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3-1 What is heredity?

Lesson Review

Write *true* if the statement is true. If the statement is false, change the underlined term to make the statement true.

- _____ 1. Characteristics of an organism are called genetics.
- _____ 2. Genetics is the study of heredity.
- _____ 3. The passing of traits from parent to offspring is called reproduction.
- _____ 4. Traits that are passed from parents to their offspring are called acquired traits.
- _____ 5. Eye color is an example of an inherited trait.
- _____ 6. The first person to study heredity was Gregor Monk.
- _____ 7. During heredity, male and female sex cells join together.
- _____ 8. Mendel is often called the father of genetics.

Skill Challenge

Skills: relating concepts, analyzing

Reread the “Real-life Science” feature on page 65 of your text. Use the information in this feature and the illustration below to answer the following questions.

Single Fertilized Egg Splitting

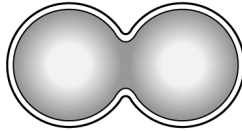


Diagram A

Pair of Eggs Being Fertilized

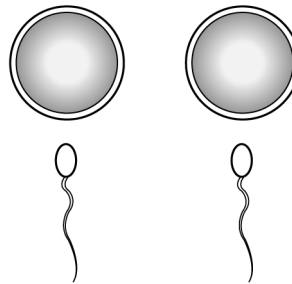


Diagram B

1. What are fraternal twins? Which diagram shows how fraternal twins are created? _____

2. What are identical twins? Which diagram shows how identical twins are created? _____

3. How do fraternal twins and identical twins differ in appearance? _____

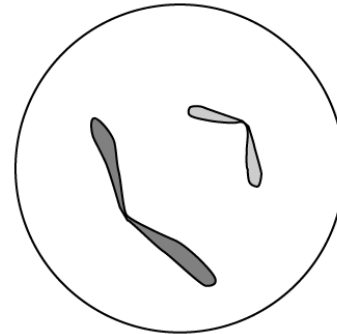
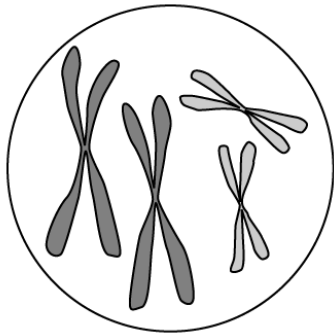
3-2 What is meiosis?

Lesson Review

PART A Complete the following.

1. What is a gamete? _____
2. What is meiosis? _____
3. What are the two kinds of gametes? _____
4. List the stages of Meiosis Part 1 in order. _____

PART B Study the diagrams below. Identify which diagram is the gamete and which diagram is the body cell in the spaces provided. Then, answer the question.

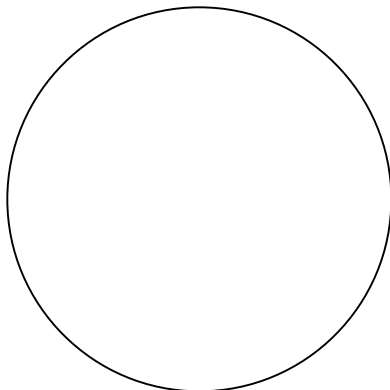


1. _____
2. _____
3. Why did you classify each cell nucleus as you did? _____

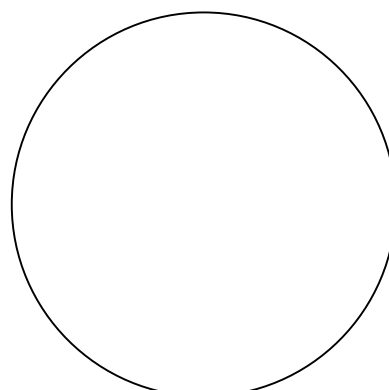
Skill Challenge

Skills: diagramming, applying concepts, calculating

In the space provided, draw the chromosomes in the nucleus of a fruit fly gamete and the chromosomes in the nucleus of a bullfrog gamete. Fruit flies have 8 chromosomes in each body cell. Bullfrogs have 26 chromosomes in each body cell.



Nucleus of a Fruit Fly Gamete



Nucleus of a Bullfrog Gamete

3-3 What is DNA?

Lesson Review

Complete the following.

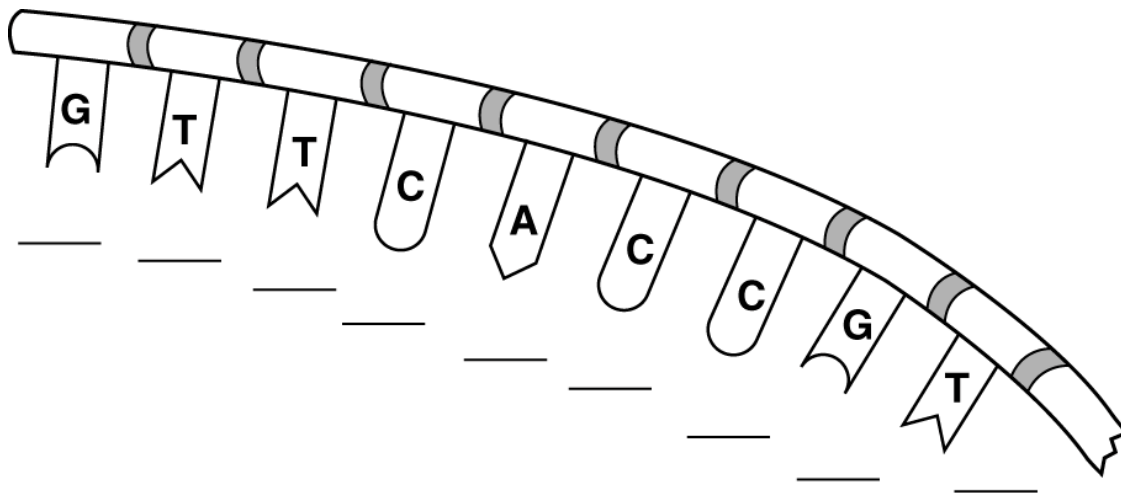
1. What is DNA? _____
2. What is replication? _____
3. What does a DNA molecule look like? _____
4. What substances make up the sides of the DNA ladder? _____
5. What substances make up the steps of the DNA ladder? _____
6. Name four nitrogen bases that make up DNA. _____
7. Explain how the nitrogen bases of the DNA ladder pair up. _____

8. What is produced after replication occurs? _____
9. What is RNA? _____
10. Where does protein synthesis occur? _____

Skill Challenge

Skills: modeling, applying concepts

One-half of a DNA molecule is shown. In the spaces provided, identify the nitrogen base that will pair with each base shown during replication. Use the letters **A** (adenine), **G** (guanine), **C** (cytosine), and **T** (thymine).



Messenger RNA

Enrichment Activity for Lesson 3-3

Skills: comparing, researching

PART A Read the passage. Then, answer the questions that follow.

Messenger RNA

The genetic code in DNA controls an organism's traits. This is true because DNA contains instructions for the making of proteins. The proteins are what determine particular traits.

Proteins are made in the cytoplasm of a cell. DNA is located in the nucleus of a cell. Scientists have wondered how the DNA in the nucleus could control the making of proteins in the cytoplasm. They discovered that a nucleic acid called RNA acts as a messenger for DNA. When a DNA ladder first splits in half, RNA in the nucleus matches up with one half of the DNA ladder. The RNA forms a reverse copy of the DNA strand. This RNA then leaves the nucleus and travels to ribosomes in the cytoplasm. There the proteins are made according to the instructions carried by the RNA.

1. Where are proteins made? _____

2. Why is RNA referred to as a "messenger"? _____

3. How is RNA important to DNA? _____

PART B Use your text and reference materials to complete the following table that compares traits of DNA and RNA. Write a check mark in the appropriate column to indicate whether DNA or RNA has each characteristic in the table.

COMPARISON OF DNA AND RNA		
Characteristic	DNA	RNA
1. Contains deoxyribose		
2. Contains ribose		
3. Contains uracil		
4. Contains thymine		
5. Contains adenine		
6. Contains guanine		
7. Contains cytosine		
8. Found in nucleus		
9. Found in cytoplasm		

3-4 What are chromosomes?

Lesson Review

Circle the term that makes each statement true.

1. Heredity is controlled by (chromosomes / traits).
2. Chromosomes are located in the (ribosomes / nucleus) of a cell.
3. The parts of a chromosome that control inherited traits are (genes / daughter cells).
4. An organized display of an organism’s chromosomes is a (karyotype / centromere).
5. Eye color and hair color are determined by (genes / sex cells).
6. (An allele / A centromere) is the point of a chromosome where two parts meet.
7. Chromosomes are composed of a material called (chromatin / karyotype).
8. (Alleles / Chromosomes) are different versions of the same gene.

Skill Challenge

Skills: *organizing, relating concepts*

Complete the table below by reordering the following structures from smallest to largest in the Number column. Write in a description of each structure in the Description column.

PARTS OF A CHROMOSOME		
Part	Number	Description
Chromatids		
Chromosome		
Centrosome		
Cell		
DNA		
Chromatin fiber		
Nucleus		

3-5 Why can offspring differ from their parents?

Lesson Review

PART A Match each term in **Column B** with its description in **Column A**. Write the correct letter in the space provided.

Column A

- _____ 1. stronger gene whose trait always shows itself
- _____ 2. having two unlike genes for the same trait
- _____ 3. having two like genes for the same trait
- _____ 4. gene of a trait that is hidden when the dominant gene is present

Column B

- a. homozygous
- b. recessive gene
- c. heterozygous
- d. dominant gene

PART B Complete the following.

- 1. In a heterozygous organism, one gene shows itself while the other gene is _____.
- 2. In pea plants, the gene for tallness is _____, while the gene for shortness is _____.
- 3. A homozygous pea plant that is short contains two genes that are _____.
- 4. A heterozygous pea plant will have one gene for tallness and a second gene for _____.

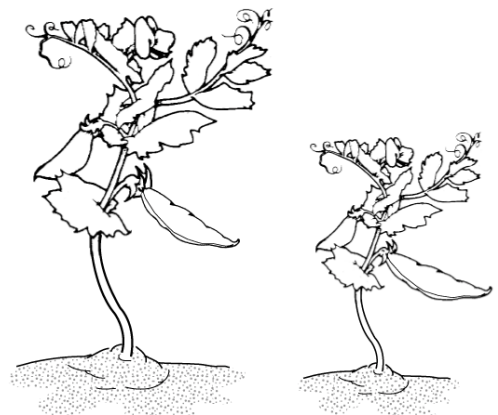
Skill Challenge

Skills: analyzing, hypothesizing

Use the diagrams to answer the following.

- 1. Which of the diagrams shows a pea plant that you know is homozygous? Explain. _____

- 2. Is it possible to tell if the tall pea plant is a homozygous plant or a heterozygous plant just by looking at the plant? Explain. _____



Tall Pea Plant Short Pea Plant

- 3. How could you find out if the tall plant is heterozygous or homozygous? _____

3-6 How do genes combine in offspring?

Lesson Review

PART A Answer the following.

1. How is a dominant trait represented using symbols? _____
2. How is a recessive trait shown using symbols? _____
3. What is a Punnett square? _____

PART B Complete the Punnett square below.

B = brown hair

b = black hair

	B	b
B		
b		

Skill Challenge

Skills: applying concepts, analyzing

Complete the Punnett square. Then, answer the questions.

T = tall

t = short

	T	t
T		
t		

1. Are the parents in this cross homozygous for tallness or are they heterozygous? _____
2. Which letters in the diagram represent an offspring that is pure dominant? _____
3. Which letters in the diagram represent an organism that is pure recessive? _____
4. Which letters in the diagram represent a heterozygous dominant organism? _____
5. a. What fraction of the offspring produced by this cross will be homozygous recessive? _____
 b. Homozygous dominant? _____
 c. Heterozygous dominant? _____

3-7 What are incomplete dominance and codominance?

Lesson Review

Complete the following.

1. What is incomplete dominance? _____

2. What is codominance? _____

3. a. Complete the Punnett square.

B = black feathers

W = white feathers

BW = mix of black and white feathers

	B	W
B		
W		

- b. Are the parents in this cross homozygous or heterozygous? _____
- c. What color are the parents? _____
- d. What are the chances that an offspring will be heterozygous? _____
- e. What colors will the offspring be? _____

Skill Challenge

Skills: analyzing, modeling

Impatiens are an example of a flower that shows incomplete dominance. Some impatiens are red. Others are white. Often when red flowers are crossed with white flowers, offspring with pink flowers are produced.

Use the information above to show what happens when a homozygous red impatiens and a homozygous white impatiens are crossed. Show this cross in Punnett square 1. Then, in Punnett square 2, show what happens when two heterozygous impatiens are crossed.

RR = red

WW = white

RW = pink

Punnett Square 1

Punnett Square 2

3-8 How is gender determined?

Lesson Review

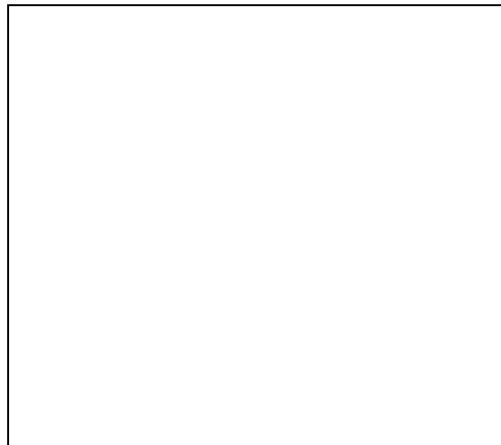
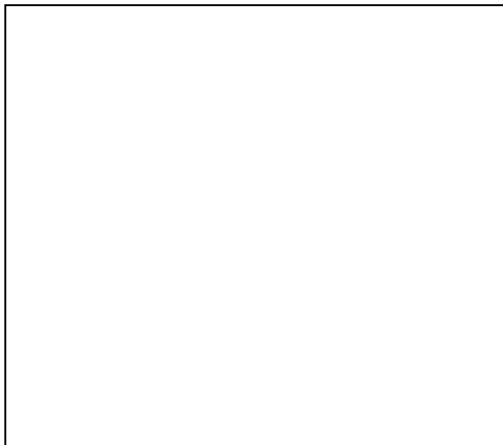
Write *true* if the statement is true. If the statement is false, change the underlined term to make the statement true.

- _____ 1. A child with XX chromosomes will be male.
- _____ 2. The gender of an offspring is controlled by the chromosomes in male sperm cells.
- _____ 3. During mitosis, each sperm cell receives only one chromosome from each pair.
- _____ 4. Female egg cells have an XY pair of chromosomes.
- _____ 5. All egg cells contain X chromosomes.
- _____ 6. All children inherit their gender from their fathers.
- _____ 7. In females, all pairs of chromosomes look identical.
- _____ 8. All human traits are determined by 24 pairs of chromosomes.
- _____ 9. During mitosis, each egg cell receives one chromosome from each pair of chromosomes.
- _____ 10. Each new offspring has a 25 percent chance of being a girl.
- _____ 11. Gender is determined by the twenty-third pair of chromosomes.
- _____ 12. A fertilized egg cell carrying two X chromosomes will develop into a male.

Skill Challenge

Skill: modeling

In the spaces provided, draw the sex chromosomes for a male child and a female child. Label your drawings.



3-9 What are sex-linked traits?

Lesson Review

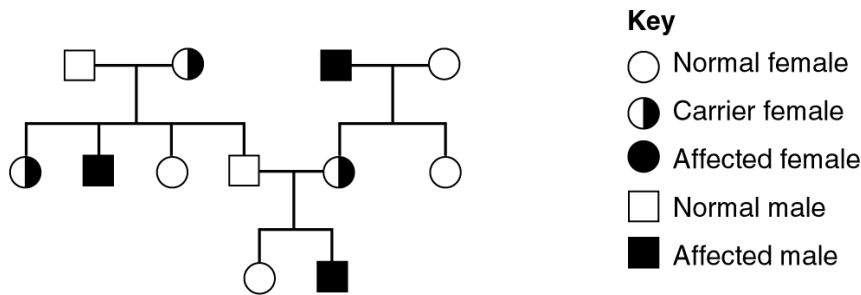
Write the term that best completes each statement in the space provided.

1. Traits that are controlled by the sex chromosomes are called _____ traits.
2. Sex-linked traits are controlled by the X and Y _____.
3. A sex-linked disorder that results in improper blood clotting is _____.
4. A disorder in which a person cannot see the difference between certain colors is _____.
5. Sex-linked disorders most often occur in _____.
6. Women who have a normal gene and a gene for a sex-linked disorder are called _____.
7. If an egg containing the X^C chromosome for a sex-linked disorder is fertilized by a sperm with a Y chromosome, the son will _____ the sex-linked disorder.

Skill Challenge

Skills: predicting, interpreting

A pedigree chart is used to study the passing of a trait through a number of generations. Use the key to interpret the pedigree chart shown.



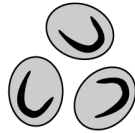
1. How many generations are shown in this chart? _____
2. The chart shows a total of five female offspring. How many of these women are carriers of color blindness? _____
3. Of the three male offspring, how many have color blindness? _____
4. Imagine that the male and female shown in the last generation had three male children. Is there a possibility that at least one of these male children would have color blindness? Explain.

3-10 What are some inherited diseases?

Lesson Review

Complete the following.

1. What is an inherited disease? _____
2. Name two inherited diseases. _____
3. Look at the red blood cells shown. Which blood cells are from a person who has sickle-cell anemia?



Blood Cells A



Blood Cells B

4. Describe the shape of the blood cells of a person who has sickle-cell anemia. _____

5. What effect does Tay-Sachs disease have on the body? _____

6. What effect does PKU have on the body? _____

7. What effect does Huntington's disease have on the body? _____

Skill Challenge

Skills: modeling, interpreting

Complete the Punnett square for sickle-cell anemia. Then, answer the questions.

S = Normal red blood cells

s = sickle-cell

	S	s
S		
s		

1. What are the chances that a child produced by this couple will have sickle-cell anemia? _____
2. What are the chances that a child produced by this couple will be a carrier of sickle-cell anemia?

3. What are the chances that a child produced by this couple will have normal blood cells? _____

Albinism

Enrichment Activity for Lesson 3-10

Albinism is a heredity condition in which an organism is unable to produce pigment. This causes the organism to have pink eyes and white hair and skin. Albinism occurs in humans as well as in many species of plants and animals.

Albinism is a recessive trait. In order to show the trait, an organism must inherit two recessive genes from its parents. An organism that inherits one normal gene and one albino gene does not show the condition.

In the Punnett squares below, the normal gene for pigment production is represented by a capital **P**. The gene for albinism is represented by a lower case **p**. Complete the Punnett squares and answer the questions that follow.

	P	p
P	_____	_____
p	_____	_____

1. According to the Punnet square above, how many offspring are homozygous dominant for this trait? _____
2. How many offspring are heterozygous for this trait? _____
3. How many offspring are homozygous recessive for this trait? _____
4. How many offspring will show albinism? _____

	p	p
P	_____	_____
p	_____	_____

5. According to the Punnet square above, how many offspring are homozygous dominant for this trait? _____
6. How many offspring are heterozygous for this trait? _____
7. How many offspring will show albinism? _____

3-11 How does the environment affect inherited traits?

Lesson Review

Complete the following.

1. Name two things that can affect the traits of an organism. _____

2. How are plants that are grown in poor soil likely to differ from plants that are grown in good soil?

3. Does a change in the environment normally cause a change in the genes of an organism? _____
4. What is a mutation? _____

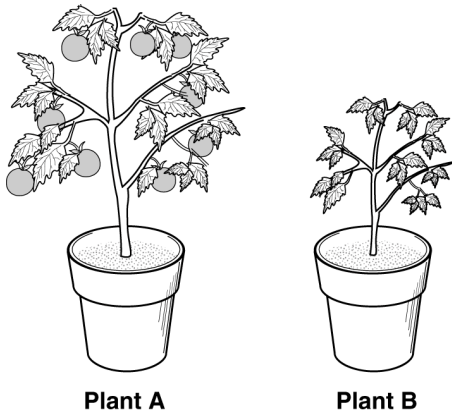
5. Name four possible mutagens. _____

6. What are carcinogens? _____

Skill Challenge

Skills: *inferring, analyzing*

Study the illustrations. Then, answer the questions below.



1. How do the two plants shown differ? _____

2. Make a hypothesis about why Plant B is not producing as much fruit as Plant A. _____

3-12 How is genetics used to improve living things?

Lesson Review

PART A Match each term in **Column B** with its description in **Column A**. Write the correct letter in the space provided.

Column A

- _____ 1. mating organisms to produce offspring with certain traits
- _____ 2. mating two different kinds of organisms
- _____ 3. mating closely related organisms
- _____ 4. process used by plant growers that crosses plants with desirable traits

Column B

- a. mass selection
- b. hybridization
- c. inbreeding
- d. controlled breeding

PART B Complete the following.

- 1. What is triticales? _____

- 2. What kind of breeding technique is used to produce a mule? _____
- 3. Why do people often control the breeding of plants and animals? _____

Skill Challenge

Skill: *building vocabulary*

Use a dictionary or other reference books to define the terms listed. Then, answer the question.

- 1. **cloning:** _____

- 2. **vegetative propagation:** _____

- 3. **genetic engineering:** _____

- 4. Which of the processes listed above can be used to produce offspring with specific traits?

THE **Big** IDEA

Integrating Mathematics

Chapter 3 How do you use mathematics in dog breeding?

Lesson Review

Refer to the article, call outs, and Figures 3-41 to 3-43 on pages 90 and 91 of your text to answer the following questions. Write true if the statement is true. If the statement is false, change the underlined term to make the statement true. Write your answers in the spaces provided.

- _____ 1. Probability is a branch of mathematics that describes the pattern of outcomes that occur by choice.
- _____ 2. Probability deals with predictable patterns that occur over time.
- _____ 3. To measure the probability of an event, you multiply the number of ways an event can occur by the total number of possible outcomes.
- _____ 4. Breeders use probability to predict the traits of offspring.
- _____ 5. Breeders try to produce puppies with a low risk of inherited diseases.
- _____ 6. The probability of rolling 2 on a single die is 2/6.

Skill Challenge

Skills: researching, identifying

1. Use the table in Figure 3-41 on page 90 of your text to determine the phenotypes of the dogs listed.

Genotype	Phenotype
a. BbSSLl	
b. bbSsLl	
c. BBssll	

2. Explain the difference between genotype and phenotype. _____

3. If you wanted to buy a dog, why would you be interested in the traits of its grandparents?

4. To predict the coat colors in a litter of puppies, the breeder must know more than the appearance of each parent. What else would the breeder need to know? _____

Science Log Writing Activity

Complete the Science Log on a separate sheet of paper. To complete the Big Idea Online, go to www.conceptsandchallenges.com. Follow the online instructions.

3-13 What is genetic engineering?

Lesson Review

Complete the following.

1. Methods used to produce new forms of DNA are called _____ .
2. The movement of a section of DNA from the genes of one organism to the genes of another organism is called _____ .
3. What substance needed by diabetics has been produced through genetic engineering?

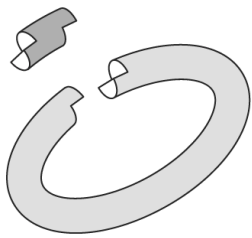
4. How might genetic engineering be used to correct genetic disorders in humans?

5. What is one of the concerns that scientists have about using genetic engineering?

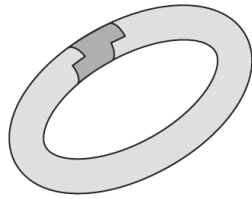
Skill Challenge

Skills: analyzing, sequencing

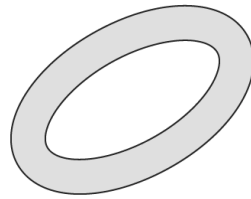
Study the diagram showing a piece of human DNA being spliced into bacterial DNA. Arrange the diagrams in order by writing the letters **A** (first) through **D** (last) in the spaces provided.



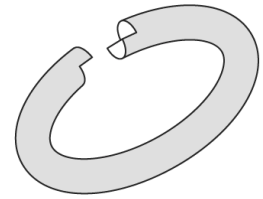
1. _____



2. _____



3. _____



4. _____

Cloning

Enrichment Activity for Lesson 3-13

Skills: synthesizing, designing an experiment

PART A Read the passage. Then, answer the questions that follow.

Cloning

Cloning is a process by which organisms are produced that are genetically identical to their parent. Scientists have used cloning to produce unusual plants. Seedless grapes and navel oranges are two results of cloning.

Scientists also have used cloning to produce some kinds of animals. In this process, an egg cell is removed from a female animal. The nucleus of the egg cell is destroyed. Then, a body cell is removed from an animal of the same species. The nucleus of the body cell is injected into the egg cell. The egg cell then develops into a new organism that has the same genetic makeup as the donor of the nucleus.

1. What is cloning? _____

2. What are two products of cloning? _____
3. Describe the procedure used to clone some kinds of animals. _____

PART B There is much debate about cloning in the world today. Many people think that living organisms should be created only through natural reproductive methods and that scientists have no right to tamper with the genetic makeup of an animal before it is born. However, many scientists argue that cloning could help to end many genetic diseases by altering the genetic makeup of embryos before they are born. Using the information you have learned about genetic engineering, write your opinions about whether you think cloning research should be continued.
