



Matter and Change

Lecture-Workshop for Grade 5 & 6 Science

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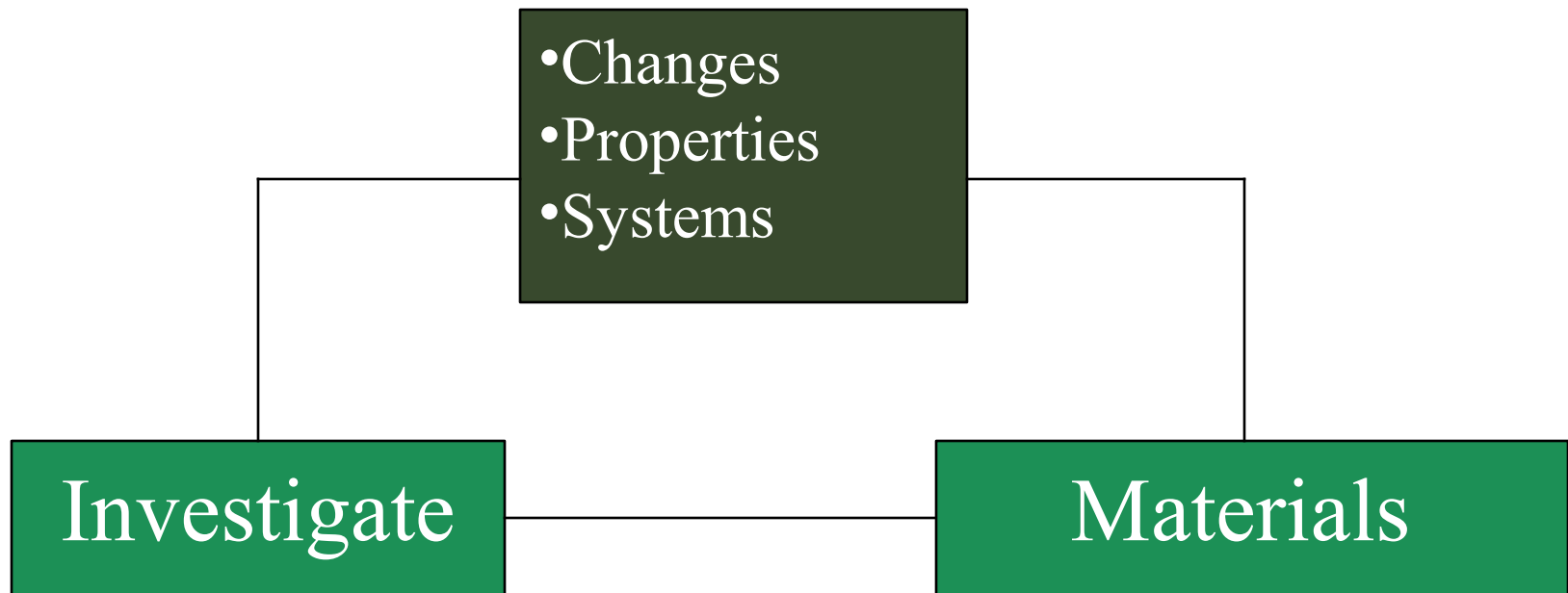


Core Learning Area Standard: for Science in the entire K to 12

- ✚ The learners demonstrate *understanding of basic science concepts and application of science-inquiry skills*. They exhibit scientific attitudes and values to solve problems *critically, innovate* products, protect the environment and conserve resources, enhance the integrity and wellness of people, make informed decisions, and engage in discussions of relevant issues that involve science, technology and environment.



Grade 5 & 6 Level Standards





Now, I have a story to tell.....

- ✚ One day, a little superhero named Juan meets a hermit. The hermit told Juan that for him to claim his full powers, he must recover the missing crystals from an unknown object. However, he must travel afar and climb the Golden Mountain to get the object.

But our little Juan is afraid for he is not yet ready for such big task. **How can we help him?**



- ✚ First, Juan must know his strengths and limitations. This is important because the journey to the Golden Mountain poses a lot of challenges.
- ✚ He must adapt to the changes of the environment.



So, what should Juan do?

✚ Know himself!



In what way can we differentiate Juan's friends from one another??

- Properties

- How we identify something.



Matter has properties

- + Two basic types of properties that we can associate with matter.
 - Physical properties
 - Chemical properties



Physical Properties

• Anything that can be observed without changing the identity of the substance. (Tends to be measurable.)

- melting point
- boiling point
- electrical conductivity
- color
- density
- thermal conductivity
- ductility
- malleability



Chemical Properties

✚ The way a substance may change or react to form other substances

- heat of combustion
- reactivity with water
- pH
- Oxidation
- Flammability
- Reactivity to other chemicals



What's Inside?

- ✚ In this activity, you will test your skills in determining the identity of an object based on its properties.

Procedure

- ✚ 1. You will receive a sealed paper bag with a number on it. Inside the bag is a mystery object. Do not open the bag.
- ✚ 2. For 5 minutes, make as many observations as you can about the object. You may shake the bag, touch the object through the bag, listen to the object in the bag, and smell the object through the bag and so on. Be sure to write down your observations.



Analysis

- ✚ 3. At the end of 5 minutes, discuss among your findings with the members of the group.
- ✚ 4. List the object's properties and make a conclusion about the object's identity.
- ✚ 5. Now you are ready to open the paper bag.
- ✚ 6. Did you properly identify the object? If so, how? If not, why not?



Matter can be changed in two ways

+ Physically

- Physical reaction
- Physical change

+ Chemically

- Chemical reaction
- Chemical change



**Now, that Juan knows his capabilities.
He is now ready to start his journey**

✚ While walking in a rocky road, he is stopped by an old man dressed like a wizard. The old man said, “to pass this road, you must overcome some challenges”.



Will you help him?



Activity 1. The Power of Coins

Materials

Plastic cup	Salt
Vinegar	Coins (at least 2
dull coins)	

Procedure

1. Fill half of the plastic cup with vinegar.
2. Place a teaspoon of salt and stir.
3. Put the coins in the mixture and wait for 5 minutes.
4. Get the coins. Dry 1 coin while the other coin should not be rinsed.

Guide Questions

1. What do you think is the composition of the coins?
2. What have you noticed to the two coins?
3. What is the purpose of vinegar and salt in the set-up?
4. What change has taken place in the coins?



Activity 2. The Power of Peroxide

Materials

10 mL hydrogen peroxide
a slice of apple
Plastic cup
Graduated cylinder

Procedure

1. Place 10 mL of hydrogen peroxide in a clear plastic cup
2. Add a slice of apple.

Guide Questions

1. What have you noticed in the apple when placed in hydrogen peroxide?
2. What type of change has taken place?
3. What new product is formed?



Activity 3. The Power of Bleach

Materials

Red food color water

Bleach stirrer

Plastic cup medicine dropper

Procedure

1. Put a drop of red food color in a clear plastic cup.
2. Fill half of the plastic cup with water.
3. Place 30 drops of bleach to the mixture of water and red food color.

Guide Questions

1. What happens when you add bleach in the mixture of water and red food color?
2. What indicates a change has taken place?
3. What type of change in matter is exhibited?



Activity 4. The Power of Candle

Materials

Candle match
glass plate J-shaped tube
jar Splinter/bamboo stick

Procedure

1. Make the candle stand on the glass plate and light.
2. Collect the candle's white smoke using the J-shaped tube. The shorter end of the tube should be closed to the wick while the other end is inside the jar.
3. When the jar is half-filled with smoke, place a burning bamboo stick inside. Observe

Guide Questions

1. What causes the candle to release white smoke instead of a black one?
2. What have you noticed when you place a burning bamboo stick in a jar half-filled with smoke?
3. What change has taken place in the lighted candle?



Activity 5. The Power of Salt

Materials

Salt	water
Plastic cup	evaporating dish
Tripod	wire gauze
Alcohol lamp	dropper

Procedure

1. Half fill the plastic cup with water.
2. Add a pinch of salt and stir.
3. Transfer 10 drops of the mixture in an evaporating dish.
4. Boil the mixture until the water evaporates completely.

Guide Questions

1. What classification of matter have you made from mixing water and salt?
2. What change has taken place when you apply heat in the mixture?
3. Can you say a new product is formed?



Let's rewind . . .

- ✚ The coins contain copper.
- ✚ The acetic acid eats away the oxide in the coins which contributes to the dullness of the coins.
- ✚ However, if the coin is not rinsed or dried, a blue colored will appear in the coin. This is called copper oxide.
- ✚ Vinegar and salt promote the reaction of oxygen to with the copper.



Let's rewind . . .

- Upon adding the sliced apple in the hydrogen peroxide, small bubbles appeared in the at the surface of the apple.
- These bubbles indicate a gas is evolved. This gas is called oxygen gas.
- This is obtained from the decomposition of hydrogen peroxide: $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$
- Apples contain the enzyme called catalase that breaks down hydrogen peroxide into water and oxygen gas.



Let's rewind . . .

- + Bleach decolorizes the solution of water and the red food color.
- + Sodium hypochlorite is the active ingredient of any bleach which can be used to remove stain or decolorizes.



Let's rewind . . .

- ✚ Placing the J-shaped tube near the wick can limit the passage of air thus, it produces white smoke instead of black. This also makes the burning incomplete.
- ✚ Placing a lighted bamboo stick in a half-filled jar of white smoke produces a fire. The white smoke indicates an incomplete combustion thus a presence of a spark or small fire will create a bigger one.



Chemical Changes

✚ The composition of the substance changes.

- The substances present at the beginning of the change are not present at the end; new substances are formed. The change cannot be “undone.”



Picture from
www.chem4kids.com



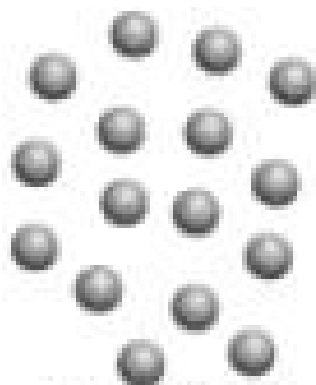
Chemical Changes

- ✚ Evidence of a chemical reaction
 - Formation of gas
 - Formation of precipitate
 - Change in color
 - Change in energy
 - ◆ **Endothermic** Absorbs heat energy (gets cold)
 - ◆ **Exothermic** Releases heat energy (gets hot)

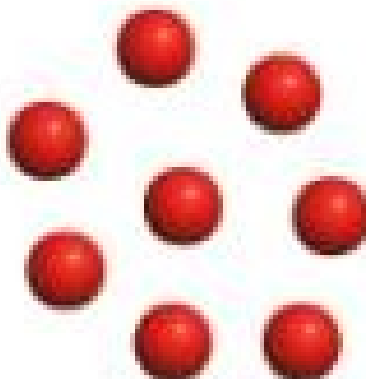


Chemical Changes

- Atoms are re-arranged, **NOT** created or destroyed

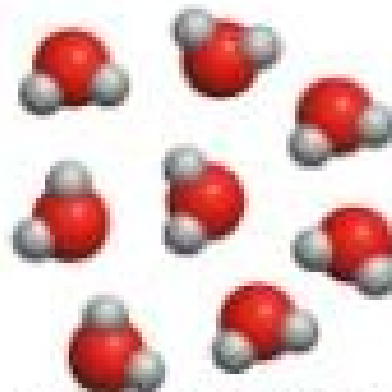


Atoms of
element X



Atoms of
element Y

(a)



Compounds of
elements X and Y

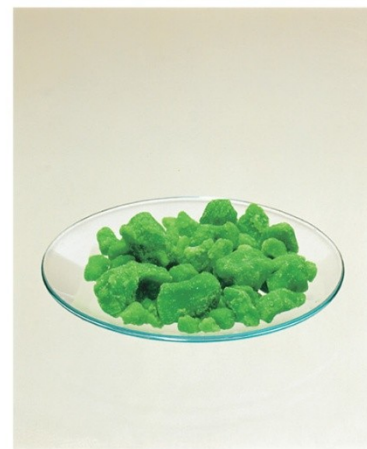
(b)



Let's rewind . . .

- ✚ The combination of salt and water is called a mixture particularly a type of called solution.
- ✚ Upon the addition of heat, water evaporates while the salt remains. This is because salt is an example of a nonvolatile substance.
- ✚ Evaporation is a simple separation technique and is a **physical process** only.

Take note . . .



- ✚ Dissolution is a physical change—you can get back the original solute by evaporating the solvent.
- ✚ If you can't, the substance didn't dissolve, it reacted.



Physical Changes

✚ Do **NOT CHANGE THE TYPE OF MATTER**

■ Nothing new or different is formed

◆ Could be a change in:

✚ Mass

✚ Volume

✚ Density

✚ Change in state

✚ Color

✚ Shape

} **Size**



Examples of Physical Changes

- + Boiling

- + Freezing

- + Dissolving

- + Breaking

- + Making a **mixture**

- 2 or more types of matter (substances) mixed together

- Not in specific amounts

- Can be separated physically



Environmental and Hazardous Impact

Product	Hazardous Ingredient	Possible Effects
Laundry and dishwashing detergents	Cationic, anionic or non-ionic solution including phosphates	Can cause skin irritation; phosphates can promotes algal growth
Toilet bowl cleaners	Oxalic acid	Can damage kidney and liver, irritate eyes and respiratory tract and corrodes mouth and stomach
	Sodium bisulfate	Forms sulfuric acid which is corrosive and burns skin
Air freshener	Formaldehyde	A strong irritant to the eyes, throat, skin and lungs; thought to cause cancer
	p-dichlorobenzene	Fumes can be irritating to eyes, skin and throat
Mothballs	Naphthalene	Can cause headaches, dizziness, and can irritate, skin, eyes and throat; prolonged exposure can cause cataract and liver damage



Brainworks

Human Graphs

Students respond to a statement by forming a human graph. Students form three lines to represent their thinking: *Agree*, *Don't Know*, *Disagree*. After selecting a line, students turn to a partner and explain why they selected that particular line. Then, one person from each line explains to the whole group why he/she chose that line. Having heard all the explanations, students may change lines.



Statements . . .

-  *Can all forms of physical change on the Earth's surface be measured?*
-  1. Evaporating water in a beaker is example of chemical change.
-  2. Preparing a hot coffee is a chemical change.
-  3. Ethanol boils at 70°C . This is chemical property.



- ✚4. Petroleum is used as fuel for transportation. This is an evidence of chemical property.
- ✚5. Salt dissolves faster in a warm water. This is chemical change.



Let's go back to Juan . . .

🚦 He is now relieved of the challenges, and made his way to the Golden Mountain.

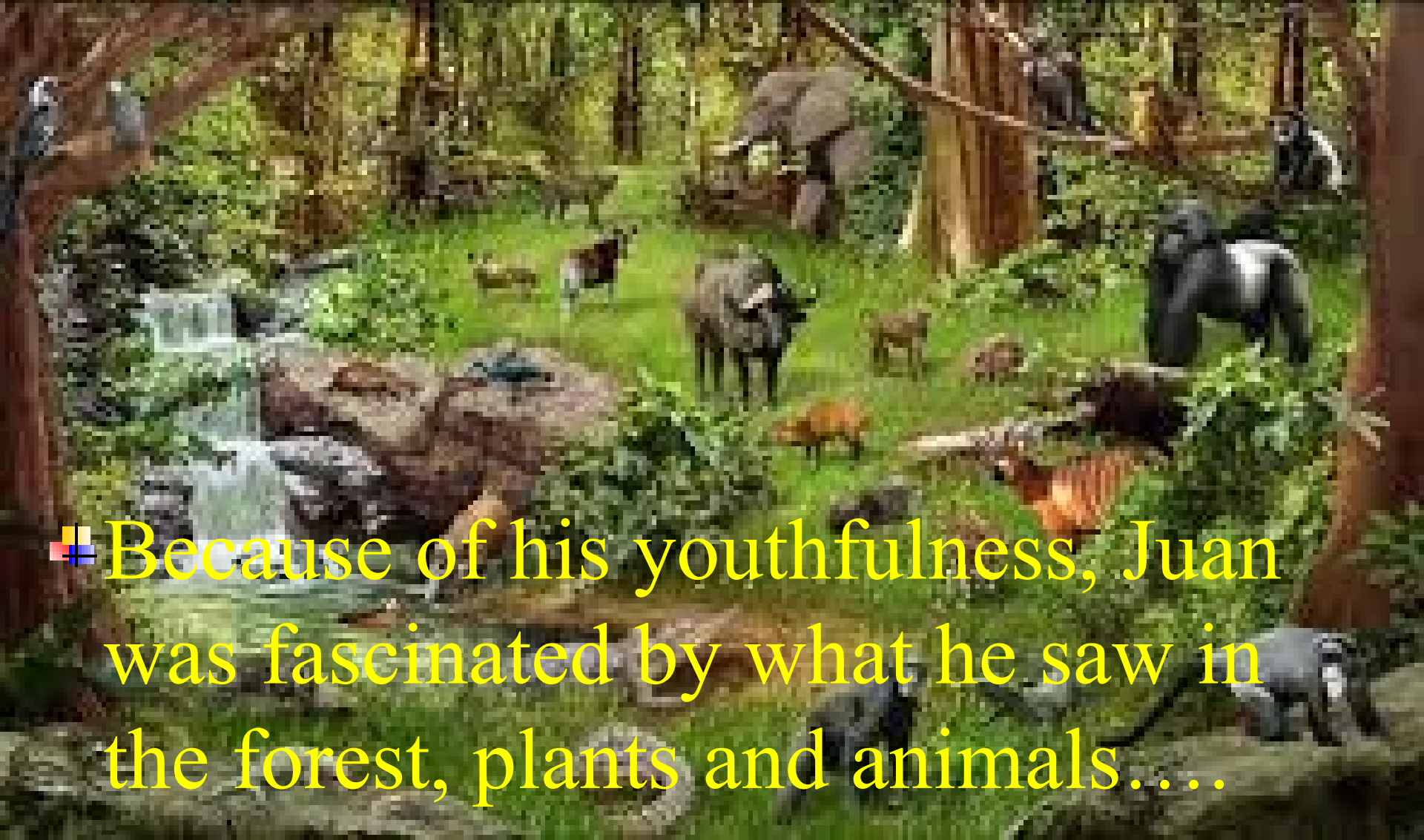


It seems Juan is lost . . .

- He is at the middle of a forest. The hermit did not say a thick forest lies in the middle of the road.
- Whatever the consequences , he will still continue his journey.



In the forest



■ Because of his youthfulness, Juan was fascinated by what he saw in the forest, plants and animals....



Still in the forest

- ✚ While enjoying the sight, he noticed a colorful butterfly. He wondered, how do other animals multiply?
- ✚ Can you look for the answers to his inquiry?





To be continued



planaria



gorilla



kangaroo



amoeba



fish



worm



rat



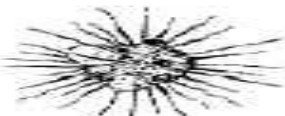
zebra



elephant



leech



heliozoa



bird



dinosaur



frog

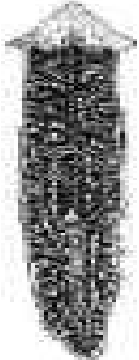


dolphin

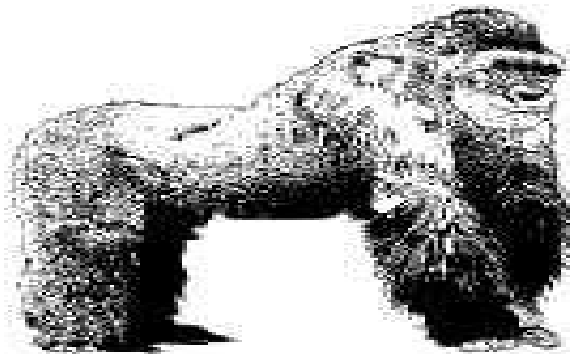


euglena

✚ The animal kingdom has a wide diversity of living things.



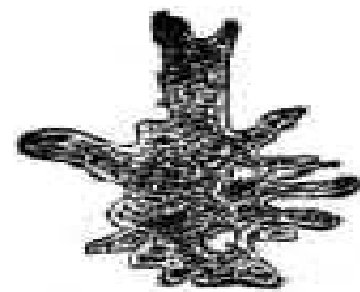
planaria



gorilla



kangaroo



amoeba



fish



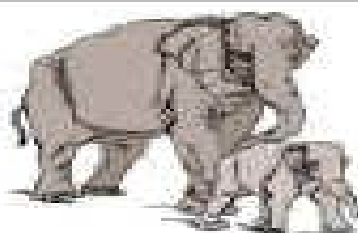
worm



rat



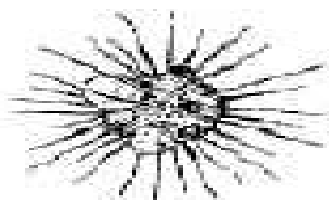
zebra



elephant



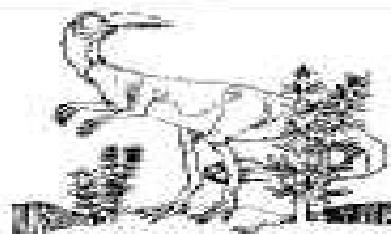
leech



heliozoa



bird



dinosaur



frog



dolphin



euglena



Let's divide . . .

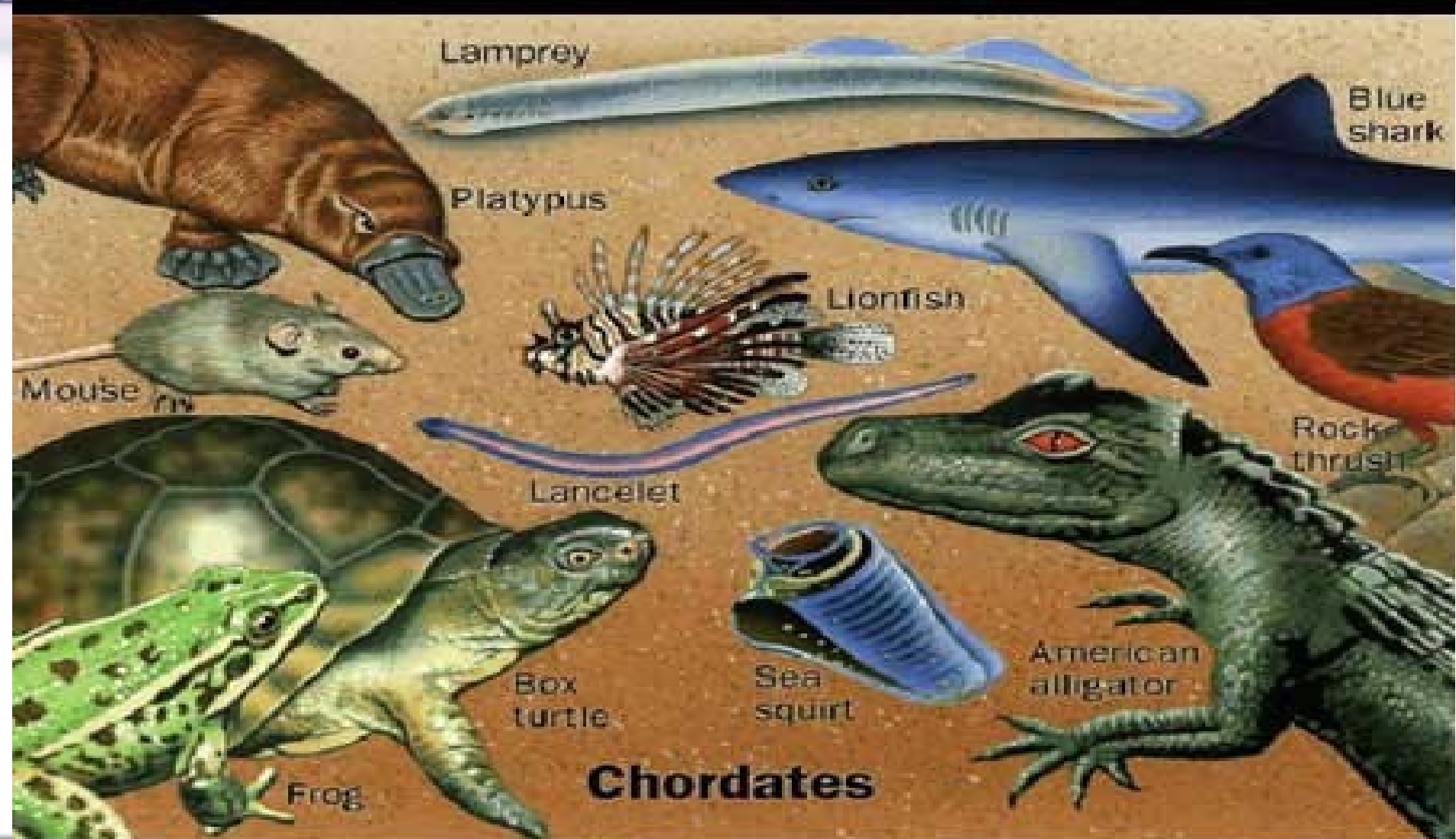
- ✚ Now, group the 16 organisms into two groups.
- ✚ What is your basis of grouping the organisms?



✚ One possible basis of your classification is based on the structure. It is common to group animals into two categories: animals without backbones, called **invertebrates**, and animals with backbones, called **vertebrates**



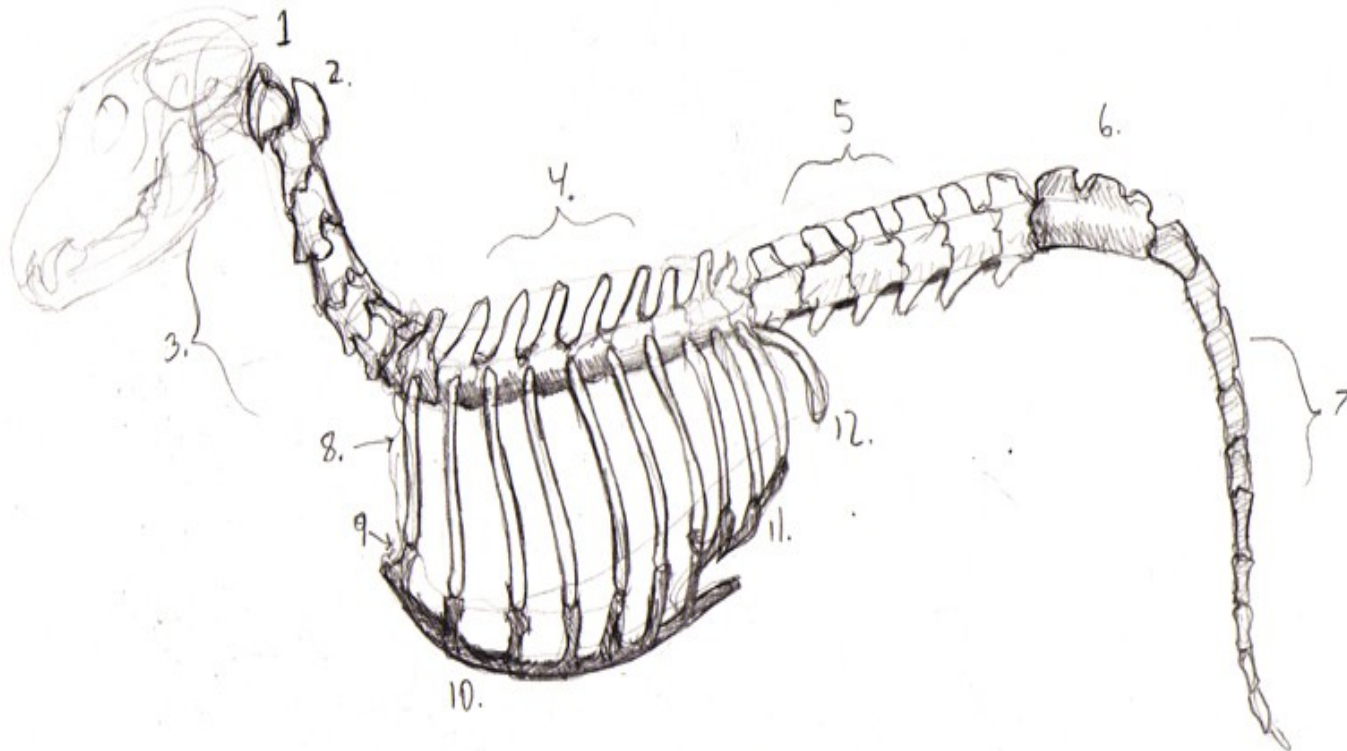
Vertebrates





Characteristics of Vertebrates

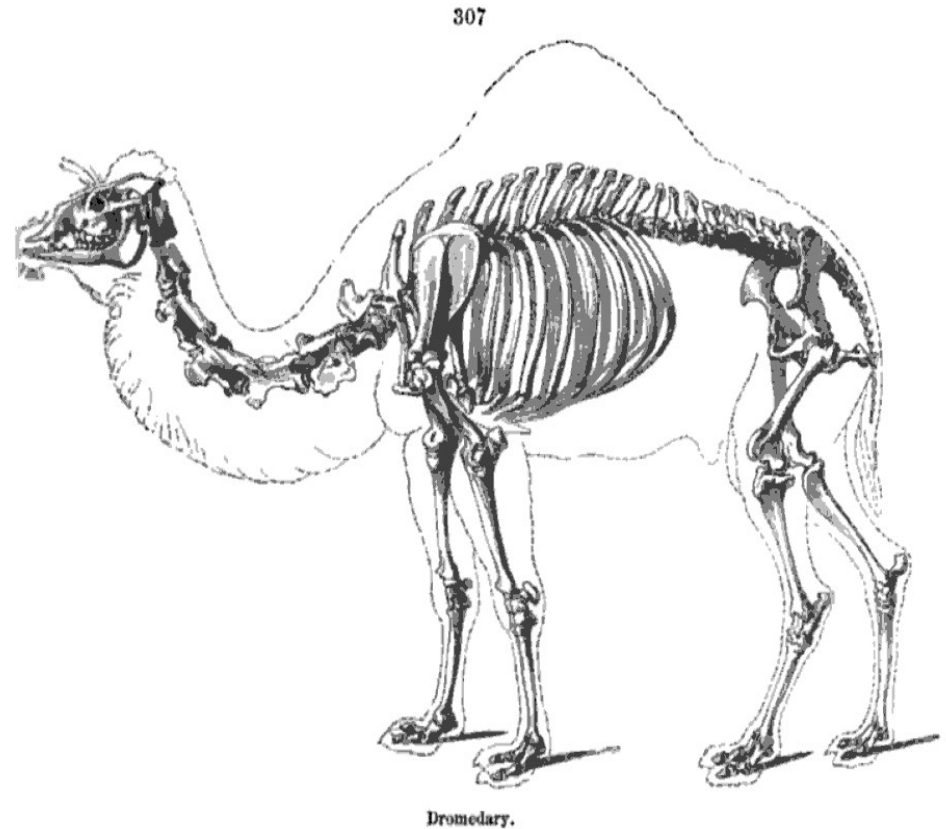
+ Internal skeleton with spine.





Characteristics of Vertebrates

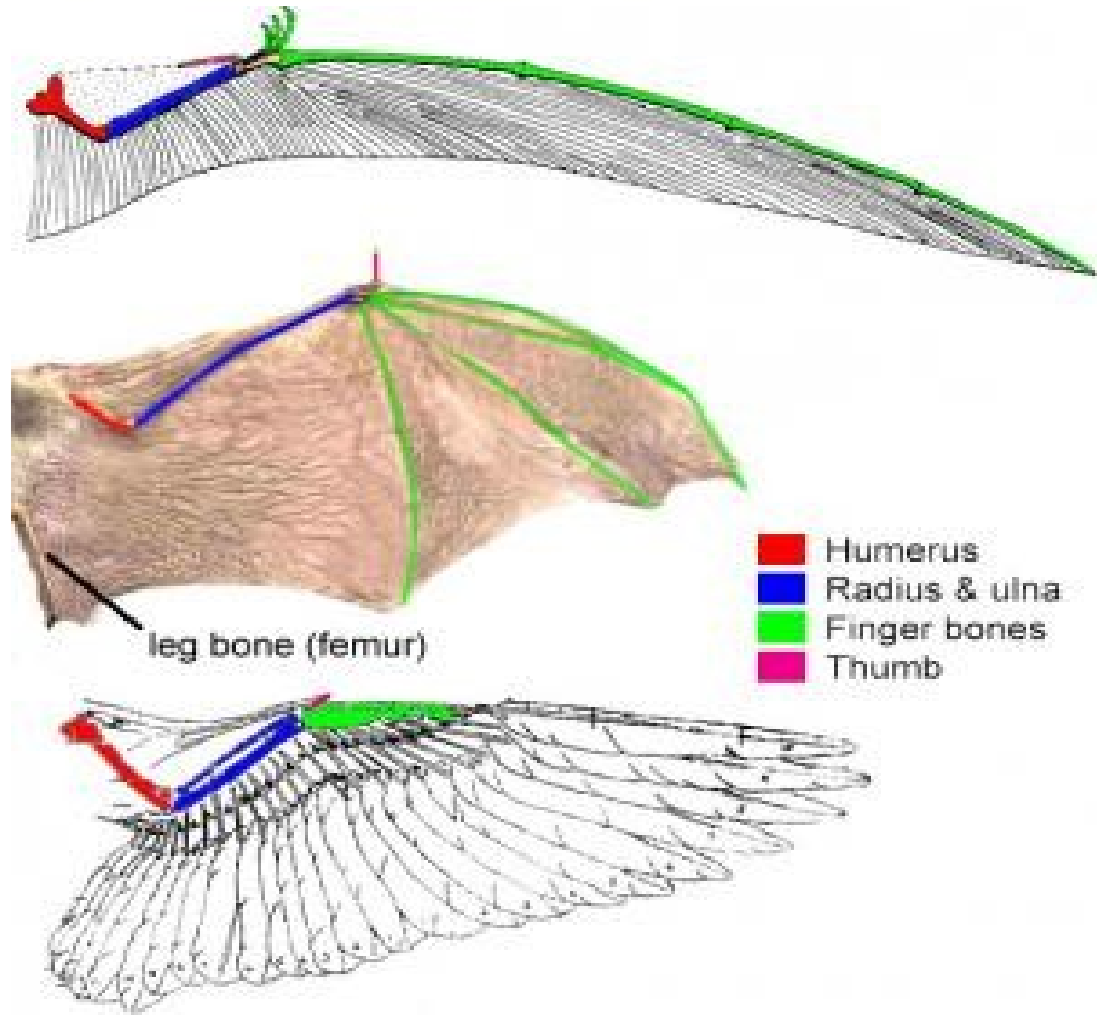
- They have three parts or regions: head, torso and tail





Characteristics of Vertebrates

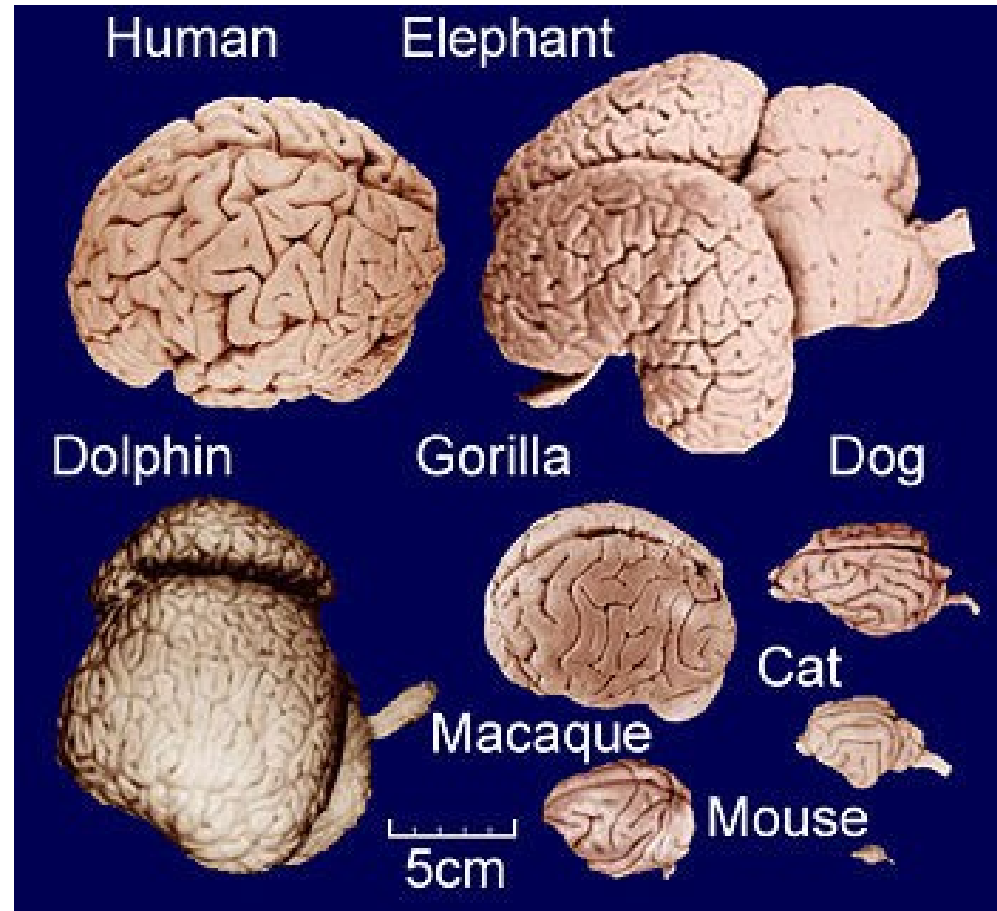
- ✚ The torso has four extremities which can be paws, wings and fins.





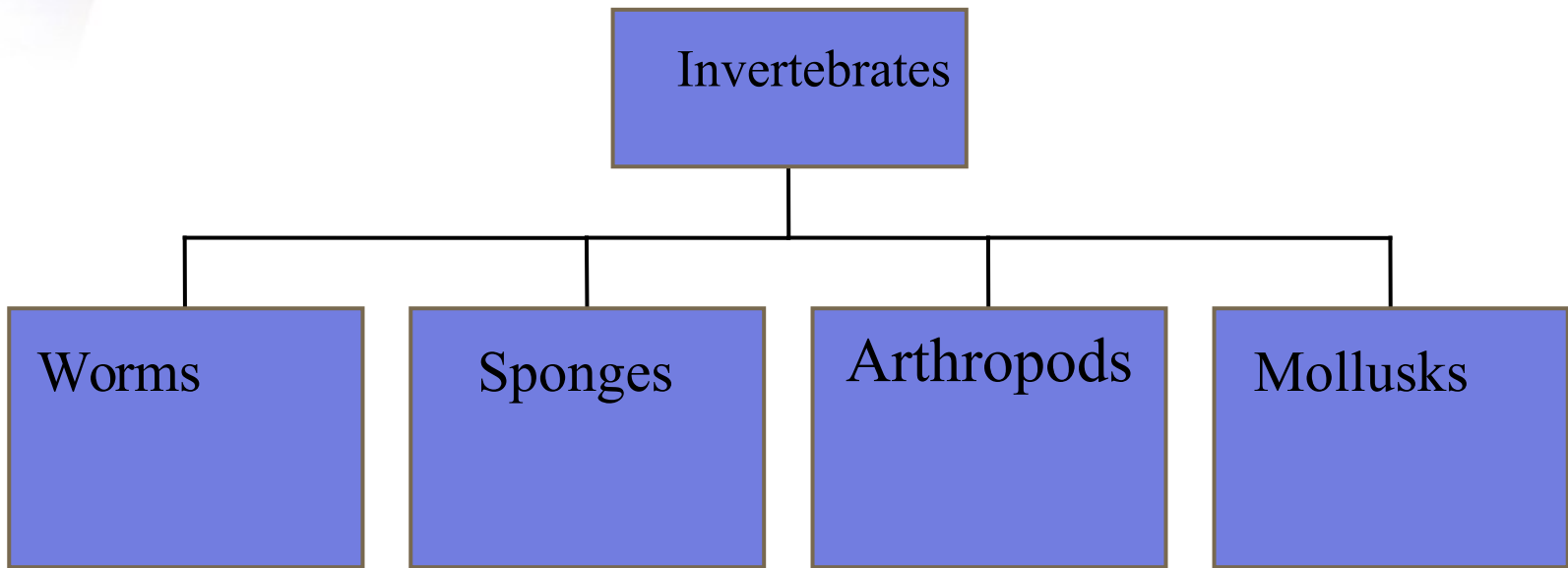
Characteristics of Vertebrates

- ✚ Their nervous system has an encephalon (brain) and a spinal cord. The encephalon is placed inside the skull and the spinal cord is placed inside the spine.





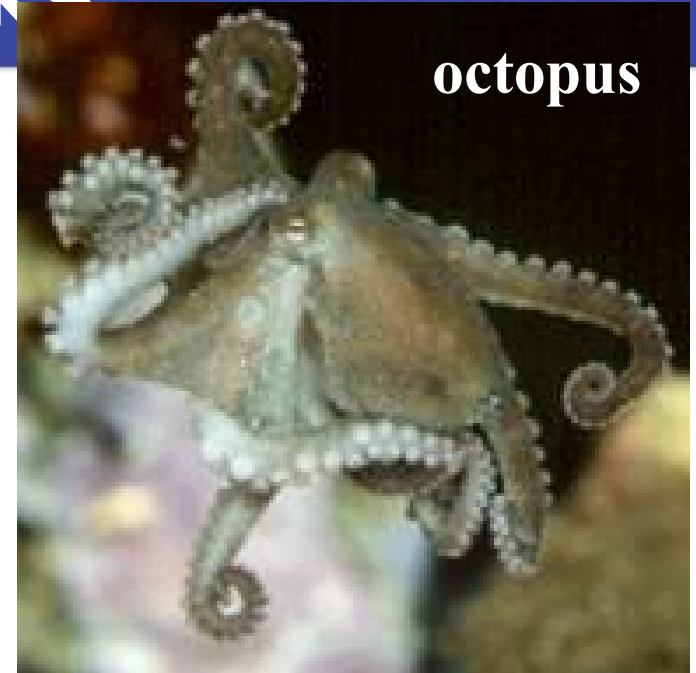
Invertebrates





Invertebrates with Soft Bodies-Mollusks

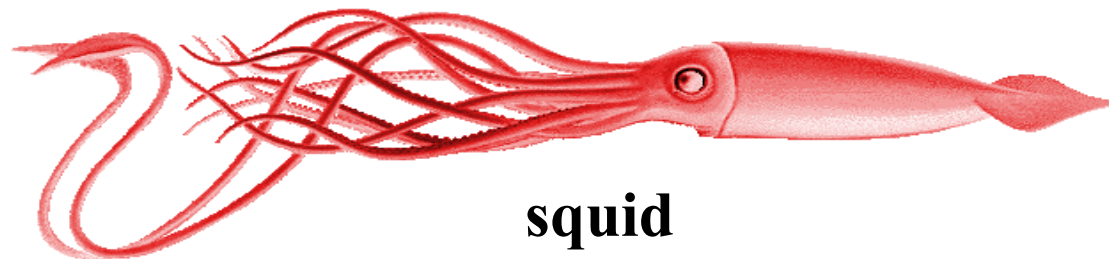
- ✚ They live on land and fresh water and ocean water.
- ✚ They make shells from minerals in the water



octopus



snail

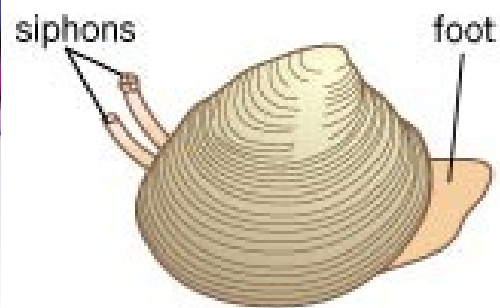


squid

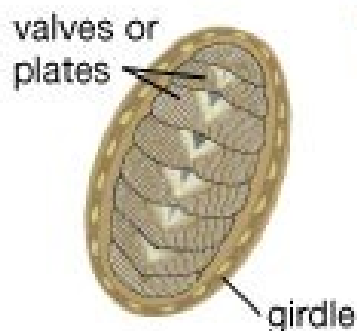


Mollusks

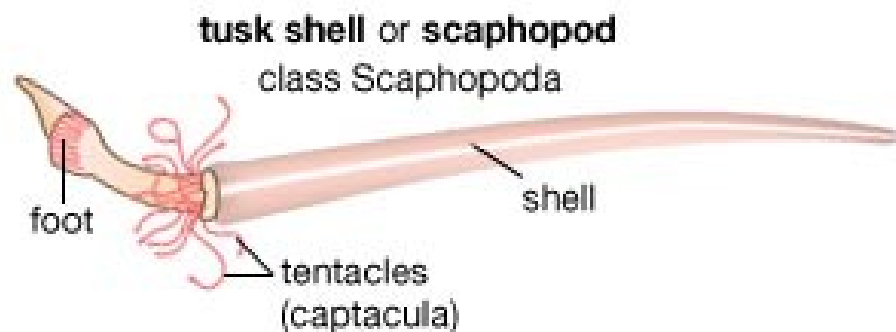
- + Have shells in one stage of their life
- + Have gills
- + Not all mollusks have shells (e.g., octopuses, squid, and slugs)
- + Their gut is equipped with jaws, tongue like structure with teeth
- + Nerves ring around the gut
- + The heart is located at the back end of the body
- + Must stay moist in order to survive
- + Muscular foot to move, dig, and hang on
- + Examples of mollusks: snails, clams, tusk shells, chitons, limpets, octopuses, squid, and slugs



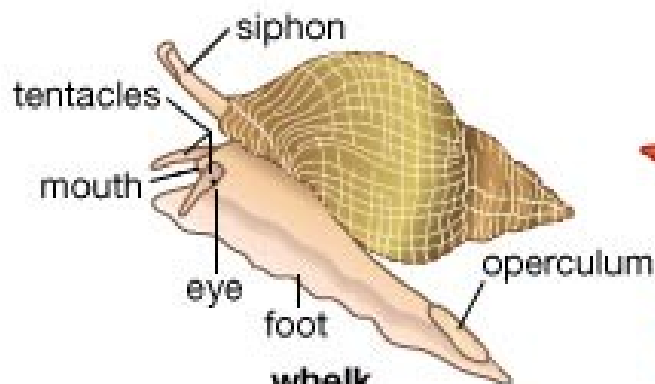
clam
class Bivalvia



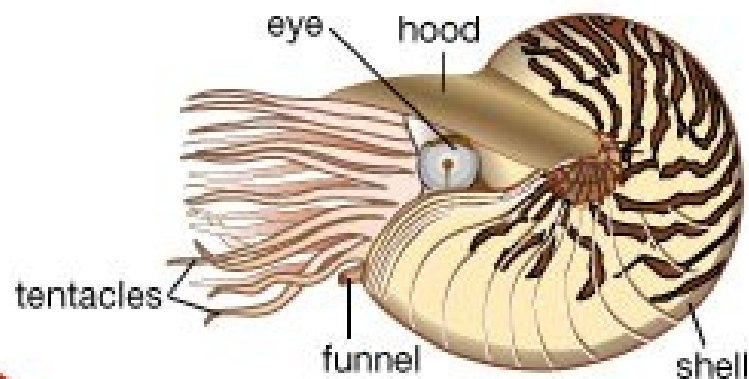
chiton
class Polyplacophora



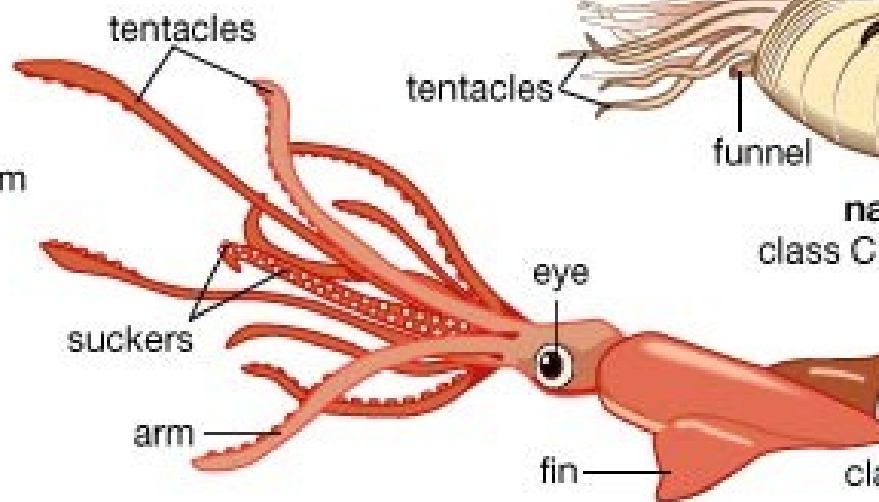
tusk shell or scaphopod
class Scaphopoda



whelk
class Gastropoda



nautilus
class Cephalopoda



squid
class Cephalopoda

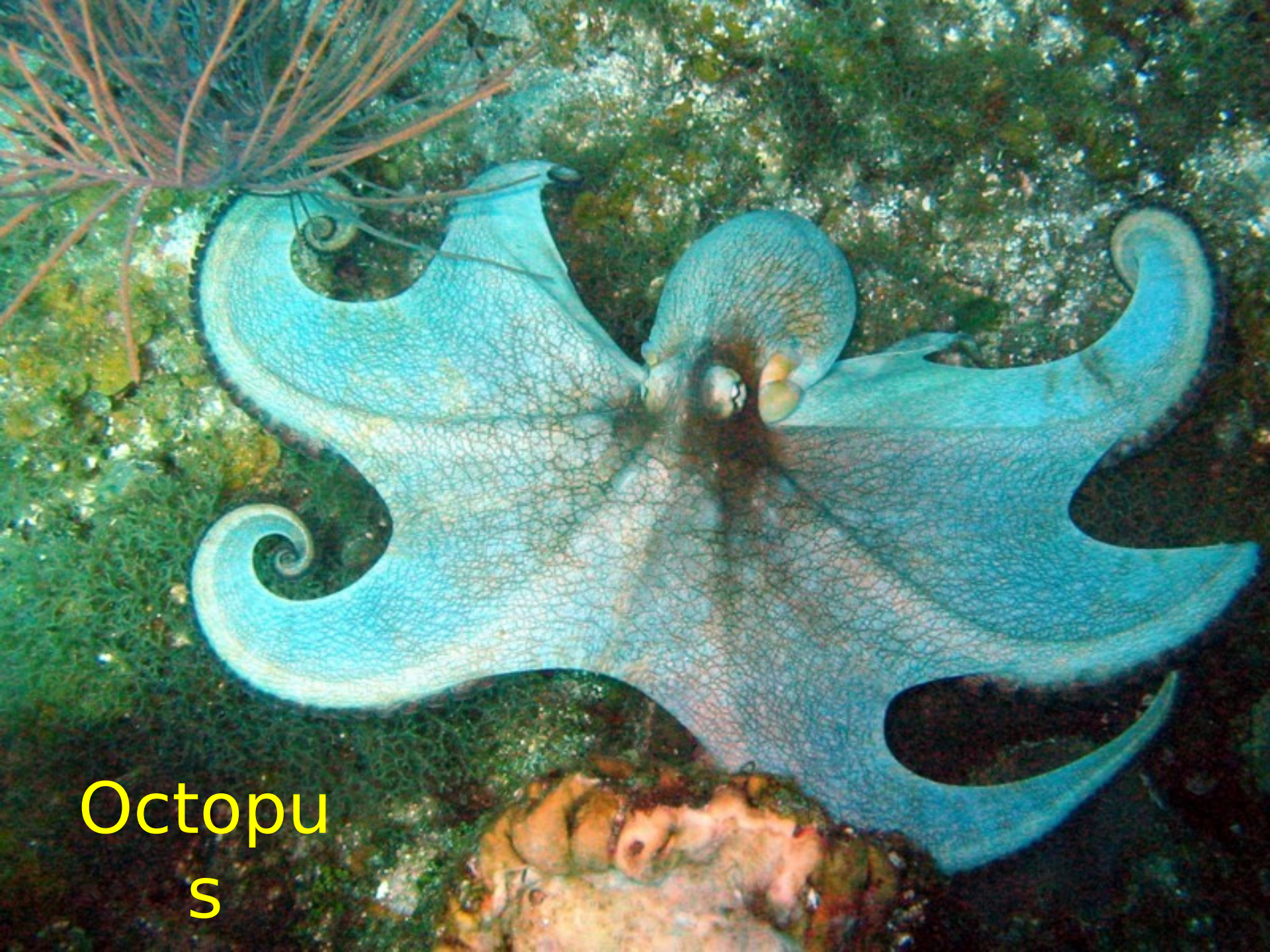


Clams

Chiton







Octopu
s



Squid



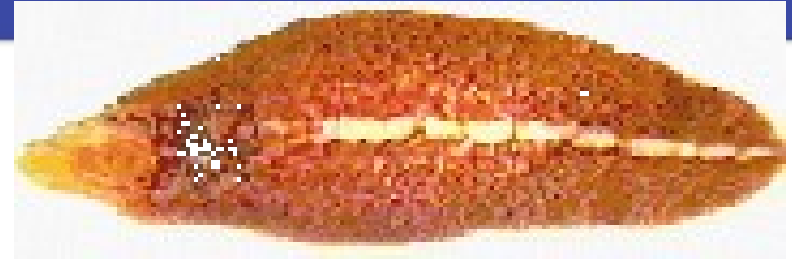
Slugs





Worms

- ✚ They can grow back parts if they lose parts.
- ✚ Some worms can grow to 30 METERS long
- ✚ An earthworm has hairs on it to help it go through the dirt!!!



Flatworm



Roundworms



Segmented



Worms

- + Elongated body
- + No arms, legs, or eyes
- + Internal body parts are in segments
- + Fluid filled body cavity provides support and flexibility
- + The gut is a straight tube
- + Simple nervous system
- + Poor sensory organs
- + Soft body parts without shell
- + There are four main groups of worms: (1) flatworms, or Platyhelminthes; (2) ribbon worms, or Nemertea; (3) roundworms, or Nematoda; and (4) segmented worms, or Annelida.



Flatworms





Ribbon Worms



Round worms



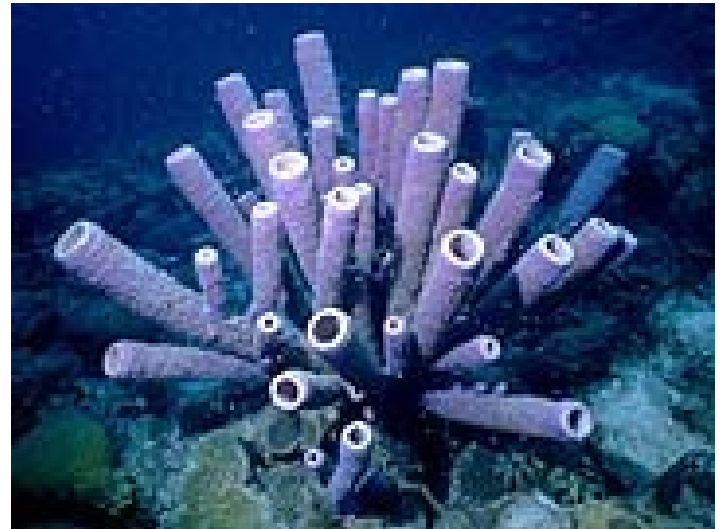
Annelida





Sponges

- + No mouth, stomachs, or other organs
- + Most live in oceans
- + Cannot move
- + They stink a lot





Sponges

- + Simplest form of multi-cellular animals
- + Bottom-dwelling creature with attaches itself to something solid
- + Don't have mouths
- + It exists by pumping water through its body. It gets food and oxygen this way.
- + Soft spongy tissue
- + Give birth to live larva
- + Skeleton is on the outside
- + There are two types of sponges: ***Encrusting sponges*** are similar to moss because they tend to cover the surfaces of rocks. ***Free-standing*** sponges have lots of inner volume compared with their surface area. Sometimes, they grow into strange shapes and gigantic sizes.



Encrusting



Free-Standing Green





Invertebrates with Stinging Cells



jellyfish

- ✚ They have tentacles
- ✚ They have a mouth
- ✚ They live on the ocean floor
- ✚ They shoot



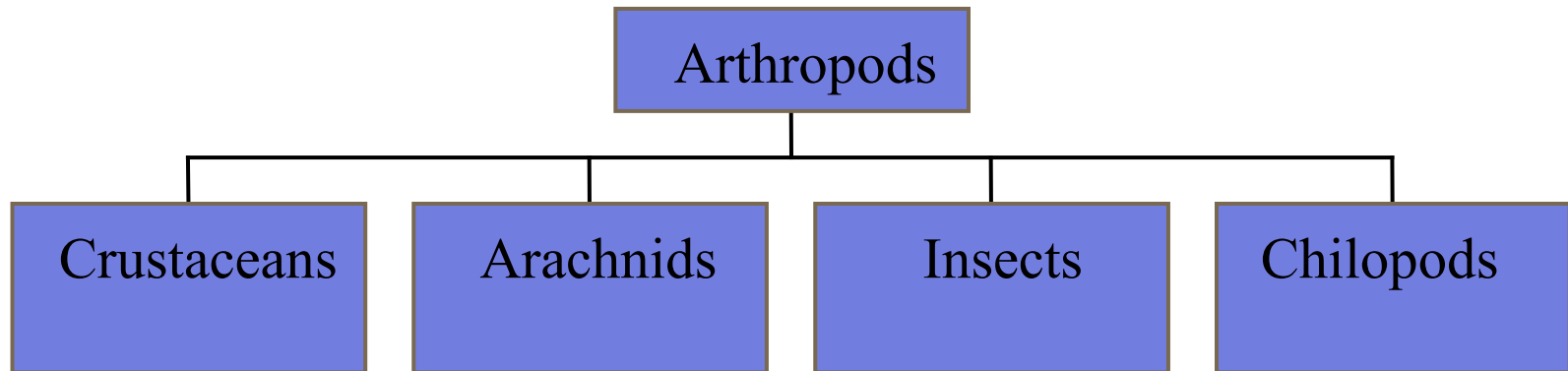
Sea anemone



coral



Arthropods





Crustacean

-  Any of a large class of mostly water-dwelling arthropods (as lobsters, shrimps, crabs, wood lice, water fleas, and barnacles) having an exoskeleton.

Arachnid

-  Any of a class of arthropods including the spiders, scorpions, mites, and ticks and having a segmented body divided into two regions of which the front part bears four pairs of legs but no antennae.

Chilopod

-  Any of a group of arthropods that includes the centipedes and millipedes.

Insect

-  Any of a class of arthropods (as butterflies, true bugs, two-winged flies, bees, and grasshoppers) with the body clearly divided into a head, thorax, and abdomen, with three pairs of jointed legs, and usually with one or two pairs of wings



Arthropod - Characteristics

- + They have keen sense organs
- + They have exoskeletons.
- + They have two or more segments (parts)



Crustaceans

- ✚ They have five pairs of legs
- ✚ They live near or on the ocean floor
- ✚ Live on land and water
- ✚ They have antennae





Arachnid

- Spiders mites and ticks.
- 4 pairs of legs
- Most live on land.
- Some live in fresh water
- They are called parasites.





Insects

- ✚ Largest group of arthropods
- ✚ 3 pairs of legs
- ✚ 3 main body part sections
- ✚ 2 pairs of eyes
- ✚ Have mouths



Monarch

Danaus plexippus



Viceroy

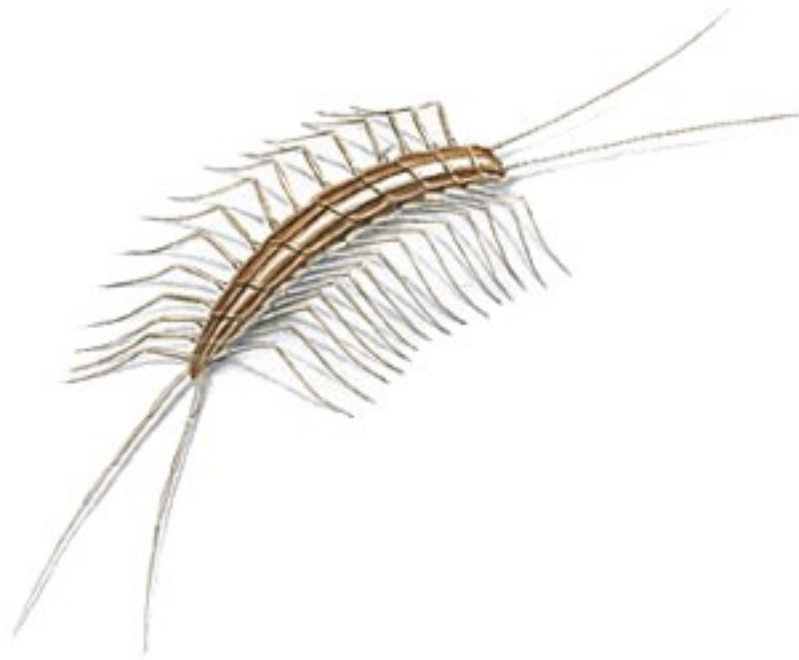
Limenitis archippus





Chilopod

- Any of a group of arthropods that includes the centipedes and millipedes.

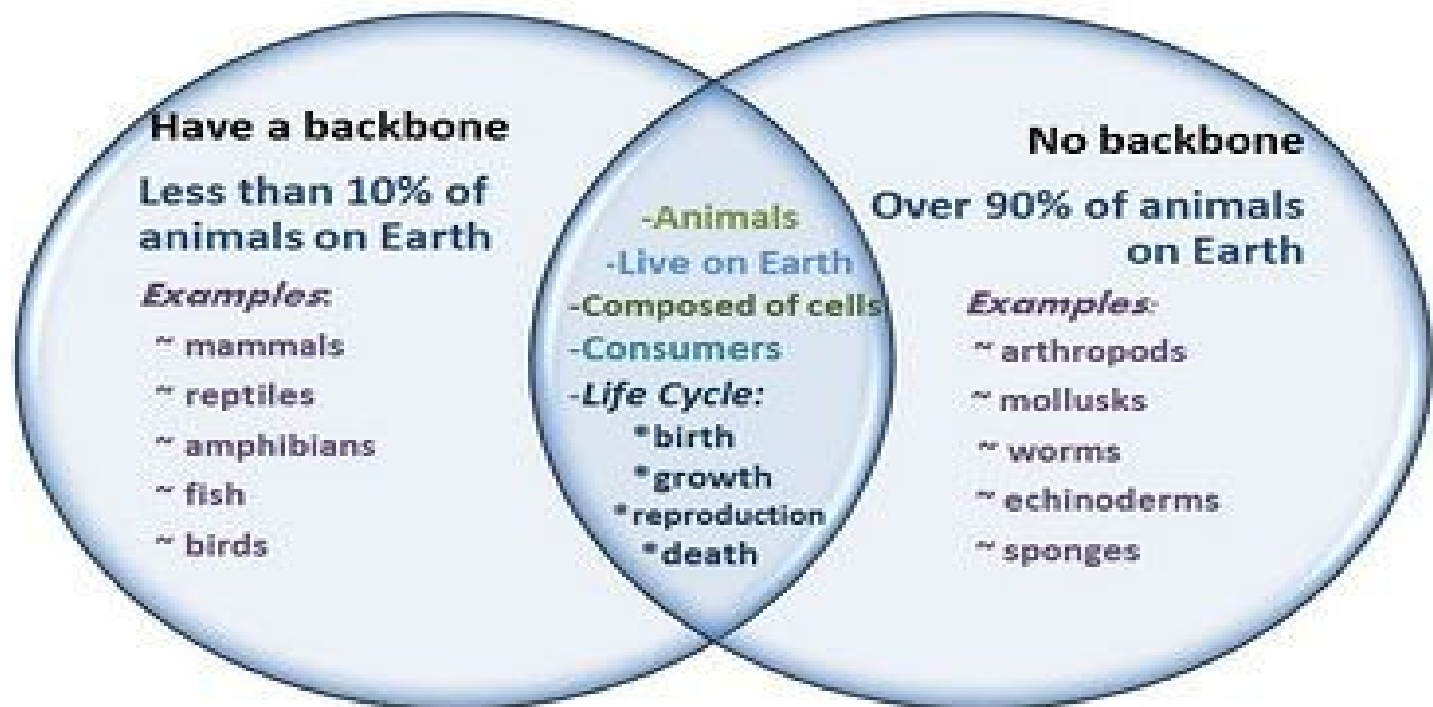




Animals

Vertebrates

Invertebrates





✚ Now, let's regroup the 16 organisms again into two categories. This time according to their mode of reproduction: *Sexual and Asexual*

✚ Now, list down the characteristics of these two modes of reproduction



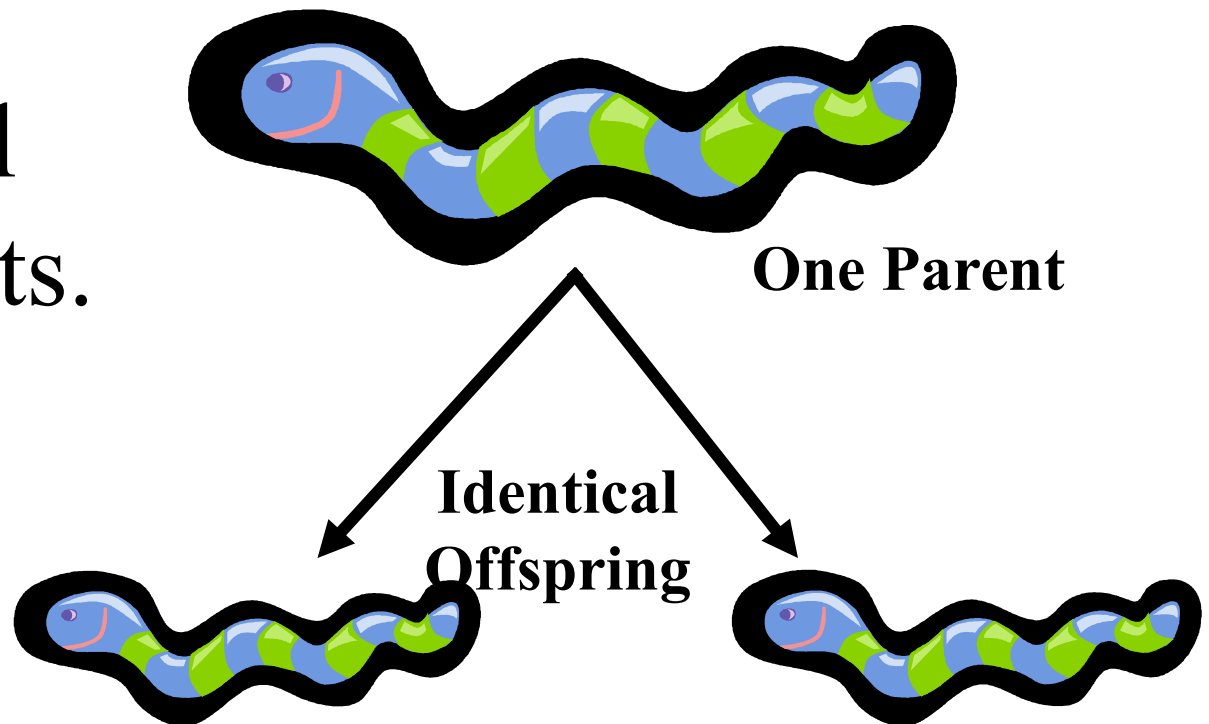
Asexual Reproduction

- Type of reproduction in which a new organism is produced from ONE parent and the offspring is identical to the parent.
- Occurs in most plants, bacteria, protists, and low invertebrates.



Asexual Reproduction

- One parent
- Offspring are identical to the parents.





Asexual Reproduction

- Advantages and Disadvantages of Asexual Reproduction
 - Advantages – Identical to parent, so will get all good characteristics.
 - Disadvantages – Identical to parent, so will also get bad characteristics and is less able to adapt to the environment.



Asexual Reproduction

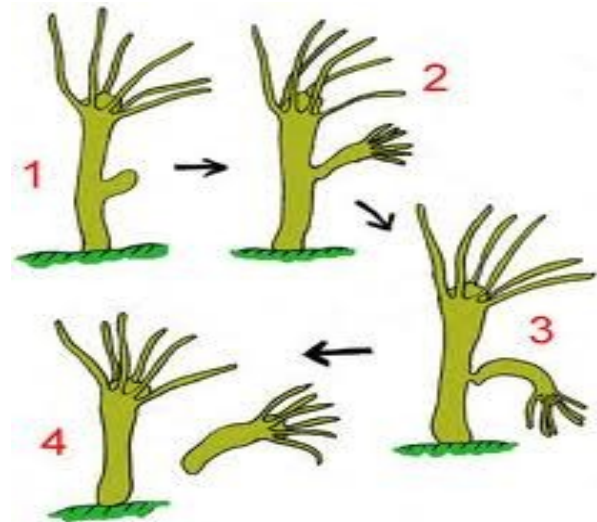
- Types of Asexual Reproduction
 - Regeneration – organism uses cell division to re-grow body parts.
 - Example: starfish, salamander





Asexual Reproduction

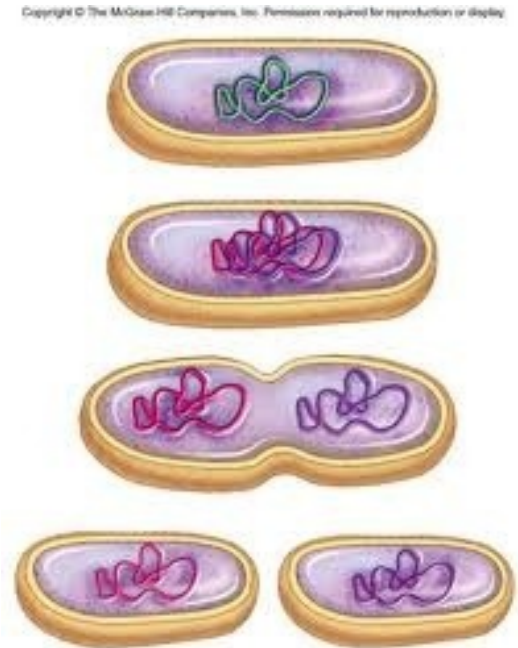
- Types of Asexual Reproduction
 - Budding – organism that produces a bud that breaks away to live on its own.
 - Example: hydra





Asexual Reproduction

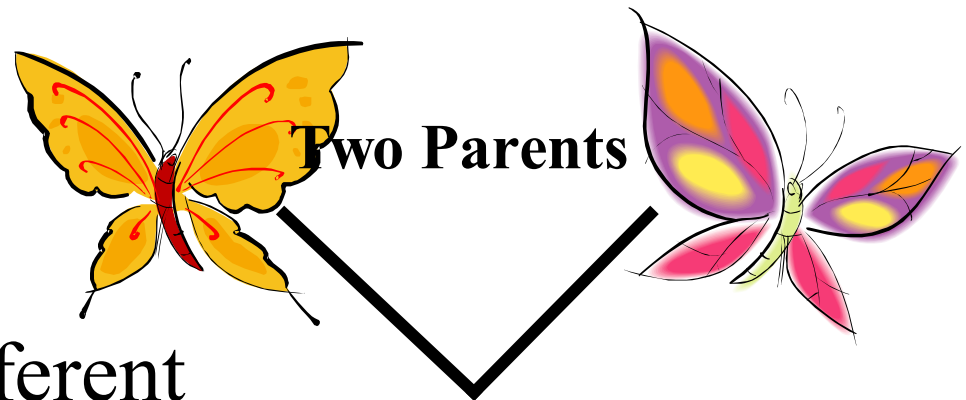
- Types of Asexual Reproduction
 - Binary Fission – used by bacteria, an organism whose cells do not contain a nucleus copy then divide into two identical organisms
 - Example: bacteria





Sexual Reproduction

- Two parents
- Offspring are a combination of both parents and are therefore different from each parent.



unique / diverse offspring





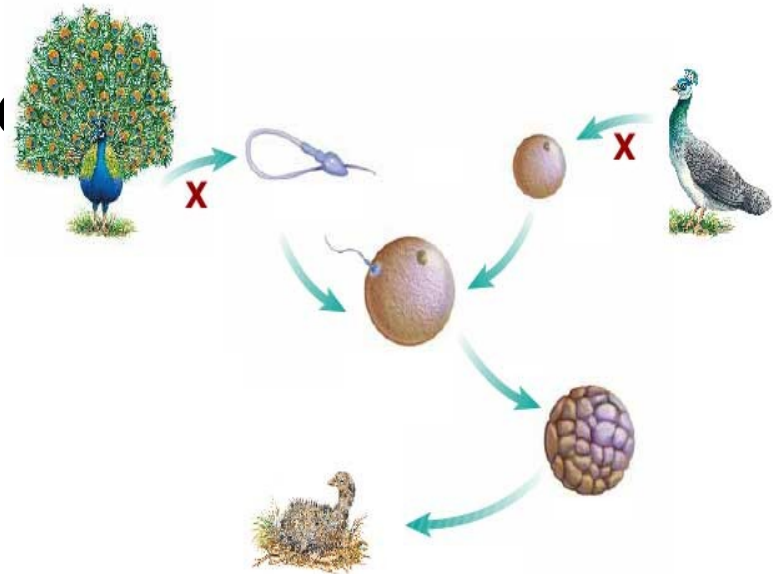
Sexual Reproduction

- Advantages and Disadvantages of Sexual Reproduction
 - Advantages – variety and/or diversity of offspring (color, shape, size, intelligence, ability, etc.), More able to adapt to environmental changes.
 - Disadvantages – uniqueness, sometimes traits needed for survival are not passed on.



Sexual Reproduction

- Types of Sexual Reproduction.
 - Animals – when the reproductive cells of one animal fertilize the reproductive cells of another animal. This produces a baby (embryo).





+ Can large animals reproduce asexually? Why?

+ Why don't little organisms reproduce sexually?



Brainworks

Each student will be given a blank ANI-O grid (like a Bingo card). In each square tile, they will put one vocabulary word related to the vertebrates and invertebrates. After everyone has filled out their cards, students will circulate the class and exchange their ani-o cards with their classmates. In order to win the game, a student must produce a line of signatures by having other students sign off on a vocabulary word and explain it to them. There is a catch though, the same person can't sign your card twice, and the first person with a line only wins if they too can explain each of the signed vocabulary words.



A

N

I-

O

A	N	I-	O



The end is near . . .

■ The light, Juan sees the light.
The Golden Mountain is almost there.

■ But, wait! One big task is up ahead. Our little hero needs to recover the crystals.



The Task

- ✚ Juan needs to recover the crystals from the unknown material.
- ✚ What will he do to perform the task? Can you help him?



Filtration

- Used to separate heterogeneous mixtures composed of solids and liquids
- Uses a porous barrier to separate the solid from the liquid
- Liquid passes through leaving the solid in the filter paper



■ **Figure 3.13** As the mixture passes through the filter, the solids remain in the filter, while the filtrate (the remaining liquid) is collected in the beaker.

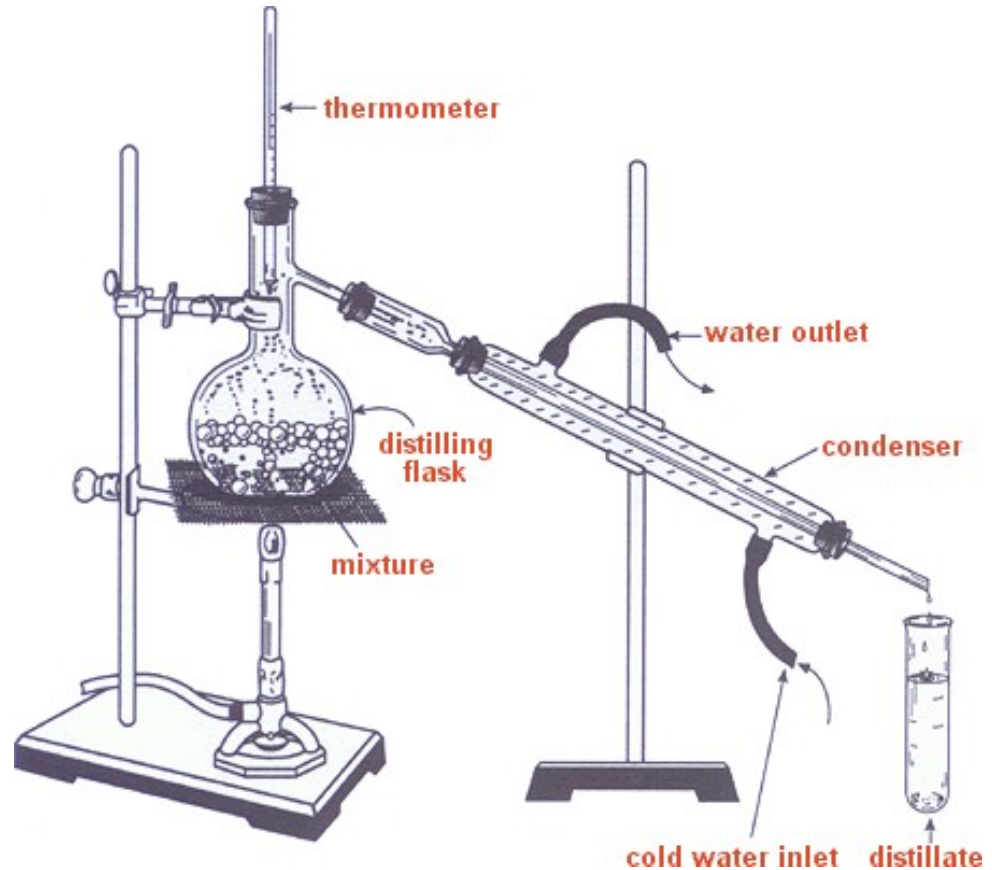


Filtration can be used to separate an insoluble substance from a soluble substance



Distillation

- ✚ Used to separate homogeneous mixtures
- ✚ Based on differences in boiling points of substances involved

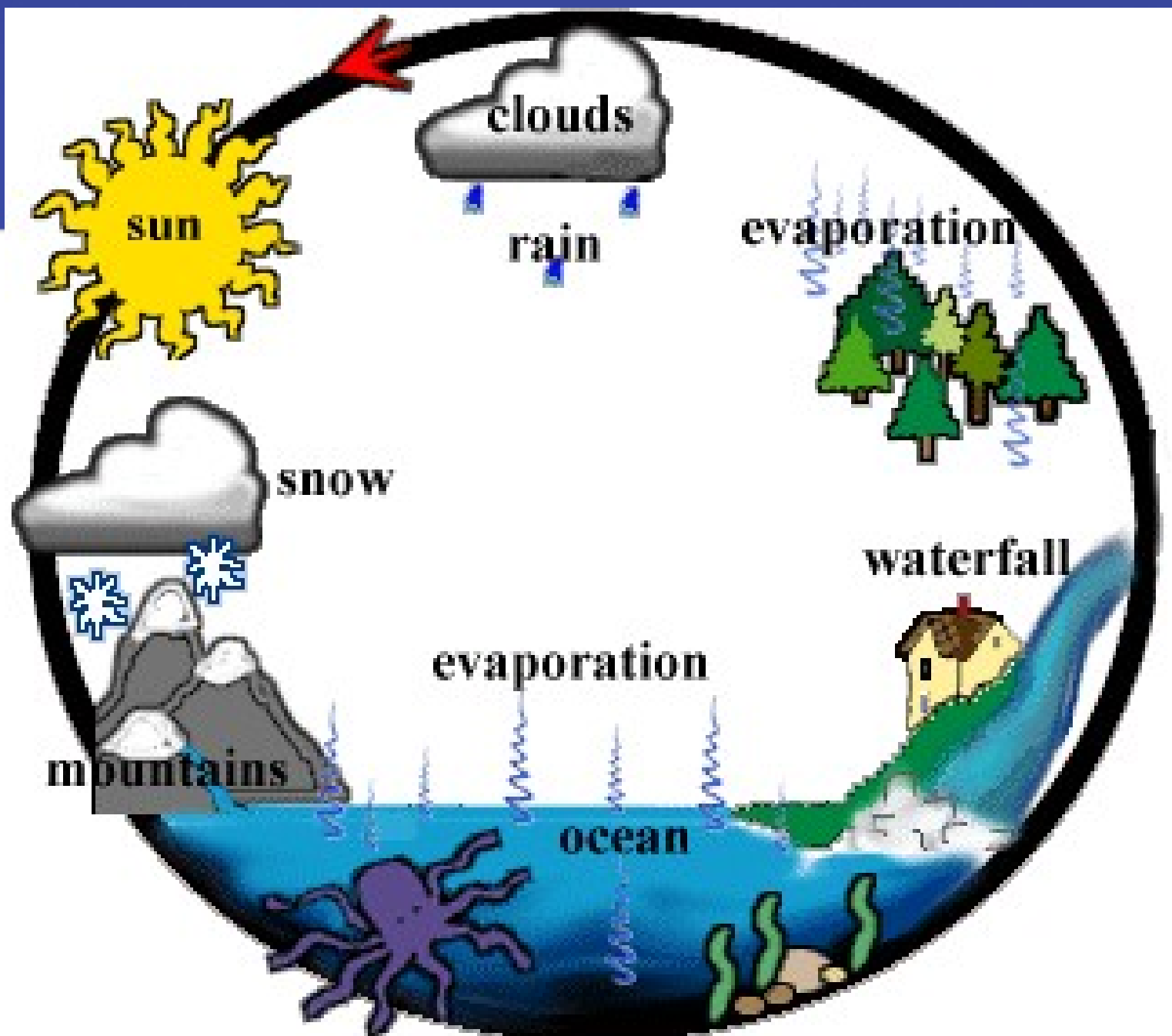




Evaporation



Evaporation can be used to separate a solute from the solvent in a solution



Centrifugation





Centrifuges rotate containers of liquids to separate suspended materials with different densities.

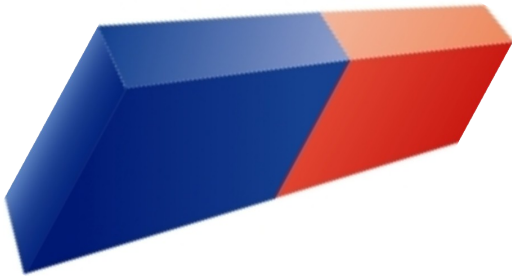
Centrifuges separate different components of human blood or milk and to clarify solutions. A high speed separator can rotate at great speed to separate fat (cream) from milk.

The spin drier in washing machines is a type of centrifuge that throws out the liquid by the "centrifugal force" of the rotation.



Using magnets

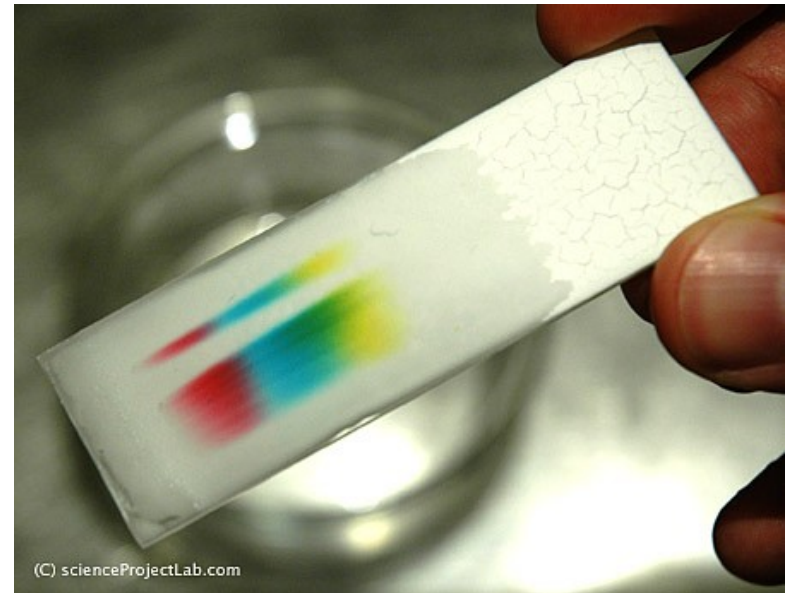
- ✚ Can be used to separate a magnetic substance from a non-magnetic substance





Chromatography

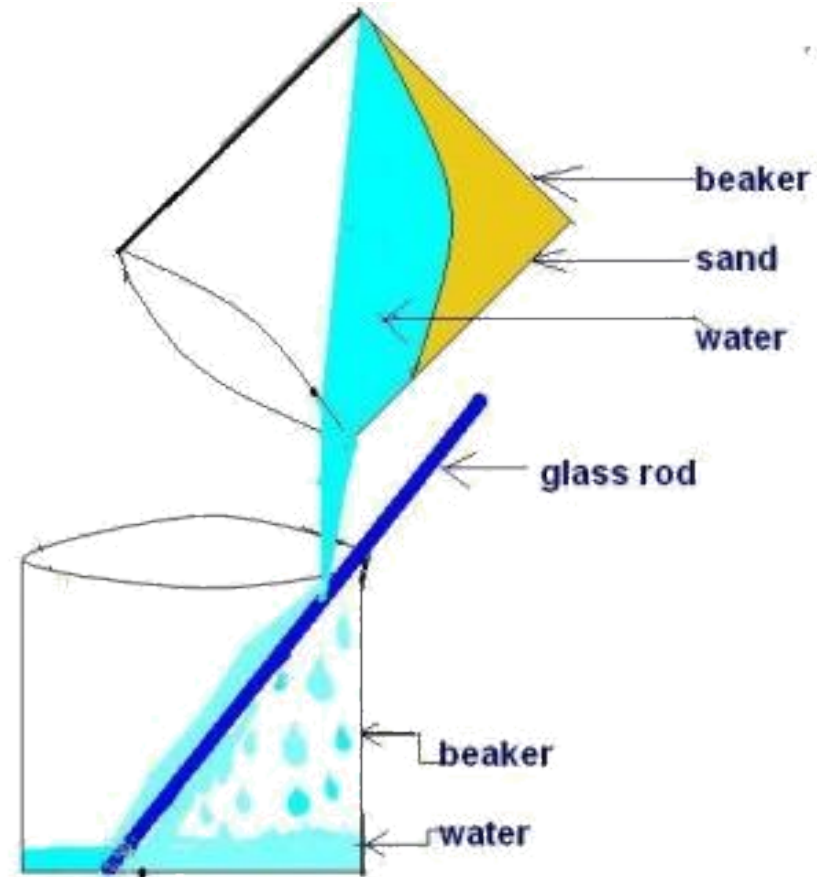
- ✚ Separates components of a mixture based on ability of each component to be drawn across the surface of another material
- ✚ Mixture is usually liquid and is usually drawn across chromatography paper
- ✚ Separation occurs because various components travel at different rates
- ✚ Components with strongest attraction for paper travel the slowest





Decantation

Decanting is done to separate particulates from a liquid by allowing the solids to settle to the bottom of the mixture and pouring off the particle-free part of the liquid. Another method is to allow two immiscible liquids to separate and the lighter liquid is poured off.





Recover the crystals

- ✚ Apparatus: 100-mL beaker, spatula, watch glass, evaporating dish, alcohol lamp, tripod, wire gauze, funnel, filter paper,
- ✚ Materials: water, unknown mixture



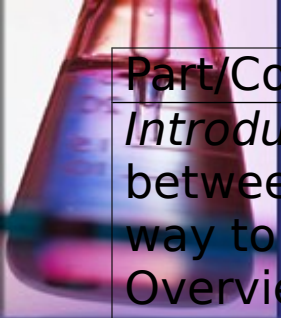
Guide Questions

- + What technique will you perform to recover the crystals?
- + What are the steps you need to take to perform the technique in recovering the crystals?
- + What do you think is the identity of the crystals?



What to expect . . .

- ✚ You are expected to write a short lab report.

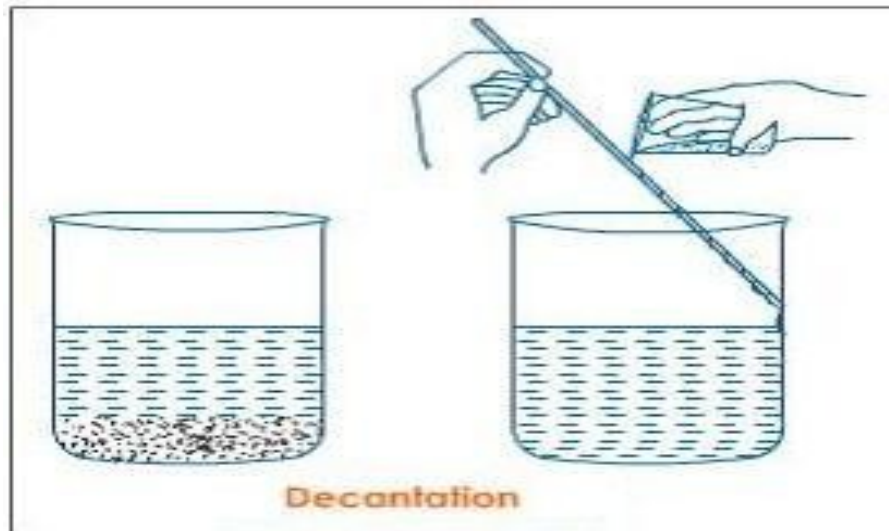


Part/Components	Points	Score
<i>Introduction</i> - Relevant background - ex: difference between elements, compounds, and mixtures, examples of way to separate mixtures using physical properties. Overview of the purpose of the lab	3	
<i>Planning and Procedure</i> - in detail exactly what your group did and why you did it based on your observations of the materials and your prior knowledge. If different procedures were followed both need to be described, or the changes need to be listed.	5	
<i>Data and Analysis</i> - Describe your observations and challenges as you separated the mixture. In your estimation, rate the recovery of each component on a scale of 1-10 (1 is worst, 10 is best). Justify the estimations of your success based on both the purity of your components and the time it took for you to do the job.	4	
<i>CONCLUSIONS</i> - 1. What made you decide to do your procedural steps in the order that you did them? Would any order have worked? 2. If you were able to do the lab over again, what specific things would you do differently and why? 3. Name any materials or tools that were not available that might have made the separation of the substances easier. 4. For each of the four components, describe a specific physical property that enabled you to separate it from the rest of the mixture. 5. Discuss the relationship you expect to find between the speed of the	5	



Let's rewind . . .

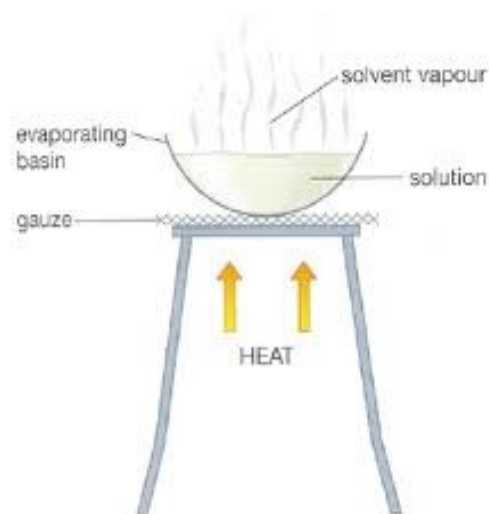
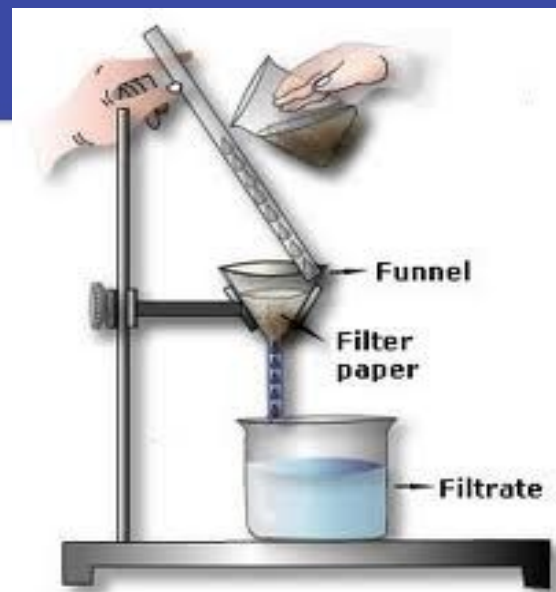
- ✚ Use magnets to separate the coarse parts of the mixture.
- ✚ Pour water into the mixture
- ✚ May perform decantation





✚ To ensure no unwanted sediments, filtration may be used.

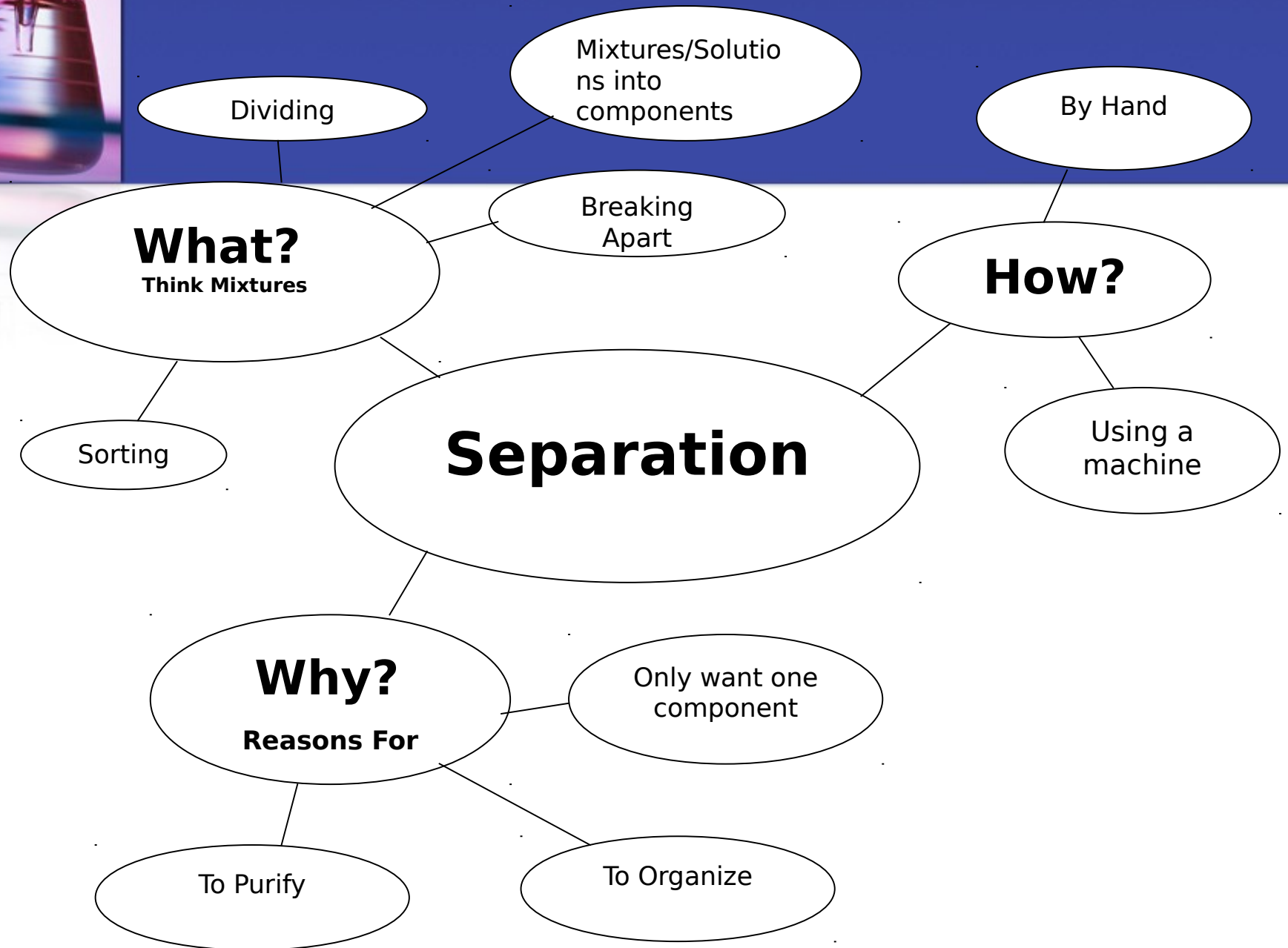
✚ To recover the crystals, heat the filtrate in an evaporation set-up





Brainworks

Name of Mixture	Candy Bar
Type of Mixture (solid-solid, solid-liquid, liquid-liquid)	
Heterogeneous or Homogeneous?	
Components	
Physical/Chemical Properties of Components	
Possible Separation Techniques	
Materials Needed for Separation	
Experimental Design	





Now, I am armed with the crystals.
I would be very powerful and ready
to protect the world.

Thank you for your help.

-Juan



Let's reflect . . .

- ✚ What are your insights in our today's learning?
- ✚ What learning activity/ies you find useful inside the classroom?
- ✚ Do you think these activities can motivate students to learn science?



Essence of Learning Science

- ✚ Experiential Learning
- ✚ Active Learning
- ✚ Constructivist Learning
- ✚ Learning Science is fun



Thank You!