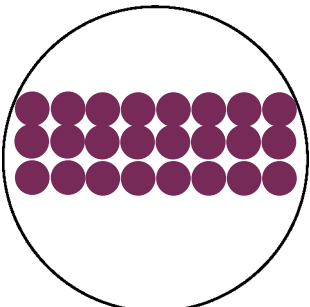
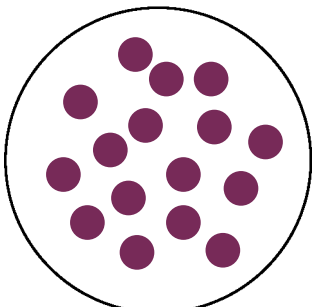
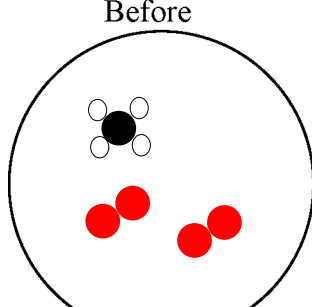
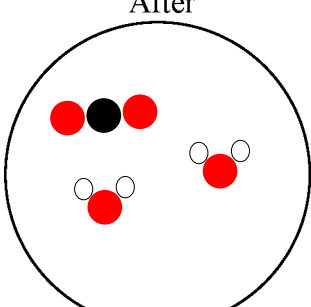


WKS 1-2: Physical & Chemical Properties & Changes

4. For the following two situations, decide whether the change described is physical or chemical. Then, in the space provided, illustrate the change at the particulate level. *Draw circles for each atom. Shade copper atoms blue, carbon atoms black, hydrogen atoms white and oxygen atoms red.*

<p>a) Pure copper can be heated until it melts just below 2000°F. The liquid copper can be poured into molds. Physical or Chemical? <u>Physical</u></p> <div style="display: flex; justify-content: space-around; text-align: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 150px; height: 150px; margin: 10px;"> <p>Before</p>  </div> <div style="border: 1px solid black; border-radius: 50%; width: 150px; height: 150px; margin: 10px;"> <p>After</p>  </div> </div>	<p>b) Natural gas consists mostly of methane gas, CH₄. Natural gas is used to heat homes and cook food. The methane is “burned” by reacting with oxygen gas, O₂. The products of this reaction are carbon dioxide gas, CO₂, and water vapor, H₂O. Physical or Chemical: <u>Chemical</u></p> <div style="display: flex; justify-content: space-around; text-align: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 150px; height: 150px; margin: 10px;"> <p>Before</p>  </div> <div style="border: 1px solid black; border-radius: 50%; width: 150px; height: 150px; margin: 10px;"> <p>After</p>  </div> </div>
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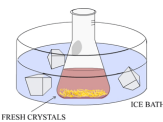
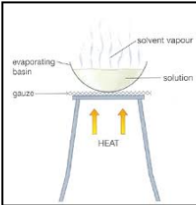
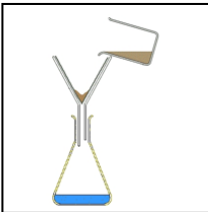
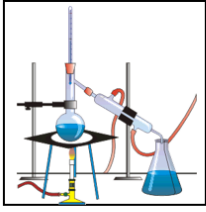
5. The following are some traditional ways of differentiating between physical changes and chemical changes. Which definition below is the most correct and useful definition? B
- A physical change is easily reversed, while a chemical change is not easily reversed. (There are chemical changes which are reversible.)
 - During a chemical change, a new substance is formed. During a physical change, no new substance is formed.
 - No bonds are formed or broken during a physical change. Bonds are formed and broken during a chemical change. (This is false because bonds/attractions must be made/broken in phases changes and when dissolving or crystallizing.)
 - A chemical change is associated with a large energy change, whereas a physical change is associated with a small energy change. (Large energy changes can occur due to a physical change. Example: $\text{NaOH(s)} \rightarrow \text{NaOH(aq)}$ gets hot. $\text{NH}_4\text{NO}_3\text{(s)} \rightarrow \text{NH}_4\text{NO}_3\text{(aq)}$)
6. Classify each of the following as either a physical change or a chemical change.

Chemical	a) Burning a log
Physical	b) Melting a piece of solid wax
Chemical	c) Food spoiling
Physical	d) Obtaining gasoline by distilling crude oil. (Crude oil is a mixture of hydrocarbons—one of which is gasoline)
Physical	e) Making rock candy by crystallizing solid sugar from a concentrated sugar/water solution.
Physical	f) Production of dry ice (solid CO ₂) from pressurized CO ₂ gas.
Chemical	g) Refining copper from copper ore (2 common copper ores are CuS and Cu ₂ O)
Physical	h) Desalination of sea water by boiling the away the water and recollecting it.
Chemical	i) Fermentation of the sugars in corn to form ethanol.
Physical	j) Separating sand out of a sand/water mixture by filtration.
Physical	k) Distilling wine (a 12% alcohol/water mixture) to form grain alcohol (an 80% alcohol/water mixture).
Physical	l) Dissolving sugar into tea.
Physical	m) Collecting oxygen from air by pressurizing and cooling air. Liquid oxygen condenses out of the air.

7. Classify each of the following as an *intensive* or an *extensive* property.
- a) Copper has a density of 8.96 g/cm³. **Intensive**
 - b) Nitrogen boils at -196°C. **Intensive**
 - c) A sample of water has a mass of 35.2 g. **Extensive**
 - d) Gold has a metallic yellow color. **Intensive**
 - e) A nail is 5.10 cm long. **Extensive**

Word Bank: *distillation, crystallization, evaporation, extraction, filtration*

8. Fill in the name of each separation technique described below, then fill in any missing information into the chart.

Diagram of technique				
Name of Technique	Crystallization	Evaporation	Filtration	Distillation
What types of substances can be separated by this technique?	Dissolved solid from liquid	Dissolved solid from liquid	Solid from liquid	Two soluble liquids
Give a specific example of a mixture that could be separated by this technique.	Sugar water (rock candy)	Collect salt from salt water	Mud (collect either solid or liquid)	Collect water from salt water or from alcohol mixture
Separation is possible due to what physical property being different between substances?	Solubility	Volatility (boiling point)	Physical size (smaller particles trapped)	Boiling point

9. Nail polish removed consists of a solution of acetone dissolved into water. Acetone has a boiling point of 55°C and water has a boiling point of 100°C. What technique could you use to separate the acetone and the water? distillation Describe this process.
- The solution is placed in the sample flask of the distillation apparatus and heated. Acetone will evaporate first since it has a lower boiling point. The acetone will enter the condenser and liquefy, and it can be collected in the collection flask.
10. Describe how one could separate a mixture of water, salt and sand. (*Make sure to state what techniques would be used and in what order.*)
- Since salt is soluble in water, it will form a salt water solution. The sand is insoluble and consists of large crystals, so the mixture is filtered, and the sand dried to remove the water. The salt water can be evaporated to remove the water and leave behind the salt, or if the water needs to be collected, distillation will leave behind the salt and allow the water to be collected.
11. The main substances of air are listed at the right. Use the specific boiling points given to describe how one could separate the substances of air? What order would the substances separate out?

	Oxygen	Argon	Nitrogen
Boiling point (°C)	-183	-186	-196
% Air by volume	20.9	0.9	78.1

Since gases condense into liquids when cooled below their boiling points, one could cool the mixture and remove each liquid as it is formed. Oxygen has the highest boiling point so would separate first, then argon and finally nitrogen.