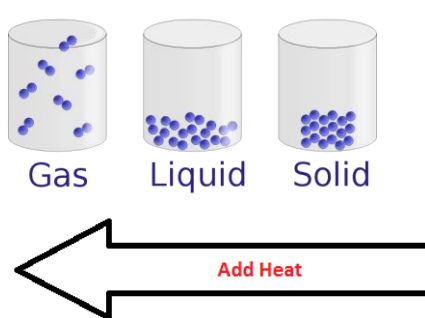



First Lego League Curriculum - Ontario

Activity Sheet	
Gr 7 - Lesson #2	Switch Block – Heated Presentation
Date:	Name(s):

<b>Check That I'm Done</b> <input checked="" type="checkbox"/>		
<input type="checkbox"/> Commented on my code	<input type="checkbox"/> Modify it task	<input type="checkbox"/> Coding Challenge

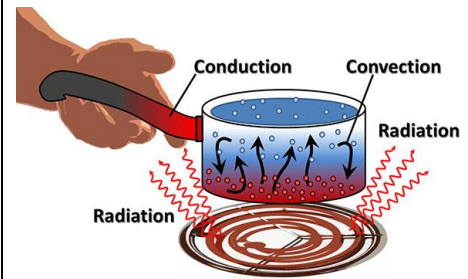
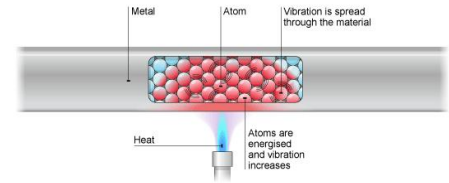
Learn	
<p>All substances, whether they are solid liquids or gases are made up of tiny particles.</p> <p>As these particles get hotter, they vibrate more rapidly. These vibrations are constantly being transferred to other particles nearby the same way you would expect on real world (macro) scale.</p> <p>Just as you would expect with a pool ball hitting another ball, as some particles are sped up, the other ones slow down. This causes an equalizing effect. Hot water mixed with cold water will eventually give you warm water for this same reason.</p> <p>This transfer of vibrations from one group of particles to another is called heat transfer. This can happen in several ways.</p> <p>Perhaps the simplest is <b>conduction</b>. When</p>	 

First Lego League Curriculum - Ontario

particles come in direct contact with other particles they hit each other and heat up. Not all materials heat up as easily as others.

In fluids, such as air or water, **convection** can occur. This is a self-stirring that occurs because the hot part of the fluid is less dense and floats to the top, while colder parts of the fluid sink down. If the heat source is at the bottom, it catches those cold particles, heats them up (via conduction) and then they rise again to the top. See the pot example →. Eventually the entire substance reaches a very similar temperature and the self-stirring stops.

**Radiation** is the least intuitive but not complex. As some particles get very hot they emit light photons. These photons are capable of travelling through space and when they hit other particles, can cause them to vibrate and heat up as well. A common example is photons from the sun, hitting a metal bench. These metal particles vibrate easily and become quite hot.



**Predict and Plan**

Which form of heat transfer do you predict would be the hardest to demonstrate with an EV3 robot? Why? \_\_\_\_\_

\_\_\_\_\_



## First Lego League Curriculum - Ontario

### Demonstrate/Design/Discover

- ✓ Get together with the other groups in your class that were given the same heat transfer type to demonstrate. You will each be acting as a particle in a substance undergoing heat transfer.
- ✓ Now that you know how to accurately control your robot, come up with a plan to demonstrate it to the class as a group. Use the visuals from the learn section above to guide you.
- ✓ For example, for convection your robots could trace out the path water particles take in a heated bot, using the indicator lights on top for extra effect. For conduction, you could show one group of hot particles/robots coming in contact with cold particles/robots. For radiation, you could show a group of particles/robots slowly heating up, producing light then particles/robots nearby (but not touching), start heating up.
- ✓ Without giving away the heat transfer type you plan to demonstrate, present your program (together with the other robots in your group) to the class. See if the class can accurately guess the type of heat transfer you're demonstrating. Make sure to practice a few times first!
- ✓ Ask the following questions to the rest of the class
  - 1) What about our program helped you guess the right answer
  - 2) What about our program was misleading, inaccurate or could have been improved?

First Lego League Curriculum - Ontario

Tips: drawing out your ideas visually on paper is a good first step. Next you can break down the types of behaviors you're responsible for, and what you need the motors and lights to do.

**Record**

Heat transfer type I was given: \_\_\_\_\_

**Questions**

Question 1 Science	One thing our program showed really well was:
-----------------------	-----------------------------------------------

Question 2 Science	One thing our program didn't show clearly was:
-----------------------	------------------------------------------------

Question 3 Science	Do most real life examples include more than one heat transfer type, or usually just one? Give an example in your answer.
-----------------------	---------------------------------------------------------------------------------------------------------------------------

Most real life heat transfer include conduction, and often one or both of the others. A stove element gets hot enough to glow and create radiation, and most things are receiving visible light at any given time. Heating soup in the microwave is another good example of all three.

Question 4 Science	Rub your hands together very quickly until they get warm. What type of heat transfer is that? Explain.
-----------------------	--------------------------------------------------------------------------------------------------------

Conduction, due to friction.

Question 5 Math	Does all the heat from a bonfire come directly from hot air touching your skin? Use the methods of heat transfer in your answer.
--------------------	----------------------------------------------------------------------------------------------------------------------------------

No, some heat comes from radiation due to the fires light, and likely



**First Lego League Curriculum - Ontario**

convection too if you're above the fire (and not just beside it).

Extension Coding and Science	Try and demonstrate an entire pot set up, showing the three heat transfer types in one demonstration. Use construction paper and other props to enhance the presentation.
------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------