Teacher Directions for Conduction Convection Radiation Station Lab

Input Stations

✓ **Read It!**
Print several copies of the reading so that multiple students can read at different paces. There are two versions of the reading passage:

 Dependent  Modified

✓ **Watch It!**
The video is on YouTube.

These are the URLs used in this station lab.
http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/heat.htm

✓ **Explore It!**
I will spend much of my time at this station make sure students understand the concepts. You will need a lamp, 2 beakers, 2 metal rods/spoons, a hot plate, ice. One of the beakers needs ice water, and the other needs just above lukewarm water. CAREFULL!

✓ **Research It!**
This station is not included for Modified learners.

These are the URLs used in this station lab.
https://www.wisc-online.com/learn/natural-science/earth-science/sce304/heat-transfer-conduction-convection-radiation

Output Stations

✓ **Organize It!**
All of the cards are included for this station. The cards for this activity are attached near the activity. Students should be encouraged to do the Research and Explore station before attempting this one. I like to label the backs with set numbers because they will get mixed up. Place this one next to the Explore It! Station.

✓ **Illustrate It!**
Make sure to include colored pencils or crayons at this station.

✓ **Assess It!**
Students should do two input stations before completing this one. This station is a good one to use for an assessment/grade.

✓ **Write It!**
This station is not included for Modified learners.

Students should do two input stations before attempting this one.

✓ **Challenge It!**
This station is not included for Modified learners.

This optional station is for early finishers and Independent-level learners.

Answer Sheets

There are two versions of the answer sheet. Dependent is for on-grade learners. Modified is for learners who need more support. Modified only has three inputs and three outputs, and includes sentence stems.

 Dependent  Modified

Teacher Directions – Overview of Choices

There are three main ways you can use the version 2 Station Lab materials to explore a topic.

The first option is to use the in-class, print version. You would use this version if your class isn't 1:1 with devices and you are able to make printed copies.

If your students are able to move around the room in groups, you can set up nine stations around the room with two to three copies of the materials at each station. The students would move from station to station, using the materials (usually laminated) and writing answers on their answer sheets.

If your students aren't allowed to move around the room or share materials, you might consider doing several of the stations together as a class (especially Watch It! and Research It!), then printing out copies of the remaining materials for each student.

There is a modified version of the reading passage and a modified answer sheet for the print version that has fewer stations, no Challenge It! station, and a word bank for the vocabular section of the Assess It! station.

The second option is to use the self-contained digital version. You could use this version if your students are working remotely or if you have 1:1 devices and can't use/share paper materials.

With this version, students open one file, either in PowerPoint or Google Slides, and interact with it in Normal edit mode. They type answers into text boxes and manipulate shapes to complete the station tasks. You might use this format if your students struggle with switching between two files or two browser tabs.

There is a separate file for the Modified version. It has a simplified reading passage, fewer stations, a word bank in Assess It!, and simplified tasks.

The third option is to use the digital version that includes a Google Form. You could use this version if your students are working remotely, or if you have 1:1 devices and can't use/share paper materials. With this version, students open two files. The first is the station lab itself, opened in Normal edit mode in either PowerPoint or Google Slides. The second is a Google form answer sheet that has been formatted with questions that match the stations. There are sections in the Form to upload screenshots of stations that have images to create/manipulate so students don't lose the opportunity to interact with those stations.

There is a separate file for the Modified version. It has a simplified reading passage, fewer stations, a word bank in Assess It!, and simplified tasks. The links to the Google forms are listed in the teacher directions of the Print Version.

Teacher Directions – Print Version

You will need to **print the stations** that start on Slide 6 of this file and go through the end of the Challenge It station. Then you will need to print the correct **answer sheet**: either the standard sheet or the modified sheet (for students with accommodations). Those slides come after the Challenge It! slides. The final slides are answer keys; you may print them if you wish.

If students will reuse materials by moving around stations in the room, we recommend **laminating** the station instructions and task cards before **cutting them up**. You should make **multiple sets** per station if your class is larger than one group.

Put one set of task cards for each station in an envelope and **attach the instructions page**. If you will have multiple sets at each station, you might want to put numbers on the back of the task cards that match a number on the envelope in case two sets get mixed up.

You will want a place for any **extra materials** needed for each station; a basket works well. Decide if the students will bring their own materials to the Illustrate It! station or if they will use materials you provide.

At least two of the stations, Watch It! and Research It!, will need a device that has an **internet connection**. The links to the sites are on the task cards, but they are also on Slide 1 of these teacher directions. Because sites and school filters are constantly changing, **we recommend checking that you can access the sites from a school computer on the school network** at least a week before the station lab, and then again the day before the station lab. You can often request a site to be "whitelisted" by your IT department if you find it is blocked. If you find a site is no longer functional, email chris@keslerscience.com so we can try to find another site as soon as possible.

On the day of the station lab, give students the printed answer sheet and explain where each station's answers will go. Recommend they do **at least two Input stations before trying an output station**. Allow them to work through the stations at their own pace. Pick a station to stand near for help and spot checks – Explore It! or Organize It! are good choices.

Some classes may need two days to complete the stations, especially the first few times. When they are done, collect the answer sheets. Check the Assess It! station as a comprehension check. If you must give grades, choose a different station each time to grade in addition to Assess It! so students will not know which ones are "important" to do correctly.

Teacher Directions for Google Form Version

To use the Google Form version of this lab, you will need the links to the Regular or Modified Google Form answer sheet.

Regular Google Form answer sheet:

https://docs.google.com/forms/d/1JkxXqio15-8DFG8Medq5hxm0u7Zy1AtF1GjwGX9-fWo/copy

Modified Google Form answer sheet:

https://docs.google.com/forms/d/1gzqsTkuDH9m3OMwcCejIT4T21Xva_S-t_5gvvL81KZ4/copy

When you click the link, you will be prompted to make a COPY of the form. Accept that prompt, then allow Google Drive to recreate the folders necessary to store student responses.

Please do NOT attempt to edit the form found at the link on this page without making your own copy. That would change the master copy that everyone downloads!

Depending on your Drive settings, you may get a warning that the form storage limit is near capacity. You can modify the amount of space allocated to each of the File Upload sections in the form by clicking on the question that is in File Upload format and changing the maximum upload size.

Once you have your own copy of the form, you can send that link to your students. They will need the Google Form version of the station lab to see the questions and do the drag/drop activities. That file can be used as a PowerPoint file in Normal edit mode or uploaded to Google Drive and saved as Slides format (still used in edit mode). They will put their answers into the Google Form.

Teacher Directions for Digital Interactive Version

The Digital Interactive file can be used as a PowerPoint file or uploaded to Google Drive and saved as Slides format. You could use this version if your students are working remotely or if you have 1:1 devices and can't use/share paper materials.

With this version, students open the file, either in PowerPoint or Google Slides, and interact with it in Normal edit mode. They type answers into text boxes and manipulate shapes to complete the station tasks.

There is a separate file for the Modified version. It has a simplified reading passage, fewer stations, a word bank in Assess It!, and simplified tasks.

When students are finished with the file, they should save it (Google autosaves) and submit it back to you. We recommend scanning the slides for completion using the Slide Sorter view, then checking the Assess It! station and one other station that you change each time you grade.

<< Slide Sorter View

Conduction Convection Radiation Station Lab

TEACHER ANSWER KEY

Read It!

1. A
2. C
3. B

4. electromagnetic energy	waves	radiation	wavelength	ultraviolet light
Words and/or drawings that convey the idea that electromagnetic energy is the type of energy given off by the sun, combining electrical and magnetic fields	*Words and/or drawings that convey the idea that waves are the form that light takes*	*Words and/or drawings that convey the idea that radiation is energy that does not need a medium to move from one location to another*	*Words and/or drawings that convey the idea that the wavelength is the distance between two points on a wave*	*Words and/or drawings that convey the idea that ultraviolet light is a form of energy that comes from the sun that can give you sunburns*

Research It!

1. Heat always transfers from the hotter object to the colder object.
2. Radiation is the transfer of heat along electromagnetic waves and radio waves. Objects are not touching.
3. Camp fire, microwave, light bulb, the human body
4. Conduction is the transfer of heat between objects that are touching. Camp fire,
5. Metal spoon in a pot. Copper wire
6. Convection is the transfer of heat through
7. Water boiling, hot air balloon, the second story in a building

Watch It!

1. The energy that exists in matter. It's also known as thermal energy.

2. Student answers will vary. Students need to provide 2 examples.

3. Convection is the transfer of heat energy through liquids or gases. Some examples are convection currents in the mantle, Earth's oceans, and Earth's atmosphere.

Explore It!

Part 1

1. Students should observe the spoon is hotter in the warm water than the one in cold water.
2. Touching an iron, touching a hairdryer.

Part 2

3. Students should observe that heat flows in predictable patterns. Warm water and air always flow away from the heat source.
4. Boiling water, deep end cold near the bottom of a pool.
5. Students should observe that heat travels away from the light source.
6. microwave, campfire

Part 3 (cont. on next page)

Challenge It!

Students may not have gotten to this station. If they did, they may simply have your verification here they completed this station. Other materials could be attached.

Explore It! (cont.)
Part 3

TEACHER ANSWER KEY

Student answers will vary. Students may reference the cyclical motion between hot (rising) and cold (sinking.) This motion occurs in solids, liquids, and gases.

Assess It!

1. D
2. C
3. B
4. waves
5. wavelength
6. electromagnetic energy
7. ultraviolet light
8. radiation

Illustrate It!

Student answers will vary. Students should have 3 images that illustrate conduction, convection, and radiation. They also need to have everything labeled correctly.

Organize It!

Radiation
Sunburn
Microwave

Conduction
Hot car seat
Curling iron
Slide

Convection
Ocean breeze
Macaroni
Tectonic plates

Write It!

1. Conduction is the flow of heat when objects are in direct contact with each other. Convection is the flow of heat through liquids and gases. Radiation is the flow of heat through electromagnetic or radio waves from one source to another.

2. Warm air is rising over the land and moving into the upper atmosphere. The cooler, more dense air gets pushed aside and falls back down over the ocean. This pattern creates a convection current, and the process is called convection.

3. The bottom of the pools is cooler because the warmer water has risen up through the process of convection. The Sun's electromagnetic waves are also not able to reach the deeper parts of the pool as easily through the process of radiation.

Conduction Convection Radiation Station Lab

TEACHER ANSWER KEY

Read It!

1. A
2. C
3. B

4. electromagnetic energy	waves	radiation	wavelength	ultraviolet light
Words and/or drawings that convey the idea that electromagnetic energy is the type of energy given off by the sun, combining electrical and magnetic fields	*Words and/or drawings that convey the idea that waves are the form that light takes*	*Words and/or drawings that convey the idea that radiation is energy that does not need a medium to move from one location to another*	*Words and/or drawings that convey the idea that the wavelength is the distance between two points on a wave*	*Words and/or drawings that convey the idea that ultraviolet light is a form of energy that comes from the sun that can give you sunburns*

Watch It!

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Organize It!

Radiation	Conduction	Convection
Sunburn	Hot car seat	Ocean breeze
Microwave	Curling iron	Macaroni
	Slide	Tectonic plates

Assess It!

1. D
2. B
3. C

Word Bank for 4 - 8:

- electromagnetic energy
- waves
- radiation
- wavelength
- ultraviolet light

4. waves
5. wavelength
6. electromagnetic energy
7. ultraviolet light
8. radiation

	Getting sunburned on a beach
Radiation	Microwave cooking food
	Touching a hot car seat in the summer
Conduction	Burning yourself with a curling iron
	Siding down a hot metal slide in August
Convection	An ocean breeze
	Water in a boiling pot of macaroni
	Currents deep within the Earth that cause tectonic plates to move

Conduction Convection Radiation Station Lab

DIGITAL ANSWER KEY

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