

THUNDERSTORMS

FRAMEWORK

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| I. Scientific and Engineering Practices 2, 3, 4, and 6 |
| II. Cross-Cutting Concepts 3, 4, and 7 |
| III. Physical Sciences 1 and 2 |

SKILLS/OBJECTIVES

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| <ul style="list-style-type: none">o Learn about matter and molecules.o Learn about density, convection, and currents.o Learn how lightening happens – static electricity. |
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MATERIALS

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| <ul style="list-style-type: none">o 15 large clear cupso 15 small cups (fits into large cups)o Small rockso Food coloring (red or blue, not yellow or green)o Knifeo Plastic wrapo 15 rubber bandso Hot (almost boiling) watero Tongso Foilo 15 Styrofoam plateso 15 Thumbtackso 15 Pencils |
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NOTES

An adult is required to puncture the plastic wrap with the knife. Also, water must be boiled before departing.
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BACKGROUND

- Why/how do thunderstorms happen?
- Density: how closely molecules are packed together – a solid object is very dense because its molecules are cold and extremely close together, whereas a liquid is less dense because its molecules are warm and move more freely.
- Convection: the transfer of heat through liquid or gas caused by movement of molecules.
- Air current: air moving from high density to low density – wind.
- Static electricity: electricity that can't flow by itself, enabling it to stick to an object until it can be transferred to something else

Activity # 1	Moving Molecules
Materials	o Nothing
Worksheet	N

- Explain that molecules are what make up matter, and matter is what makes up everything we see, from books to plants to people. Although we can see matter, the molecules are too small to see with our eyes.
- Let's act out the movement of molecules. **Have the whole class stand up and explain that they are now going to become molecules.** Explain that warm molecules move around a lot and they like to spread out away from each other. **Ask the students to act this out by walking, bouncing, or dancing.**
- The hotter the molecules are, the faster they move. **Ask the students to act like hot molecules.**
- **Next, ask them to act like cold molecules, which like to huddle together and bounce slowly.** The colder the molecules are, the slower they bounce and when they freeze they bounce really slowly, but they don't stop moving. **Ask the students to act like frozen molecules.**
- **Give cues to the students as to how they should act. Yell out hot molecules, cold molecules, and warm molecules, and the students should act accordingly.** Start off changing the cues slowly but then get faster, see if the class can respond right away. When the molecules are hot and further apart, they have a low density. Although when the molecules are cold and very close together, they have a high density.

Activity # 2	Rising Air
Materials	- o 15 large clear cups - o 15 small cups - o Small rocks - o Food coloring - o Knife - o Plastic wrap - o 15 rubber bands - o Hot water - o Tongs
Worksheet	N

- Explain that warm and cold air molecules move to cause currents. Although these currents may be hard to see, they are what cause different types of weather, like thunderstorms and tornados.
- **Fill the large cup with three quarters cold water.**
- **Add several small rocks to the small cup.**

- **Have an adult fill the small cup to the brim with hot water.**
- **Add several drops of food coloring to the small cup.**
- **Stretch the plastic wrap over the cup and seal it with a rubber band.**
The plastic wrap will swell up because the air above the water is heating up and expanding.
- **Have an adult poke a small hole in the plastic wrap with the knife.**
- **Use tongs to place the cup of hot water in the bottom of the large cup of cold water.** The colored hot water will move upwards into the cold water because hot air rises. Tiny molecules of air (or in this case water) move faster and farther apart from each other (this distance is called density) when heated. Since warm air is lighter and less dense than cold air, it rises. When the risen warm air begins to cool down, which will happen to the colored water, too, the molecules move slower again and sink (this is called convection). This up and down movement forms currents.

Activity # 3	Static Electricity
Materials	- o Foil - o 15 Styrofoam plates - o 15 Pencils - o 15 Thumbtacks
Worksheet	N

- Explain that lightening in the sky happens because storms build up electric charges, positive and negative. In order to even out the pressure in the sky, sparks of light occur.
- **Rip off a piece of foil and fold it several times.**
- **With an adult's help push a thumbtack through the foil and stick the eraser of the pencil into it.**
- **Rub the Styrofoam plate with the piece of wool for one minute.** This process creates static electricity because electrons jump from the wool to the plate, making the plate negatively charged.
- **Carefully pick up the foil by the pencil and place it on the plate.** The foil has a positive charge so when it's placed on the plate, some of the negative charges from the plate are attracted to the positive charges on the foil, making the them stick together.
- **Slowly touch the foil with your finger without touching anything else.** The kids should feel a shock due to electrons moving around. Some of the negative charges jump from the pie plate to their fingers, which are positively charged.
- If time allows: **use your other hand to hold the pencil on the foil.** Turn off the lights. **Lift up the foil and touch it with your finger.** Did anyone see a spark? The spark is a result of tiny representation of lightening –

electrons moving around to even out the charges. Lightening happens the same way – negative charges from thunderclouds jump to positive charges on the group or in another part of the clouds. This jump produces a large scale spark of lightening because the charges are stronger than the static charges produced in this activity.

CONCLUSIONS

- **Molecules are what make up matter. They move according to their temperature.** If it's hot, they move very quickly and bounce off each other, revealing a low density. However if it's cold, they move very slowly and huddle together, revealing a high density.
- **Hot air rises because it is less dense than cold air. This movement creates currents.**
- **The up and down cycling of air is called convection.** When convection currents occur, clouds are formed. Sometimes these clouds turn into thunderstorms. When the warm air cools, it sinks and the thunderstorm subsides.
- **Static electricity is produced by negative and positive charges jumping from one object to another.** Sometimes the spark will be too small to see, but you can almost always hear a crackle.