Science 3-5: Heat Conduction

Intended Audience: Students with significant cognitive disabilities

# **Standards:**

SC.3.P.11.2 Investigate, observe, and explain that heat is produced when one object rubs against another, such as rubbing one’s hands together.

SC.3.N.1.6 Infer based on observation.

SC.4.P.11.2 Identify common materials that conduct heat well or poorly.

SC.4.N.1.7 Recognize and explain that scientists base their explanations on evidence.

SC.5.P.11.2 Identify and classify materials that conduct electricity and materials that do not.

SC.5.N.1.6 Recognize and explain the difference between personal opinion/interpretation and verified observation.

# **Learning Objectives:**

 1. Students will identify materials that conduct heat.

 2. Students will identify why metal is the best conductor of heat.

 3. Students will explain why heat moves along a conductor.

# **Vocabulary:**

1. heat: energy that causes things to become warmer

2. friction: the act of rubbing one thing against another

3. conductor: an object that allows heat to move through it

4. molecule/atom: the smallest possible amount of a substance; as it relates to metal, it conducts heat.

5. metal: a substance that is a good conductor of heat and can be melted

6. wood: a substance that makes up the trunk and branches of trees

7. plastic: a substance not found in nature that can be molded

# Materials:

* Video: [Heat Transfer: Conduction](https://www.youtube.com/watch?v=NKZSImhSn6k) (0:19- 2:42 only)
* Article (for whole group or small group work): [Geography for Kids: Conduction](https://kidsgeo.com/geography-for-kids/conduction/):
* Video: [Cool Science Experiments Headquarters- Heat Conduction](https://www.youtube.com/watch?v=Ry8yXhCxclA) to guide students’ inquiry
* Gather prior to inquiry: hot water, a small bowl, 3 spoons (metal, plastic, and wood), butter, small beads
* Prepare prior to instruction: a chart to mark observations during inquiry
* Clear jar with pompoms (visual support for defining and explaining molecules and atoms)
* Timer or stop watch
* Science journals

# **Essential/Guiding Questions:**

 1. Which material conducts heat the most efficiently?

 2. How do molecules affect heat?

# Lesson Presentation:

**Activating Prior Knowledge:**

1. Gather students in a whole group. Ask students to put their hands together, palms touching in front of them. Ask them to notice how their hands feel. (Responses vary.)

2. Have students vigorously rub their hands together for approximately 15 seconds.

3. Ask probing questions: “What did you feel?” “What happened?” “What is the difference between how your hands felt before you rubbed them together and now?” (Responses vary.)

4. Tell students they are going to learn about heat and things that create heat.

**Modeled instruction:**

1. Play the video, [Heat Transfer: Conduction](https://www.youtube.com/watch?v=NKZSImhSn6k) (0:19- 2:42 only). Clarify content when necessary.

2. Define the vocabulary from the video: heat, conductor, molecule, and atom. Use visuals from the video as well as photos and images to support understanding. Deepen student understanding of molecules and atoms by showing pompoms in a glass jar. Start by moving a pompom or two slowly, speeding up the movements to eventual vigorous shaking. Tell students that this is an example of how heat is conducted.

3. Ask questions: “How did the wax melt?”, “Why did the nails fall off of the iron rod?”

4. Read the article, [Geography for Kids: Conduction](https://kidsgeo.com/geography-for-kids/conduction/).

5. Draw attention to the references for metal conduction and wood conduction. Tap in to students’ background knowledge (i.e. cooking over a campfire, kitchen experiences). Share personal experiences to encourage student response.

6. Tell students that tomorrow they’ll do an inquiry/experiment to see which types of material heats up the most and conducts the most heat.

**Supported/Guided instruction:**

1. Replay the video, [Heat Transfer: Conduction](https://www.youtube.com/watch?v=NKZSImhSn6k) (0:19- 2:42 only) or choose another video from Additional Resources that shows a heat inquiry.

2. Review vocabulary relevant to inquiry/experiment. Have students put vocabulary in Science journals; students may use visuals, photos and images

3. Re-read the article, [Geography for Kids: Conduction](https://kidsgeo.com/geography-for-kids/conduction/). If appropriate, provide students with a copy. Identify the main idea and underline it: identify key details and circle them.

4. Tell students that it is time for an inquiry. Show the video [Cool Science Experiments Headquarters- Heat Conduction](https://www.youtube.com/watch?v=Ry8yXhCxclA) from 0:00-1:50 only.

5. Ask students “What do you think will happen to the beads on each of the spoons?” Have students write predictions in their Science journal or share out.

6. Conduct inquiry as demonstrated in the video. (Adults only when using very hot water; discuss safety prior to beginning inquiry.)

7. With a timer or stop watch, time the falling of each of the beads/melting of the butter. Ask students “What is happening?”

8. Finish watching the video [Cool Science Experiments Headquarters- Heat Conduction](https://www.youtube.com/watch?v=Ry8yXhCxclA) from 1:50- 3:15 (end). Ask students “Were your results the same? Why?”

**Independent Work:**

1. Revisit predictions in journals. Students record results of the inquiry in Science journals.

**Small group suggestions:**

1. Students can find objects/substances at home and at school that conduct heat.

2. With support, students can ask the cafeteria manager for access to the cafeteria to share examples of heat conduction.

3. Students can brainstorm a list of conductors and non-conductors.

# Assessment:

1. Students will identify and classify substances/objects that conduct heat and those that do not.

2. Teachers should utilize district created rubrics to score student work.

# UDL:

**Multiple means of representation:**

1. Students can use a T-chart to list heat conductors and non-conductors.

2. Students can re-create inquiry with different materials and adult support.

3. Students can write a journal entry identify and classifying conductors/non-conductors.

4. Students can draw pictures to show which materials are conductors and which are not.

5. Students can work individually, in pairs, or in a small group.

6. Students can work independently with peer or adult supports.

**Multiple means of expression:**

1. All students should have access to expressive language/technology that is appropriate for their specific need.

2. Expression may come in the form of verbal responses, signed responses, pointing/gestures, eye gaze, or through the use of a low or high tech device.

3. Text to speech options are available for computers, iPads and other hand held devices. Google Chrome offers free extensions, such as Selection Reader and Select and Speak-Text to Speech, and apps, such as Text to Speech, Text to Speech with Google Drive, and TTS Reader- Unlimited Text-to-Speech.

4. Speech to text options are also available from Google. Extensions include Voice Note II-Speech to Text, Online speech recognition, and Co: Writer Universal. Voice Note II is also available as an app; Speech notes-Speech to Text Notepad is available as well.

5. Additional information about text to speech and speech to text options are available through your district Assistive Technology Department.

**Multiple means of engagement:**

1. Provide students with choices of how to interact with materials.

2. Provide students or small groups with various places in the classroom in which to work, i.e. floor, desks, at the board.

3. Limit distractions in the work areas.

4. Encourage collaboration with peers in partners or small groups.

5. Allow students to work independently.

6. Allow students to be positioned for maximum learning engagement.

7. Provide students with additional materials, if necessary.

8. Provide supervision to students who need assistance when handling hot and potentially dangerous, objects.

# Assistive Technology Recommendations:

1. All students should have a means of expressive communication and a way to be actively engaged in learning.

2. Response modes may include, but are not limited to: eye gaze, gesturing or pointing to pictures/words/phrases, signing, low tech devices (Go Talks, etc.), or dynamic devices (iPad, etc.)

3. Lesson vocabulary, photos/pictures and graphic representations should be created and/or printed prior to the lesson to provide all students with an opportunity to be engaged in discussion.

# Technology Needed:

* Smartboard, doc camera

# Additional Resources:

* Video: [Heat Transfer by Conduction: Science for Kids](https://www.youtube.com/watch?v=DmnQD3eEkNk) to show examples of heat conduction
* Book: Do You Really Want to Burn Your Toast? by Daniel D. Maurer, Teresai Alberin, illus.
* Book: Energy Makes Things Happen, by Kimberly Bradley, Paul Meisel, illus.
* Website: [Heat Transfer for Kids](https://www.real-world-physics-problems.com/heat-transfer-for-kids.html)
* Website: [Heat Conduction](https://www.factmonster.com/dk/encyclopedia/science/heat-transfer#ESCI083CONDUC)

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