

NAME: \_\_\_\_\_ PERIOD: \_\_\_\_\_

# Genetics

Objective 1: Explain the importance of DNA in a cell.

Objective 2: Determine the possible outcomes of single crosses using Punnett squares.

Objective 3: Compare sexual and asexual reproduction in regards to the number of parents (2 for sexual, 1 for asexual) and variation of genetic material (varies for sexual, identical for asexual). Give examples of organisms for each strategy.

Objective 4: Compare inherited structural traits of offspring and their parents.

Assignment	Objective	Points Possible	Points Earned
#1 DNA Textbook	Obj. 1	2	
#2 Punnett Square Textbook	Obj.2	5	
#3 Phenotype vs. Genotype	Obj.2	10	
#4 Punnett Squares	Obj.2	15	
#5 Alien Genetics	Obj.2	15	
#6 Reproductive Strategies	Obj.3	8	
#7 Asexual vs. Sexual Video	Obj.3	5	
#8 Venn Diagram	Obj.3	5	
#9 Comparing Inherited Traits	Obj.4	5	
#10 Review	Obj. 1,2,3,4	10	
Total		80	

## 1. DNA Textbook Assignment (textbook pages 85-87)

If a trait does not show up in an organism can it still be there? If so HOW?	
What is Genetics?	
What is DNA?	
How can DNA be compared to a blueprint for a house?	
What does the genetic information do for living organisms?	

## 2. Punnett Square Text (textbook pages 87-91)

What does <b>Inherit</b> mean in genetics?	
What is an <b>Acquired</b> Trait?	
What is a <b>Trait</b> ?	
Explain what a <b>Dominant Trait</b> is:	
When does a <b>Dominant Trait</b> show up (appear)?	
What kind of letter do you use to indicate a <b>Dominant Trait</b> ? <i>Give an example too.</i>	

<p>Explain what a <b>Recessive Trait</b> is:</p>	
<p>When will a <b>Recessive Trait</b> show up?</p>	
<p>What kind of letter do you use to indicate a <b>Recessive Trait</b>? <i>Give an example too.</i></p>	
<p>Define <b>HOMOZYGOUS</b>. <i>Give an example.</i></p>	
<p>Define <b>HETEROZYGOUS</b>. <i>Give an example.</i></p>	
<p>Explain what a Punnett Square is and why we use them.</p>	

### 3. Phenotype vs. Genotype

Terms	Examples
Dominant	T
Recessive	t
Homozygous (purebred)	TT, tt
Heterozygous (hybrid)	Tt
Genotype	TT, Tt, tt
Phenotype	Tall or short

If "T" represents tall and "t" represents short, **tell whether the following genotypes will produce a tall or short person.**

1. TT \_\_\_\_\_
2. tt \_\_\_\_\_
3. Tt \_\_\_\_\_
4. tT \_\_\_\_\_

Tell whether the following genotypes are **homozygous or heterozygous**.

5. HH \_\_\_\_\_
6. Bb \_\_\_\_\_
7. TT \_\_\_\_\_
8. hh \_\_\_\_\_
9. bb \_\_\_\_\_
10. Tt \_\_\_\_\_

**Using the letters "T" and "t," write the following genotypes.**

11. Heterozygous \_\_\_\_\_
12. Homozygous dominant \_\_\_\_\_
13. Homozygous recessive \_\_\_\_\_

**14. Circle all the phenotypes and cross out all the genotypes.**

Tall	HH	Rr	white	Yy
Tt	wrinkled	smooth	ss	short

Use the keys to answer the following questions.

Keys:	T=tall	R=round	G=green
	t=short	r=wrinkled	g=yellow

Give the phenotypes for the following genotypes

15. rR \_\_\_\_\_
16. GG \_\_\_\_\_
17. rr \_\_\_\_\_
18. TT \_\_\_\_\_
19. Rr \_\_\_\_\_
20. gg \_\_\_\_\_
21. gG \_\_\_\_\_
22. Gg \_\_\_\_\_
23. Tt \_\_\_\_\_

Give all possible genotypes for the following phenotypes

24. wrinkled
25. yellow
26. round
27. tall
28. There are **3** incorrectly written questions on this page. **Circle them.**

## 4. Punnett Squares

1. Cross TT X Tt


G = \_\_\_\_\_

P = \_\_\_\_\_

Probability of being tall = \_\_\_\_\_%

2. Cross gg X GG


G = \_\_\_\_\_

P = \_\_\_\_\_

Probability of being Green = \_\_\_\_\_%

3. Cross aa X Aa


G = \_\_\_\_\_

P = \_\_\_\_\_

Probability of being Heterozygous = \_\_\_\_\_%

4. Cross Rr X Rr


G = \_\_\_\_\_  
P = \_\_\_\_\_  
Probability of being wrinkled = \_\_\_\_\_%

5. Cross aa X AA


G = \_\_\_\_\_  
P = \_\_\_\_\_  
Probability of being white = \_\_\_\_\_%

6. Cross a homozygous black rabbit with a heterozygous black rabbit. \_\_\_\_\_ X \_\_\_\_\_


G = \_\_\_\_\_  
P = \_\_\_\_\_  
Probability of a white rabbit offspring = \_\_\_\_\_%

7. A heterozygous round seeded plant (Rr) is crossed with a homozygous round seeded plant (RR). Fill in the Punnett Square. What is the likelihood that the offspring will be homozygous (RR)?

\_\_\_\_\_


8. Cross a heterozygous round (Rr) seed with a wrinkled (rr)seed. (Round seeds are dominant over wrinkled). Fill in the Punnett Square What percentage of offspring will be round? \_\_\_\_\_


9. In pea plants, purple flowers (P\_) are dominant to white (pp) flowers. If two white flowered plants are crossed. Fill in the Punnett Square: what percentage of their offspring will be white flowered? \_\_\_\_\_


10. A white flowered plant is crossed with a plant that is heterozygous for the trait. Fill in the Punnett Square: What percentage of the offspring will have purple flowers? (purple is dominant) \_\_\_\_\_


11. In guinea pigs, the allele for short hair (S\_) is dominant to (ss) long.  
 What genotype would heterozygous shorthair be? \_\_\_\_\_  
 What genotype would pure breeding shorthaired be? \_\_\_\_\_  
 What genotype would longhaired guinea pig be? \_\_\_\_\_

12. Show the cross for a pure breeding shorthaired guinea pig and a longhaired guinea pig. Fill in the Punnett Square: What percentage of the offspring will have short hair? \_\_\_\_\_


13. Fill in the Punnett Square for two heterozygous guinea pigs.

What percentage of the offspring will have short hair? \_\_\_\_\_

What percentage of the offspring will have long hair? \_\_\_\_\_


14. Two shorthaired guinea pigs are mated several times. Out of 100 offspring, 25 of them have long hair. Fill in the Punnett Square. What are the genotypes of the parents?

\_\_\_\_\_ X \_\_\_\_\_


15. A father with a structural trait of an unattached earlobe (dominant) and a mother with a structural trait of an unattached earlobe (dominant) to have a child with a structural trait of an ATTACHED earlobe (recessive). How is this possible? Fill in the Punnett Square U=dominant u=recessive

\_\_\_\_\_ X \_\_\_\_\_




16. Which of the following cows should a farmer cross with his new “pure bred” steer he just bought to see if it is really purebred. **Work out all the crosses** and explain if each cross will help out the farmer, by telling us why or why not.

Steer is either RR OR Rr (R = black, r=white)

Cross steer (both possibilities) with a RR cow

Cross steer (both possibilities) with a rr cow





## 5. Alien Genetics Lab

Working together with a partner, you will flip a coin or roll a die to determine the different traits that your alien baby is going to have. After you complete the activity, draw a picture of the alien and name it. The picture should be in color!

Procedure:

1. You and your partner will flip coins to determine the different traits of the alien baby. Both parents are heterozygous for each trait and could pass on either a dominant or recessive allele. Heads (or even dice) will be the dominant trait while tails (or odd dice) will be the recessive trait.
2. Fill in data table #1 with the information for the genotype and phenotype of the alien.
3. Draw a picture of your offspring, showing each of the structural traits that were determined. (*Each person should have his or her own drawing on a separate blank sheet of paper ATTACH this to the back of your packet.*)
4. Before you start, determine the sex of your alien. The person sitting on the left should flip their coin. Tails (or even) is a girl, heads (or odd) is a boy!!!
5. Don't forget to name the alien!

<i>Trait</i>	<i>Parent #1 Genotype</i>	<i>Parent #2 Genotype</i>	<i>Genotype of the Baby Alien</i>	<i>Phenotype of the Baby Alien</i>
Sex	-----	-----	-----	
Color of skin (green is dominant to blue)	Gg	Gg		
Fingers- Suction Cups are dominant to Webbed fingers	Hh	Hh		
3 Antennae is dominant to 4 antennae	Aa	Aa		
2 Eyes is dominant to 4 Eyes	Ee	Ee		
Mouth- Fangs is dominant to no fangs	Ff	Ff		
Feet-2 feet is dominant to 3 feet	Ww	Ww		
Tail-having a tail is dominant to no tail	Tt	Tt		
Tongue-long tongue is dominant to a short tongue	Ll	Ll		
Spots (red spots is dominant to purple)	Ss	Ss		
Neck- a long neck is dominant to a short neck	Nn	Nn		
Body hair- No body hair is dominant to having body hair	Bb	Bb		
Shape of head- Egg shaped head is dominant to square shaped	Ee	Ee		
Shape of body- an hourglass figure is dominant over a pear shape	Hh	Hh		
Number of arms- 4 arms is dominant over 6 arms	Aa	Aa		
Type of eyes- Large oval shape is dominant over half moon shape	Oo	Oo		

**\*\*\*Now, draw a picture of your alien baby. Each of you needs to turn in a picture! It should be in color and have your alien's name on it.**

**Analysis Questions**

1. What chance did you have of producing a male alien? \_\_\_\_\_ Explain why.
2. Would you expect the other students in your class to have an alien similar to yours? Explain.
3. Which of your alien's traits were homozygous dominant?
4. Which of your alien's traits were heterozygous?
5. If an alien is homozygous dominant for type of eyes and she marries an alien who is heterozygous for type of eyes, what are the possible genotypes and phenotypes of their alien babies? Fill out the next Punnett square to figure this out.

Genotype:

Phenotype:


6. How might it be possible for the alien baby to show a trait when neither of the alien parents have it?
7. Do the following Punnett Square Problems. You may need the information from your data table.
  - a. Cross your alien baby's skin color with a homozygous recessive alien.


- b. Record the genotype and phenotypes of the offspring.

Genotype:

Phenotype:

8. A hybrid green-skinned male is crossed with a homozygous green-skinned female. Do the Punnett Square. What are the possible outcomes in the phenotypes and genotypes of their offspring?


Genotype:

Phenotype:

## 6. Reproductive Strategies

### Asexual Reproduction

- involves only \_\_\_\_\_ parent
- offspring are \_\_\_\_\_ to parent
- involves \_\_\_\_\_ body cells
- \_\_\_\_\_

### Binary fission

- happens in \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- one parent cell splits into \_\_\_\_\_  
\_\_\_\_\_

### Budding

- happens in \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- parent produces a \_\_\_\_\_
- bud gets \_\_\_\_\_ and \_\_\_\_\_ into offspring which is identical to parent

### Vegetative Reproduction

- does \_\_\_\_\_ involve \_\_\_\_\_
- some \_\_\_\_\_ can grow from cuttings (e.g. coleus), runners (e.g. strawberries), tubers (e.g. potatoes) or bulbs (e.g. tulips)... which are \_\_\_\_\_ of the \_\_\_\_\_

### Sexual Reproduction

- involves \_\_\_\_\_ parents
- offspring genetic \_\_\_\_\_ parents
- involves specialized \_\_\_\_\_ cells
- its \_\_\_\_\_

### Sexual Reproduction in Animals

- involves \_\_\_\_\_ sex cells called \_\_\_\_\_
- the union of a \_\_\_\_\_ and \_\_\_\_\_ gamete results in the formation of a \_\_\_\_\_ that develops into a new \_\_\_\_\_.

### Sexual Reproduction in Plants

- \_\_\_\_\_
- flowers are designed to lure \_\_\_\_\_ to help with the \_\_\_\_\_ process

- also \_\_\_\_\_, \_\_\_\_\_, birds can \_\_\_\_\_ pollen

### **Sexual Reproduction Summary**

- Some Organisms do \_\_\_\_\_
- most plants that produce seeds ( \_\_\_\_\_ ) can also reproduce asexually by things like \_\_\_\_\_ or \_\_\_\_\_
- this gives them an \_\_\_\_\_ for survival

### **Which is More Successful?**

*It depends!*

#### **Asexual Reproduction**

- Advantages
  - does \_\_\_\_\_ require \_\_\_\_\_ or a lot of \_\_\_\_\_ structural traits are identical to parents
  - can produce offspring quickly
  - in a stable \_\_\_\_\_ creates large, thriving population
- Disadvantages
  - limited ability to adapt
  - face massive die-off \_\_\_\_\_.

#### **Sexual Reproduction**

- Advantages
  - lots of \_\_\_\_\_ within a species structural traits are similar to parents, but NOT identical
  - able to live in a variety of \_\_\_\_\_ settings
  - able to \_\_\_\_\_ to changes in the environment
- Disadvantages
  - needs \_\_\_\_\_ & \_\_\_\_\_
  - produce \_\_\_\_\_ populations

*Do the following set of Self Check questions*

1. What type of reproduction only has 1 parent?
2. What type of reproduction only has 2 parents?
3. What type of reproduction results in offspring that have structural traits identical to the parents?

4. What type of reproduction results in offspring with a mix of structural traits from both parents?
5. What type of reproduction is used by most animals?
6. What type of reproduction is used by most plants?
7. What type of reproduction is used by bacteria?

## **7. Asexual vs. Sexual Video**

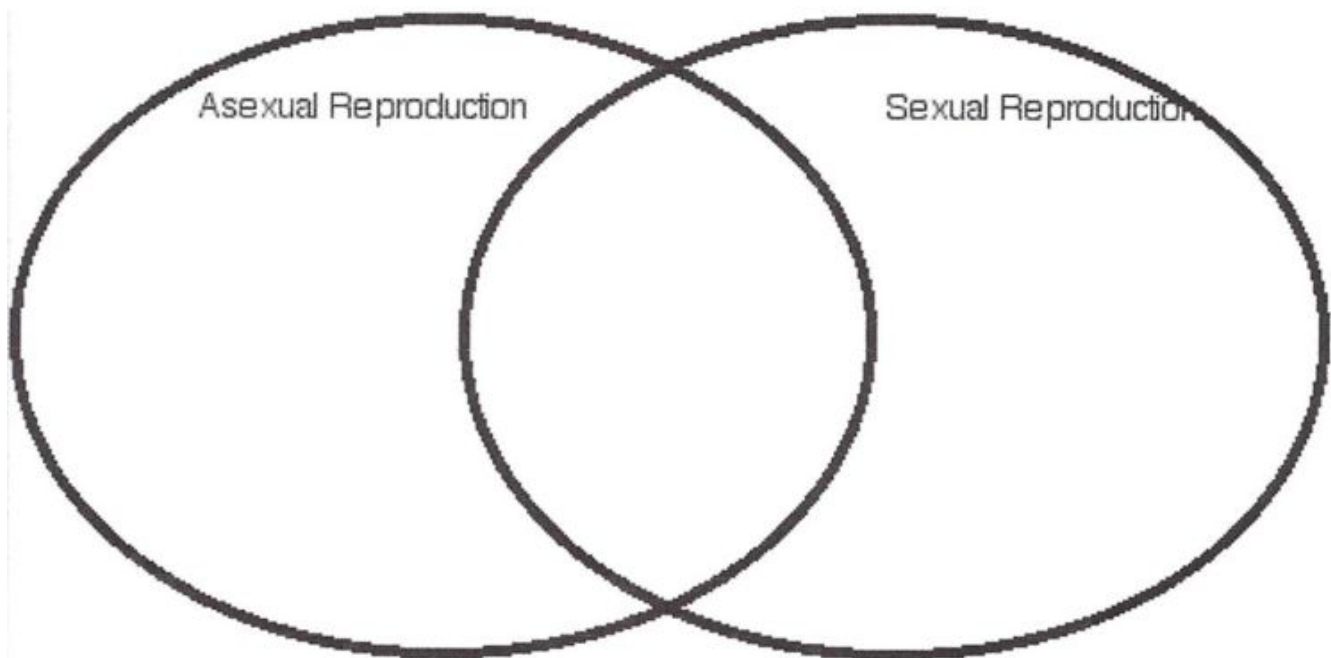
Watch the video and answer the questions below.

1. What is sexual reproduction?
2. For asexual reproduction, where do the genes come from?
3. How is unique about the combination of genes in asexual reproduction?
4. What are the methods described for asexual reproduction?
  - a. Division
    - i. Explanation-
    - ii. Example-
  - b. Budding
    - i. Explanation-
    - ii. Example-
  - c. Split into 2 (AKA REGENERATION)
    - i. Example-
    - ii. Example-

## 8. Venn Diagram

Fill in the Venn Diagram with information from the word bank which is true about **Asexual** reproduction on the left, is true about **Sexual** reproduction on the right and is true about **both** asexual and sexual reproduction in the overlapping center.

two parents	Identical genetically	Usually only a few offspring	Lots of offspring	Very slow
Mix of traits genetically	Very fast	One parent	clones	Bacteria use this method
Plants use this method	Lots of diversity	Mammals use this method	Ability to adapt is low	No diversity
Ability to adapt is high	Can use either method	Offspring are nurtured by parent(s)	Offspring are on their own from start	Lots of variety in structural traits



## 9. Comparison of Inherited Traits

**Introduction:** Living things inherit their traits from their parents. You may know of traits in your family that have been inherited, sometimes for several generations. Red hair, curly eyelashes, brown eyes or being tall may be easy to see in the parents and children of your family.

Scientists define two ways traits are inherited based on the type of reproduction that occurs. In this activity, you will observe the offspring of different organisms and decide what type of inheritance has occurred. Remember that in sexual reproduction, two parents produce offspring with characteristics of both parents. In asexual reproduction, one parent produces an offspring with the same characteristics as the parent.

**Directions:**

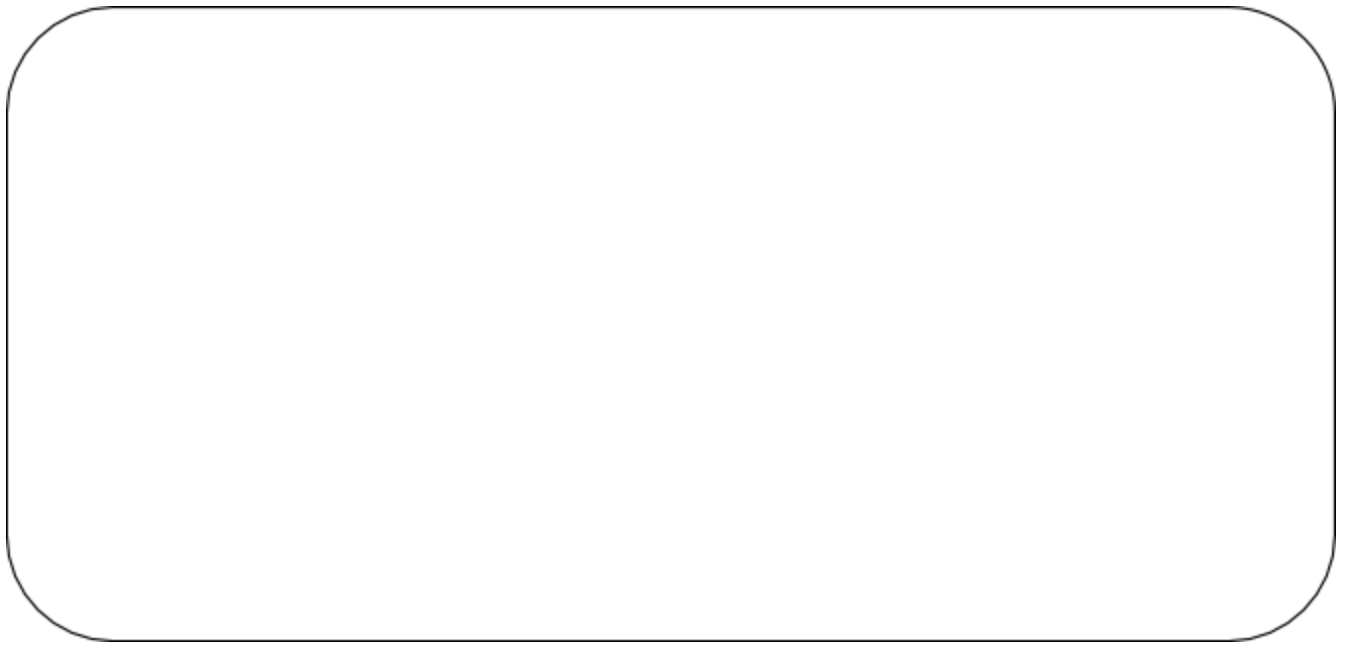
1. Look at the pictures and decide which pairs represent sexual or asexual reproduction. Write the type of reproduction on your data table below.
2. Decide which characteristics helped you make your decision and write them on the data table.
3. For each picture, list one similar structural trait and one different structural trait between the parent and offspring. Write them on the data table.
4. Draw another parent/child pair. Exchange your drawing or pictures with someone else and record which type of inheritance has occurred and why. Repeat this step with at least 2 other classmates.

**Data Table:**

Organism	Type of Reproduction	Evidence for type of reproduction	Similar Structural Trait	Different Structural Trait
1				
2				
3				
4				
5				
6				
7				
8				

My Drawing:





Analysis:

1. What are characteristics of sexual reproduction?
2. What are characteristics of asexual reproduction?
3. When is asexual reproduction an advantage to a species?

## 10. Review

### Objective 1

1. Why is DNA important for a cell?
2. Which part of the cell holds the genetic material?
3. Farmer Brown wants to raise cattle without spots. How could knowing about genetics of the cattle help him?
4. Why are the cells in your ears designed differently from the cells in your eyes or the cells in your liver?

### Objective 2

5. Complete the chart for the following vocabulary words:

	Definition	Example (Use a letter)
Dominant		
Recessive		
Heterozygous		
Homozygous		
Phenotype		
Genotype		

6. If a trait can be hidden for a generation, but expresses itself in the next generation, it is probably what kind of trait?
7. In pea plants, tall (T) is dominant to short (t). If a plant is homozygous tall, what is its genotype?
8. In guinea pigs, black fur (B) is dominant to brown (b) fur. If a guinea pig has brown fur, what is his genotype?
9. What does a genotype have to have for a recessive trait to appear in the phenotype?
10. Cross BB x bb. If the blue phenotype is dominant, what percentage of the offspring will show the blue phenotype?

11. An alien species generally has blue faces that are caused by a dominant gene (B). The homozygous recessive condition results in an orange (b) face. Two heterozygous aliens are crossed. Make the Punnett square and list the possible outcomes of the offspring.
  
12. A blue-faced alien (homozygous) is married to an orange-faced alien. They have 4 offspring. Make the Punnett square. Then list ALL the possible outcomes for their offspring.
  
13. What are the chances of an offspring with a blue face? (From the cross in question #12).
  
14. In sheep, the gene for white wool (D) is dominant over the gene for black wool (d). Use a punnett square to show a cross between a homozygous dominant and homozygous recessive sheep. What are the possible outcomes of this cross in the offspring?

### **Objective 3**

15. You are given 3 unknown organisms labeled A, B, C. When looking at the DNA of the three unknown organisms, you find that they all have the EXACT SAME SEQUENCE OF DNA (in other words, they are identical). What is the most logical explanation?
  
16. A flower is a structure that allows which type of reproduction for the plant?
  
17. Explain the following information about **sexual** reproduction.
  - a. How many parents?
  
  - b. What is one advantage for sexual reproduction?
  
  - c. What is one disadvantage for sexual reproduction?

- d. Are the offspring genetically identical or not genetically identical?
  - e. What are 2 examples of organisms that use sexual reproduction to produce offspring?
18. Explain the following information about **asexual** reproduction.
- a. How many parents?
  - b. What is one advantage for asexual reproduction?
  - c. What is one disadvantage for asexual reproduction?
  - d. Are the offspring genetically identical or not genetically identical?
  - e. What are 2 examples of organisms that use sexual reproduction to produce offspring?
19. How can knowing about **asexual** reproduction be helpful to a gardener?

**Objective 4**

20. Which physical (*also known as structural*) trait do nearly all children have in common with their parents?
21. Are physical (*also known as structural*) traits typically the same between parents and their offspring?
22. Describe one physical (*also known as structural*) trait that is common among all living things:
23. List 3 examples of human traits that are NOT physical (*for instance these are acquired traits*).
24. List 3 examples of human traits that are physical (*for instance these are acquired traits*).
25. How are traits passed down?