B. 47 chromosomes in their karyotype
   C. one copy of chromosome
   D. 21three copies of chromosome 18

6. Which of the following events in mitosis is incorrect?
   A. DNA replicates
   B. double-stranded chromosomes pull apart
   C. the cell grows
   D. the nucleus disappears

7. Which of the following best describes the difference between mitosis and meiosis?
   A. Mitosis only occurs in single celled organisms.
   B. Mitosis plays a role in asexual reproduction but not in sexual reproduction.
   C. Mitosis produces more daughter cells than meiosis.
   D. Mitosis results in daughter cells identical to the parent cell, except for mutations.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
_____ 8. gametes	A. gametes in plants
_____ 9. mitosis	B. formed from the process of fertilization
_____10. zygote	C. produces genetically different offspring
_____11. meiosis	D. specialized cells needed for reproduction
_____12. pollen	E. the process where double-stranded chromosomes divide in two
_____13. sexual reproduction	F. produces daughter cells that are genetically unique

Short Answer Questions

14. How does the nucleus control the functions of life?

_____

_____

_____

15. Explain the relationship among genes, chromosomes, and DNA.

_____

_____

_____

16. List three types of asexual reproduction. Provide an example of each type.

_____

_____

_____

_____

17. (a) What are mutations?

(b) How are mutations caused?

18. Use the T-chart to compare the advantages of asexual reproduction and sexual reproduction.

Asexual Reproduction	Sexual Reproduction

19. Describe how the process of fertilization takes place within a flower.

20. What main events occur in fetal development within the first three months after fertilization?

21. Describe a syndrome that is caused by a chromosome mutation.

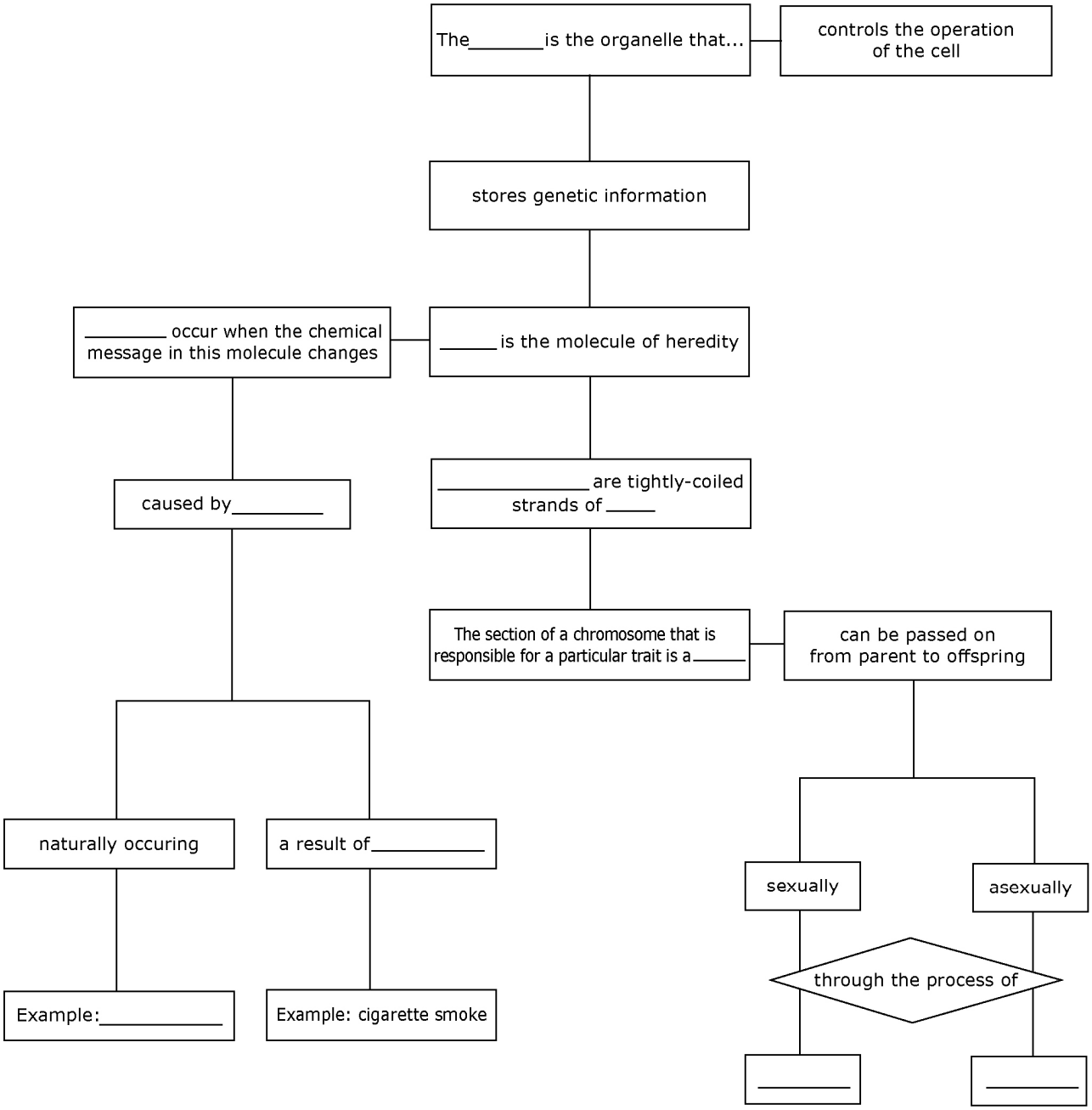
DATE: NAME: CLASS:

UNIT 2

Unit 2 Review Concept Map

BLM 2-34

Goal • Use this concept map to complete question 1, Unit 2 Review, page 218 of *Discovering Science 9*.



Unit 2 BLM Answers

BLM 2-2A, Chapter 4 Key Terms

Riddles will vary.
chromosome: a very compact, X-shaped structure made of DNA. Forms when the DNA is ready to divide.
DNA (deoxyribonucleic acid): carries the master set of instructions for cell function. The DNA molecule looks like a twisted ladder called a double helix.
gene: small segments of DNA located at specific places on a chromosome
gene mutation: change in the specific order of the A, G, C, and T bases that make up a particular gene. Can have a positive, negative, or neutral effect on an organism.
heredity: the process through which patterns of traits are passed on from an individual to its offspring
mutagen: substances or factors that can cause mutations in DNA. Can be natural or be caused by human activity
nucleus: the organelle that is responsible for heredity and for controlling the functions of the cell
trait: a particular feature that can vary in size or form from individual to individual within a species

BLM 2-2B, Chapter 5 Key Terms

Across
1. asexual reproduction
2. spore
3. budding
4. cytokinesis
5. binary fission

Down
1. cell cycle
2. interphase
3. replication
4. mitosis
5. fragementation

BLM 2-2C, Chapter 6 Key Terms

1. D
2. H
3. I
4. A
5. J
6. T
7. W
8. M
9. K
10. C
11. O
12. G
13. Y
14. Z
15. C2; the female plant structures that contain the egg cells
16. U
17. S
18. V
19. B
20. L

21. E
22. R
23. F
24. A2
25. B2
26. N
27. X
28. Q
29. P

BLM 2-3, Making Predictions about Mutations

Predictions and examples may vary.
positive mutation: errors in the sequence of DNA bases that produce proteins that are beneficial to an organism and therefore to the survival of its species; example: resistance to HIV
negative mutation: errors in the sequence of DNA bases that produce proteins that are harmful to an organism and could cause the species to become extinct; example: sickle cell anemia
neutral mutation: errors in the sequence of DNA bases that produce proteins that have no effect on an organism; example: the white coat colour of the Spirit Bear
mutagen: a substance or factor that can cause mutations in DNA; example: cigarette smoke
gene therapy: new experimental medical techniques used to treat mutated genes; example: experimental treatment for melanoma

BLM 2-4, Chapter 4 Review

1. B
2. B
3. A
4. C
5. B
6. D
7. E
8. C
9. D
10. F
11. B
12. A
13. The information contained in the nucleus instructs your cells to produce or import all of the materials they need to survive. The nucleus contains the master set of instructions that determines what each cell will become, how it will function, when it will grow and divide, and when it will die.
14. Answers may vary. Some people carry a mutated gene that produces the instructions for a protein that prevents HIV from infecting them. This means they will never develop AIDS. Other people have a gene mutation that makes their hemoglobin have an abnormal sickle shape (sickle cell anemia). These hemoglobin molecules cannot carry oxygen efficiently and cause other problems that make these people very sick.

BLM 2-6, Showing Cell Growth with Pennies

1. Answers will vary. The pennies will have more value than $1 000 000.

2.

Square	Value (cents)
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256
10	512
11	1024
12	2048
13	4096
14	8192
15	16384
16	32768
17	65536
18	131072
19	262144
20	524288
21	1048576
22	2097152
23	4194304
24	8388608
25	16777216
26	33554432
27	67108864
28	134217728
29	268435456
30	536870912

3. Predictions will vary. There will be approximately 9.2×10^{18} pennies on the 64th square (if they all fit!)
4. Factors include competition for resources such as food, water, oxygen, and space.
5. (a) Students should continue the graphed line with a positive slope, but the slope should decrease, become zero, or even become negative at some point.
   (b) Growth will slow at some point because the bacteria will use up all the oxygen, food, or space.

BLM 2-8, Stages of the Cell Cycle

Name of Cell Cycle Stage	Cell Activities	Nucleus Activities
Interphase	• longest stage of cell cycle • cell carries out its functions • cell doubles everything in cytoplasm	• DNA inside nucleus is replicated
Growth and preparation	• cell increases in size • cell makes proteins • organelles duplicate	
Replication		• DNA inside nucleus is replicated
Continued growth and preparation	• cell gets larger • cell makes proteins • organelles duplicate	
Mitosis	• shortest stage	• contents of cell nucleus divides
Early prophase	• protein fibres begin to form and centrioles appear in animal cells	• X-shaped chromosomes become visible • nuclear membrane begins to break down
Late prophase	• protein fibres complete forming • chromosomes attach to protein fibres	• nucleus no longer visible
Metaphase	• protein fibres pull chromosomes into a single line at equator	• nucleus no longer visible
Anaphase	• single-stranded chromosomes separate and move to opposite poles	• nucleus no longer visible
Telophase	• one complete set of chromosomes now at each pole of the cell • protein fibres disappear	
Cytokinesis	• two nuclei separated into two daughter cells • cell membrane pinches together to divide the cell's cytoplasm and organelles	• nucleus now bound by membrane

BLM 2-9, The Cell Cycle

1. B
2. F
3. D
4. C
5. A
6. E

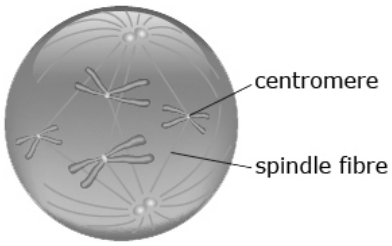
7.

Structure	Interphase	Prophase	Metaphase	Anaphase	Telophase	Cytokinesis
Nucleus	✓					✓
Cell membrane	✓	✓	✓	✓	✓	✓
Nuclear membrane	✓					✓
Chromosomes	✓	✓	✓	✓	✓	✓

8. Replicated DNA separates into two identical sets of DNA, one for each new cell's nucleus.

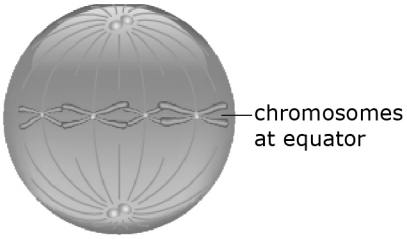
BLM 2-10, Steps of Mitosis

Phase 1: Prophase
Drawing:



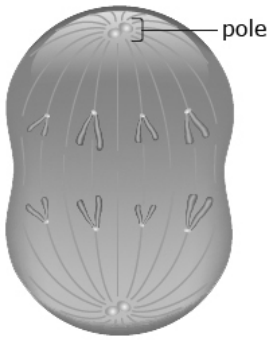
Description: Nucleus and nuclear membrane disappear. Protein fibres form and attach to double-stranded chromosomes.

Phase 2: Metaphase
Drawing:



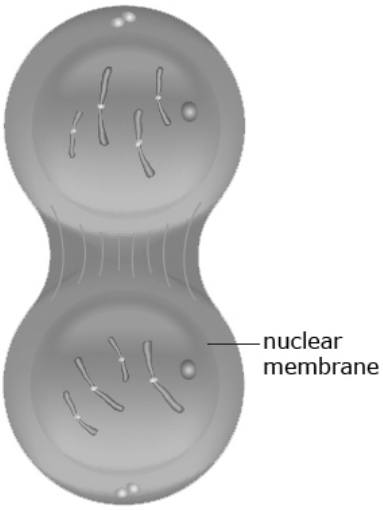
Description: Protein fibres pull double-stranded chromosomes across the middle of the cell.

Phase 3: Anaphase
Drawing:



Description: Protein fibres pull double-stranded chromosomes apart. Single-stranded chromosomes move to opposite poles of the cell.

Phase 4: Telophase
Drawing:



Description: One set of chromosomes is now at each pole of the cell. Protein fibres disappear. A nuclear membrane forms around each set of chromosomes.

BLM 2-11, Cell Growth and Division

1. telophase
2. anaphase
3. replication
4. cytokinesis
5. prophase
6. cytokinesis
7. metaphase
8. interphase
9. two cells

BLM 2-19, Chapter 5 Review

1. C
2. A
3. C
4. C
5. B
6. D
7. D
8. D
9. C
10. B
11. F
12. E
13. D
14. B
15. C
16. A
17. G
18. The cell cycle is necessary to life because all living things need to repair and replace the cells in their bodies.
19. (a) Fragmentation and budding are both methods of asexual reproduction.
    (b) Simple organisms like yeast and hydras reproduce by budding. More complex multicellular organisms reproduce by fragmentation.

20. No energy is required to find a mate. Many offspring are produced quickly.
21. Offspring are genetic clones. If the conditions change or a disease appears it could wipe out the whole population.

BLM 2-20, How Variation Occurs in Meiosis

1. meiosis I
2. meiosis II
3. double-stranded chromosomes
4. single-stranded chromosomes
5. crossing over, non-sister
6. double-stranded chromosomes

BLM 2-21, Gametes

1. body cells
2. gametes
3. body cells
4. mitosis
5. egg cells
6. sperm cells
7. chromosomes
8. Gametes have half the number of chromosomes as body cells.

BLM 2-22, Mitosis and Meiosis

1. C
2. F
3. A
4. E
5. D
6. B
7. G
8. After mitosis, there will be 20 chromosomes in a cell and after meiosis, there will be 10 chromosomes in a cell (gamete).

BLM 2-23, Cell Reproduction

1. F. Gametes have half as many chromosomes as body cells.
2. T
3. T
4. F. Gametes are formed during meiosis.
5. T
6. T
7. F. There is one cell division during mitosis.
8. T

BLM 2-24, Gamete Summary

1. sperm cell
2. both
3. both
4. sperm cell
5. sperm cell
6. both

7. egg cell
8. egg cell
9. both
10. A zygote is produced when the sperm fertilizes the egg.

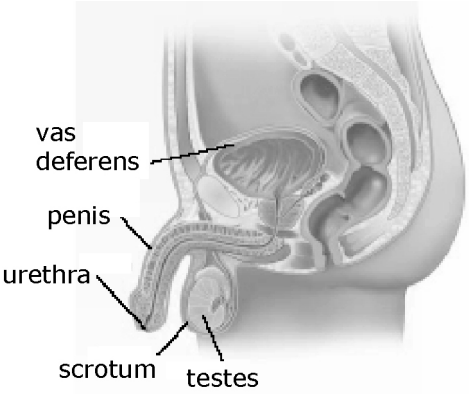
BLM 2-25, Compare the Results of Meiosis and Mitosis

1. gametes; body cells
2. two chromosome pairs; two chromosome pairs
3. two chromosomes; four chromosomes
4. zero chromosome pairs; two chromosome pairs
5. In mitosis, chromosomes are not paired, but they do line up along the cell centre. In meiosis, chromosomes first line up and then become arranged along the cell centre.
6. The locations are the same, but in meiosis, in each pair of single-stranded chromosomes, the original and copy are still attached to each other.
7. Mitosis produces two cells identical to the original cell. Meiosis produces four cells, each with half the chromosomes of the original cell.
8. The zygote would have twice the normal number of chromosomes.

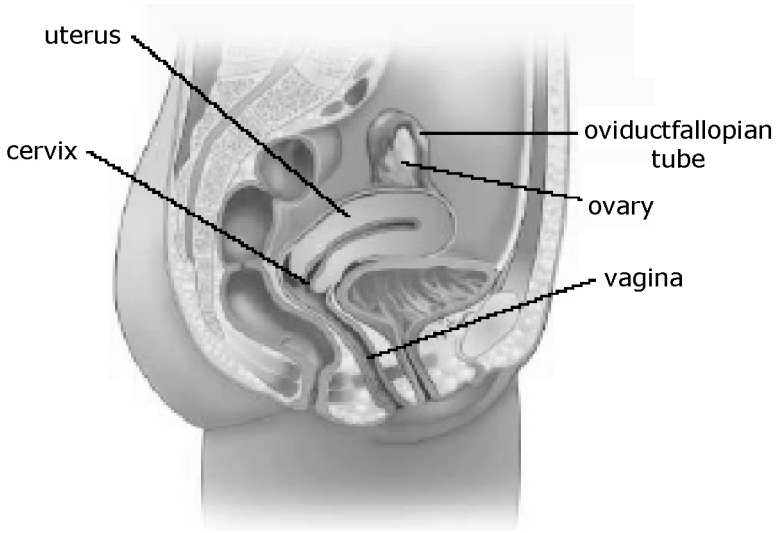
BLM 2-26, Meiosis

1. (a) four double-stranded chromosomes
   (b) eight single-stranded chromosomes
2. Across the centre of the cell.
3. (a) To opposite ends of the cell.
   (b) different
4. Each cell has one chromosome from each pair. Each chromosome is composed of two single-stranded chromosomes.
5. The chromosomes are not paired.
6. Pairs of single-stranded chromosomes separate as they do in mitosis.
7. (a) four new cells
   (b) Half the number of chromosomes.

BLM 2-27, The Male Reproductive System

1. C
2. D
3. A
4. E
5. B
6. 

BLM 2-28, The Female Reproductive System

1. B
2. E
3. A
4. C
5. D
6. 

BLM 2-29, Chapter 6 Review

1. D
2. C
3. A
4. D
5. B
6. B
7. C
8. G
9. D
10. A
11. C
12. E
13. F
14. B
15. Variation is produced through independent assortment and crossing over in meiosis and the meeting of egg and sperm in fertilization.
16. Mosses need water to move their gametes so the sperm and eggs will met.
17. Parents care for and protect their offspring, increasing the offspring's chance of survival.
18. Answers could include missed period(s), positive pregnancy test, sore breasts, widened hips, enlarged breasts, bulging belly, nausea, food cravings, aversion to foods, more frequent urination, fatigue, dizziness, stronger sense of smell, heartburn, weight gain, constipation, mood swings, higher body temperature, and cramping.

BLM 2-33, Unit 2 Test

1. B
2. B
3. A
4. C
5. B
6. C
7. D
8. D
9. E
10. B
11. F
12. A
13. C
14. The nucleus contains the genes that store the information to make proteins, and proteins have many different functions within the cell such as to function as enzymes and hormones.
15. DNA is loosely coiled in the nucleus until it is ready to be copied. Then it coils tightly into an X-shaped double helix called a chromosome. A gene is a small part of a chromosome that controls one trait. A chromosome can contain thousands of genes.
16. Answers could include budding in yeast, spore formation in fungus, vegetative reproduction in potatoes, fragmentation in sea stars, and binary fission in bacteria.
17. (a) Mutations are errors in the sequence of DNA bases which can have a positive, negative or neutral effect on an organism.
    (b) Mutations are caused by human made and natural mutagens such as cigarette smoke, X rays, UV rays, pollutants, and industrial chemicals.
18.

Asexual Reproduction	Sexual Reproduction
• Energy is not required to find a mate. • Large numbers of offspring are reproduced very quickly from only one parent when conditions are favourable. • Large colonies can form that can out-compete other organisms for nutrients and water. • Large numbers of organisms mean that species may survive when conditions or the number of predators change.	• Very little energy is required to find a mate (external fertilization). • Greater numbers of offspring can repopulate an area after a disaster (external fertilization). • More protection is given to the embryo and more parental care is given to offspring (internal fertilization). • Offspring are genetically different from their parents, so they may survive new diseases or other threats that appear in a population.

19. Pollen grains carry the sperm cells in a protective case to the ovules, which are the female plant structures that contain the egg cells. After the pollen lands on the female part of the plant, one or more structures form to deliver the sperm cells to the egg cells.
20. The main events in fetal development that occur within the first three months following fertilization are the formation of the brain and spinal cord; fingers appear; and eyes, kidneys, lung, liver, and muscles develop.
21. Down syndrome includes characteristic facial features, shorter stature, and a tendency to heart defects. It is caused by a chromosome mutation.

DATE: NAME: CLASS:

UNIT 2

Chapter 4 Review

BLM 2-4

Goal • Check your understanding of Chapter 4.

What to Do

Circle the letter of the best answer.

1. Which of the following is a trait?
   A. age
   B. eye colour
   C. name
   D. number of siblings

2. Which of the following gives a cell the instructions it needs to develop into a muscle cell, a bone cell, or a skin cell?
   A. chromosome
   B. DNA
   C. gene
   D. nucleus

3. Which one of the following statements is true?
   A. A gene stores the information to make a particular protein.
   B. All the genes within the nucleus of a cell will be copied to make a protein at some time in the life cycle of a cell.
   C. Different proteins have the same sequences of bases.
   D. Different types of cells in your body contain different genetic information.

4. What does DNA do when a cell is ready to divide?
   A. It divides into 46 parts.
   B. It divides into two parts.
   C. It folds up into a chromosome.
   D. It unfolds into a gene.

5. A gene mutation is which of the following?
   A. a change in the specific order of the sugar and phosphates that make up a particular protein.
   B. a change in the specific order of the A, G, C, and T bases that make up a particular protein.
   C. a substance that causes genes to be copied incorrectly.
   D. a substance that changes the DNA structure.

6. Which of the following is an example of a natural mutagen?
   A. cigarette smoke
   B. cleaning products
   C. industrial waste
   D. virus

Match the Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.	
Term	**Descriptor**
_____ 7. chromosome _____ 8. DNA _____ 9. gene _____10. gene mutation _____11. nucleus _____12. trait	A. feature that varies from individual to individual B. controls the functions of the cell C. long, two-stranded molecule that carries instructions for cell activities D. small segments of DNA located at specific places on a chromosome E. X-shaped structure of loosely folded DNA F. change in the order of A, G, C, and T bases in a gene

Short Answer Questions

13. Explain how the nucleus controls the activities within a cell.

_____

_____

_____

14. Describe two effects of specific gene mutations.

_____

_____

_____

_____

DATE: NAME: CLASS:

UNIT 2

Find Out Activity 5-1A, From One Cell to Many Cells

BLM 2-5

Goal • Use these pages to complete Find Out Activity 5-1A, From One Cell to Many Cells.

What to Do

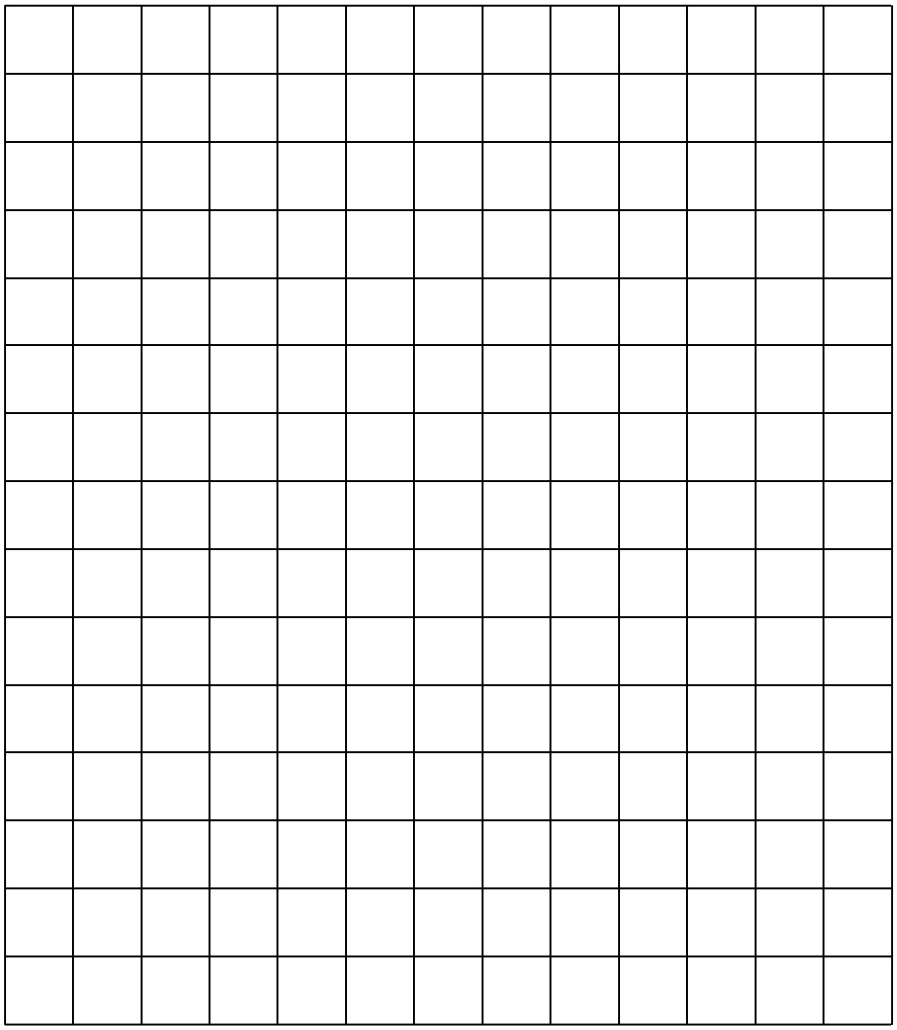
1. Assume that the cells divide once a day. Calculate how many cells will result in 30 d, if the cells do not stop dividing at any time during the 30 d period. Use the cell division chart below to organize your answers.

Day	Number of Cells	Day	Number of Cells	Day	Number of Cells
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

2. A mass of cells would become just visible to the eye at about 1 mm in width, which is about 250 000 cells. Calculate approximately on which day the cells would be visible.

_____

3. Use the information in your chart to plot a graph of cell number versus time.



4. Use your graph to determine approximately how many cells would be present after
   (a) 5.5 d of growth. _____
   (b) 17.5 d of growth. _____

What Did You Find Out?

1. If a scientist detected a tumour 1 cm in width, how many days would the cells have divided for the tumour to reach this size? _____

2. What do you think would happen if all cells in the human body continually divided without stopping?

_____

_____

3. Look at the pattern in the numbers you entered in the chart. How could you quickly calculate the number of cells that would be present after a particular number of days had passed?

_____

_____

4. (a) Without doing additional calculations, could you predict from your graph approximately how many cells would be present after 40 d of growth?

_____

_____

(b) In order to make the estimate in (a), you must assume that the pattern of cell growth will remain the same after 30 d. Do you think it is likely that these skin cells would continue to multiply at the same rate indefinitely?

_____

_____

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UNIT 2

Showing Cell Growth with Pennies

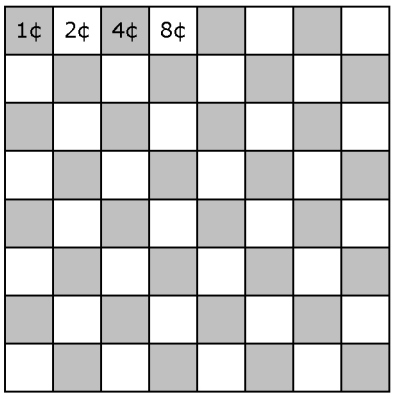
BLM 2-6

Goal • Investigate the effects of exponential growth.

What to Do

1. Imagine that you were told to place one penny on the first square of a checkerboard, two on the next square, four on the next, and to keep doubling the number of pennies on each square. Then, imagine that you were told you could either have all the pennies on the last square of the checkerboard, or have $1 000 000.00. Which would you choose? Do not calculate. Write your answer here.

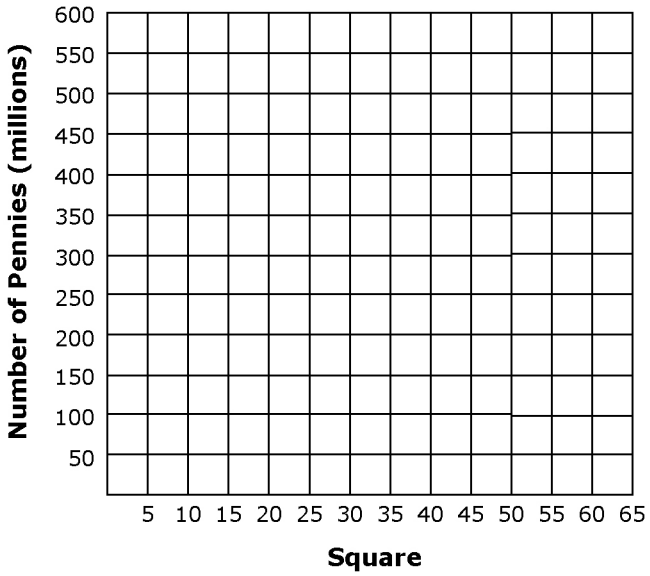
_____



3. Complete this table of values to show the value of the pennies on each of the first 30 squares.

Square	Value (cents)	Square	Value (cents)
1	1	16	
2	2	17	
3	4	18	
4	8	19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	

4. Draw a graph to show how the value of the pennies. Plot points on your graph for squares 1, 5, 10, 15, 20, 25, and 30.



What Did You Find Out?

1. Were you surprised by the values of the pennies on each square? Why or why not?

_____

2. The value of the pennies grows exponentially. Describe the speed of exponential growth at different stages. Refer to the shape of your graph. _____

_____

_____

3. Without doing additional calculations, use your graph to predict approximately how many pennies will be on the 64th square of a checkerboard._____

4. Cells can grow exponentially for a while, but eventually this growth slows down. What factors might cause the exponential growth of cells to slow down?

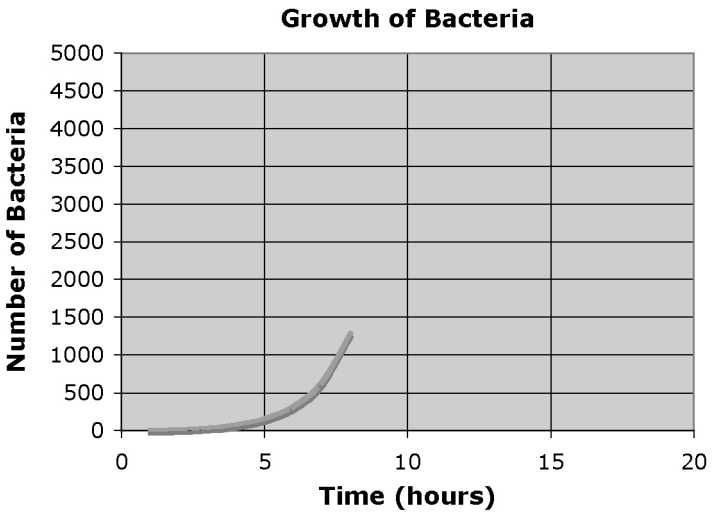
_____

_____

_____

5. (a) This graph shows the growth of a population of bacteria in a laboratory. Continue the line to show how many bacteria you think there might be after 10 h, 20 h, and 30 h.

Time (hours)	Number of bacteria
1	10
2	20
3	40
4	80
5	160
6	320
7	640
8	1280



(b) Explain why you drew the line where you did in part a.

_____

_____

_____

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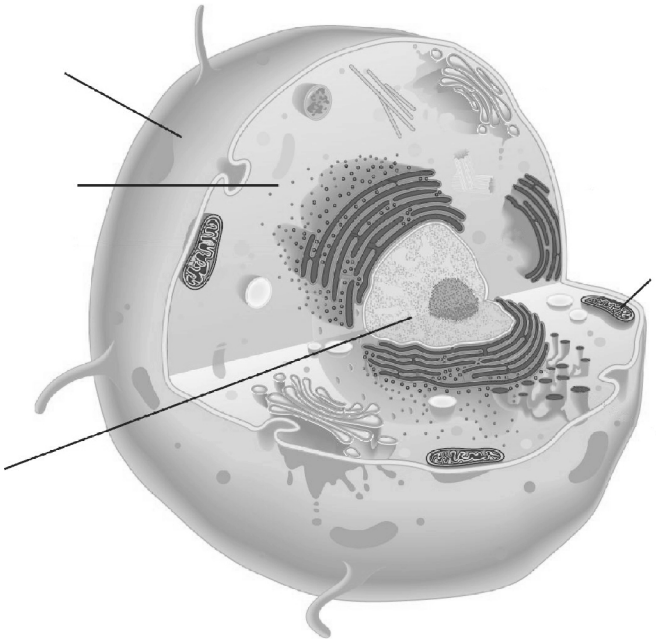
UNIT 2 # Parts of the Cell **BLM 2-7**

Goal • Review the parts of an animal cell and a plant cell.

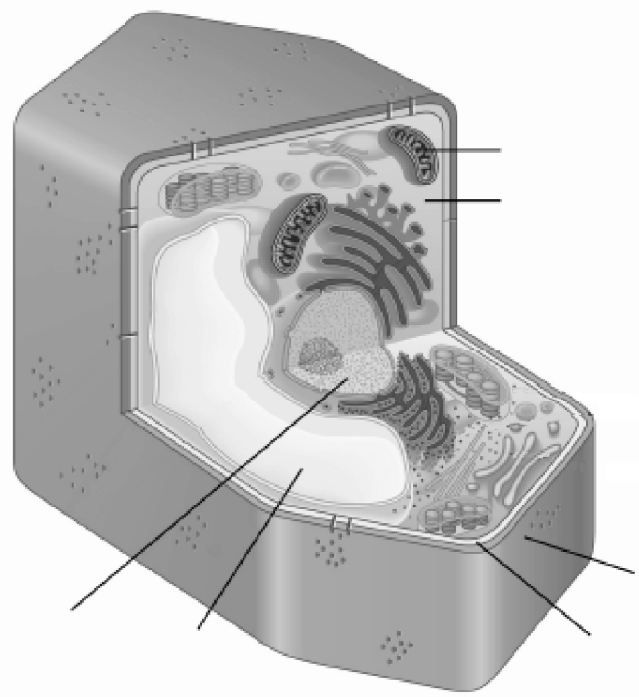
What to Do

Label the parts of each cell.

Animal Cell



Plant Cell



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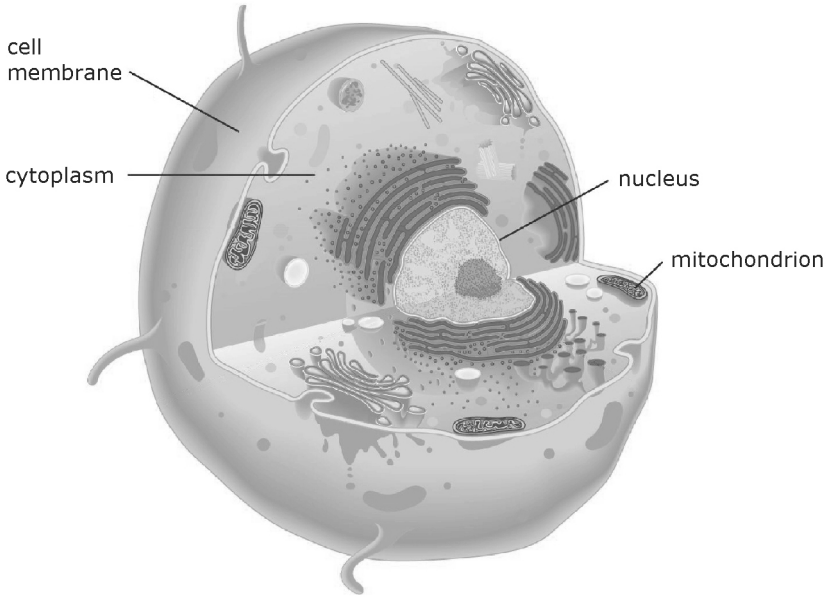
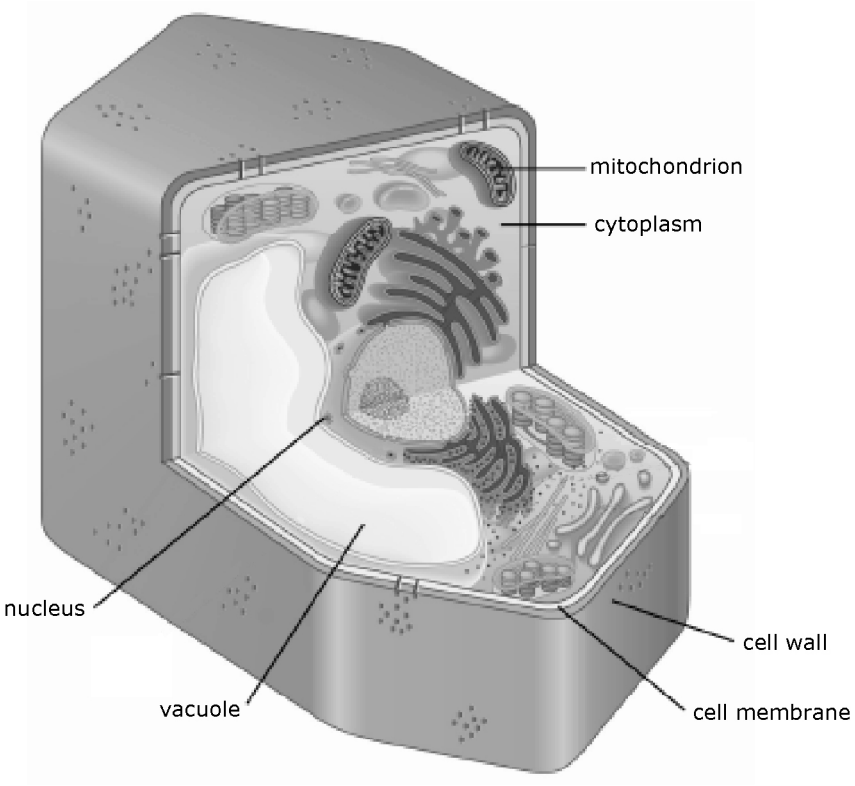
BLM 2-7 continued

Animal Cell



Plant Cell



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UNIT 2

Stages of the Cell Cycle

BLM 2-8

Goal • Use this page to record what you learn about the stages of the cell cycle.

What to Do

Complete the table as you read about the stages of the cell cycle on pages 139 to 144 of *Discovering Science 9*. Not all stages have activity in both the cell and the nucleus.

Name of Cell Cycle Stage	Cell Activities	Nucleus Activities
Interphase		
Growth and preparation		
Replication		
Continued growth and preparation		
Mitosis		
Prophase		
Metaphase		
Anaphase		
Telophase		
Cytokinesis		

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UNIT 2 # The Cell Cycle **BLM 2-9**

Goal • Review terms and concepts about the cell cycle.

Match the Term on the left with the best Descriptor on the right.
Each Descriptor may be used only once.

Term	Descriptor
_____ 1. interphase _____ 2. late prophase _____ 3. metaphase _____ 4. anaphase _____ 5. early prophase _____ 6. cytokinesis	A. chromosomes become visible B. cell grows and DNA replicates C. single-stranded chromosomes move toward opposite poles D. double-stranded chromosomes form a line across the middle of the cell E. nuclear membrane forms around each set of chromosomes F. chromosomes attach to protein fibres

7. If you watched each phase using a light microscope, which structures could you see? Mark the boxes with a check mark (✓).

Structure	Interphase	Prophase	Metaphase	Anaphase	Telophase	Cytokinesis
Nucleus						
Cell membrane						
Nuclear membrane						
Chromosomes						

Short Answer Questions

8. Describe the end result of mitosis.

_____

_____

_____