Middle School Demo Show

Using Science to Excite and Engage Students

bit.ly/2020Present

Steven Smith (K-12 Earth, Atmospheric, and Planetary Sciences Outreach)
Sarah Nern (K-12 Chemistry Outreach)

Purdue University

PURDUE UNIVERSITY

Disclaimer:

Always use proper safety equipment for any demonstration.
Though we do not always tell you what safety equipment to use for each demo, **you are responsible for your safety and the safety of others around you**. Please do not do a demo if you are unsure how to perform it safely.

PURDUE UNIVERSITY

We need your feedback!

Are you a middle school science teacher? Let us know what we can do to better serve you by completing this short survey: bit.ly/2020middle

You are invited to join us at Purdue University - West Lafayette, July 2020!

6th grade: July 20-21 **7th grade:** July 23-24 **8th grade:** July 27-28

Fee: $20 for EACH 2-day PD sesion.

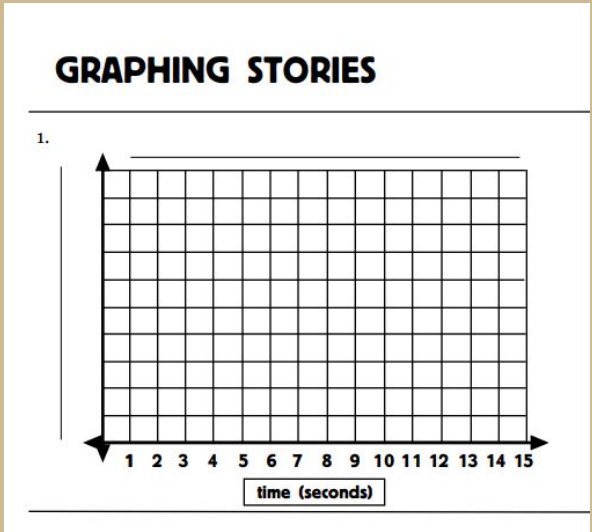
Registration Link: bit.ly/2020MiddleSchool

The deadline to register for these two-day PD sessions at Purdue is Friday, July 10, 2020.

PURDUE UNIVERSITY

Describe motion graphically

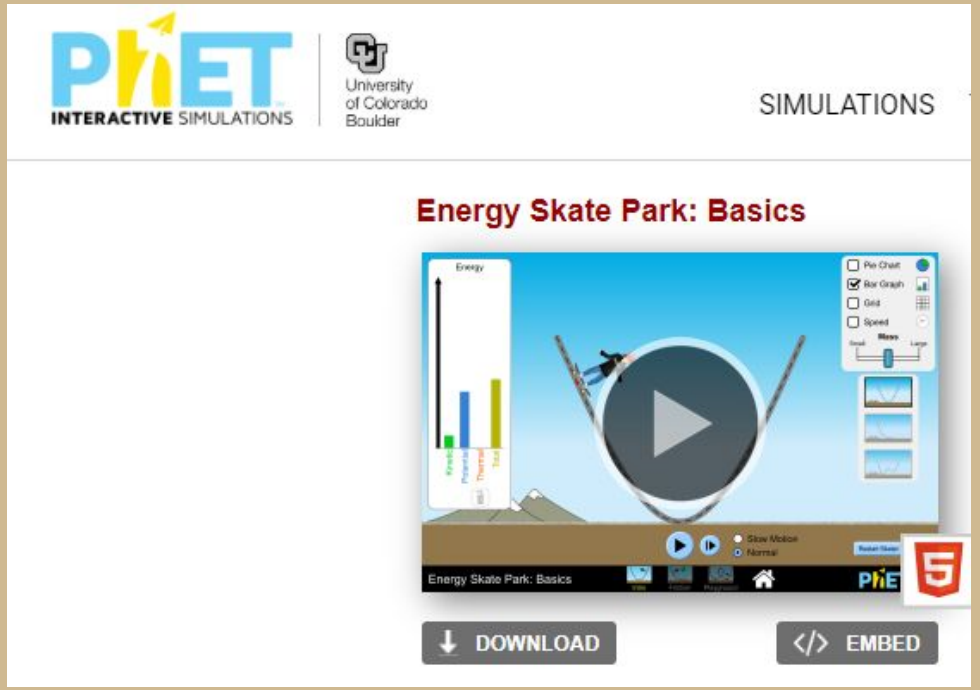
www.graphingstories.com



PURDUE UNIVERSITY

Kinetic and Potential Energy

https://phet.colorado.edu/en/simulation/energy-skate-park-basics



PURDUE UNIVERSITY

Investigate energy waves

A wave is a transfer of energy

Spring

- You can use a slinky or a long spring available at science supply sites.
- Have a student hold one end a distance from you so that the spring is taunt.
- Compress part of the spring and then let go. The wave will visibility travel down the spring to the other person. Their hand will move for the energy.
- Note that some of the energy will be reflected back and some absorbed by the person.
- This is great for showing compression waved but I suggest not using it for “s” waves as the spring gets stretched out.

Rope

Investigate energy waves

- You can do this in the air or on the floor.
- Have someone hold the other end of the rope and shake the rope up and down to make a wave travel to the other person. If you are doing this on the floor, shake it back and forth instead of up and down.
- This is great for showing S waves and wavelengths.
- Keep a long wave going and discuss parts of a wave; node, crest, wavelength. Ect
- We use a long rubber rope for nice movement but any rope will work
- Show a long wave and ask if shorter waves have more or less energy. Then make a series of short waves by moving your hand more quickly.

Resonant rods

Investigate energy waves

- These are just aluminum stock that is about 1/2” round or so.
- Different lengths will resonate at different tones.
- Use rosen (SP?) on your fingers to help reduce friction so that your fingers can glide down the rod.
- Find the ‘node’ or center of the rod. Hold it there with 2 fingers. Take 2 fingers of the other hand and squeeze the rod close to the node. Drag you fingers down the rod squeezing with the fingers as you go. Slide your fingers down several times to add enough energy to get the rod to resonate.
- I am told you can get them at hardware stores but we bought ours from a science supply site

Investigate energy waves

UV light and beads

- This is great to show the energy from UV light.
- Purchase the UV beads at a science supply site.
- We leave them in the bag and use them for years. So that we don’t have to buy new ones every year. Some teachers have students make bracelets with 3-4 beads and give them to their students.
- The beads will lumness and show color when exposed to enough UV light.
- You can use the sunlight or a black light bulb for this demonstration.

Investigate energy waves

Prism glasses with clip light

- Prism glasses are a lot of fun for students (and us teachers)
- They can be purchased at science supply but we just ordered them on Amazon.
- Have students put them on and then look at different lights.
- We often dim the lights to increase the effect.
- A candle will be amazing with these if you are allowed to light one in your classroom. If so, just put it in the front of the classroom high enough for everyone to see.
- If you have access to different kinds of lights such as a neon light, you can see the spectrum they emit.

Investigate energy waves

Radiometers

- Put them out on tables and have students come up with a plan on how to make them work without touching them or bumping the tables. I generally have a variety of flashlights and other lights in the room for them to discover and try.
- Line up a few of them and shine a light on either one end or in the middle. This will show the difference in energy from direct and indirect light, just like the seasons of the Earth. If you only have one or two of them, you can still do this. Just keep moving one of them farther from the path of direct light.

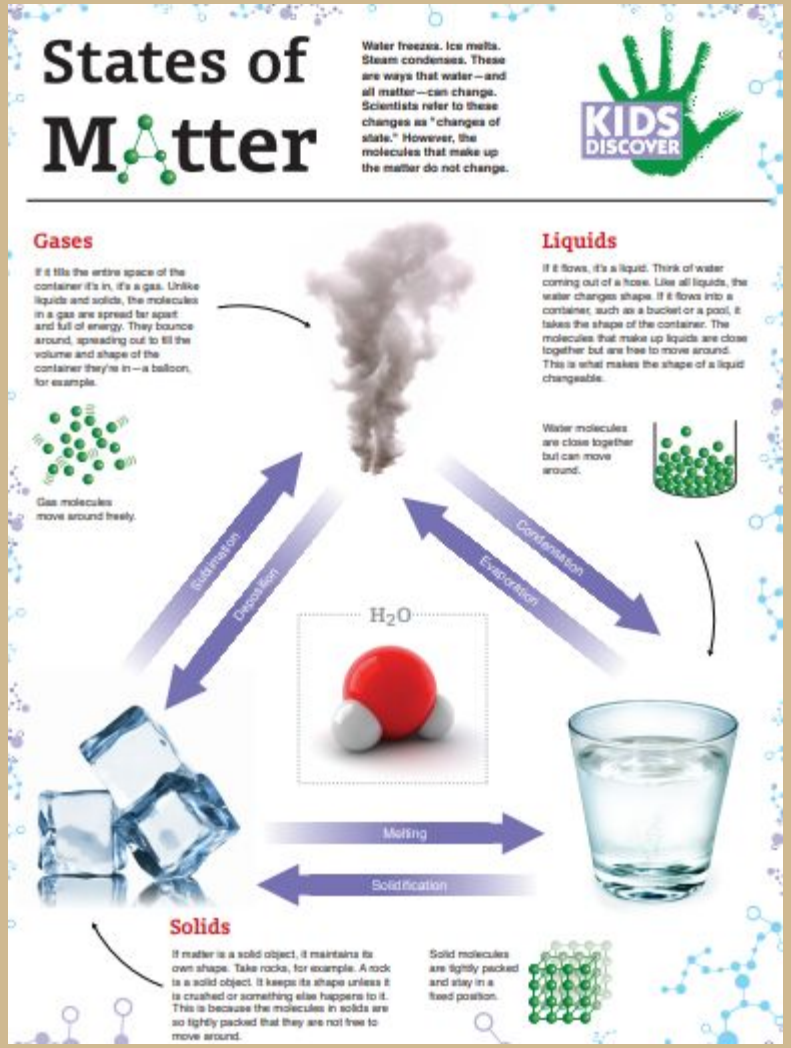
States of Matter

States of Matter Infographic Poster is available to download for free from Kids Discover at:
http://www.kidsdiscover.com/infographics/infographic-states-of-matter-for-kids/?mc_cid=4d777d4bc2&mc_eid=b01eecf992

Density box

- Make a square on the floor using masking tape.
- Have a bunch of students cram into the “box” ask how much room they have and how compacted they are. This is like a solid.
- Let half of them go to there seats. Ask how the amount of energy they can use changes. This is like a liquid.
- Let half of the rest out and discuss the amount of energy them can use to move around now. This is like a gas.

PURDUE UNIVERSITY



Density Column

Build a Stack 9 Density column:
https://www.stevespanglerscience.com/lab/experiments/density-tower-magic-with-science/

honey, corn syrup, maple syrup, whole milk, dish soap, water, vegetable oil, rubbing alcohol, and lamp oil. Add food coloring to the water and the rubbing alcohol for contrast so they stand out in the finished column.

For the solid objects: Start with a bolt, then release a popcorn kernel, then a plastic game die, then a cherry tomato, then a plastic beads, followed by a soda bottle cap. You may have to nudge the bottle cap a little with a straw or spoon handle so it fills with liquid and sinks. The Ping-Pong ball will float very nicely on top of the lamp oil.

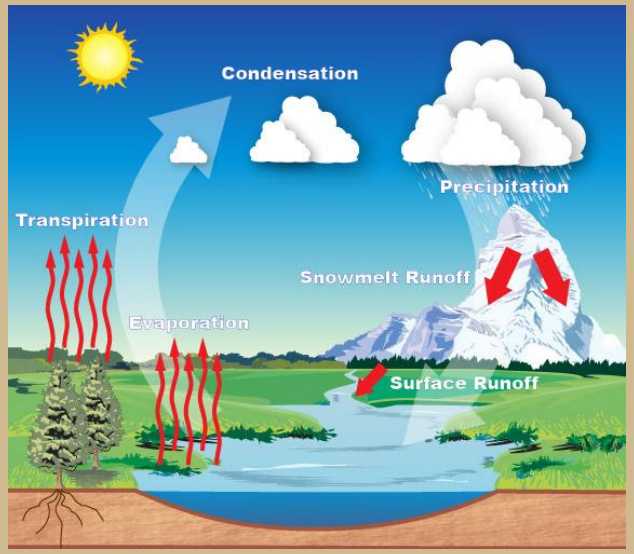
Tie in to density driving oceanic crust (subduction) and continental crust (uplift).

PURDUE UNIVERSITY

Cloud in a bottle

States of Matter

- Supplies include: a 2 liter bottle, bicycle pump, basketball needle, small amount of water, and small amount of rubbing alcohol, safety glasses.
- Set up you will need to drill a small hole inthe #4 stopper, just large enough for the ball needle
- Add a small amount (cup or two) of water and a bit of rubbing alcohol (a couple tablespoons worth).
- Put stopper with ball needle in it on the bottle and add air. You will have to hold it in tightly. This requires some hand strength.
- Show that the high pressure has no clouds. Pull the stopper out quickly and the low pressure will allow the system to support less water vapor. The water vapor will condensate on a nulci and form a cloud.
- Pump the system up again, and the liquid water droplets evaporate back into water vapor and the cloud dissipates.



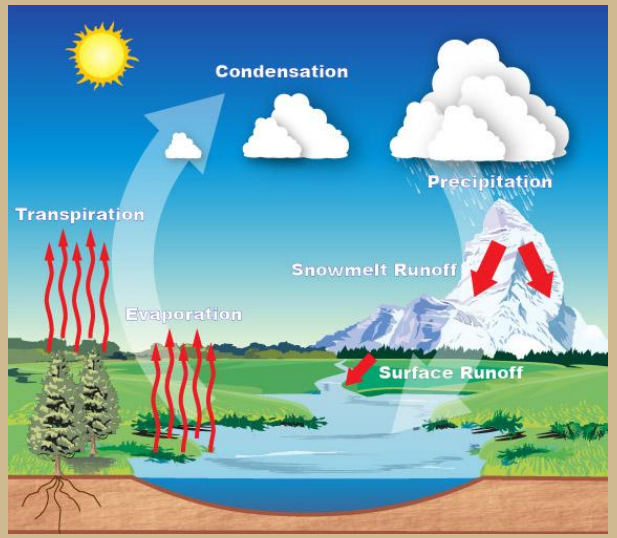
Taken from Noaa.gov

PURDUE UNIVERSITY

Can crush

States of Matter

- Add a small about (a few tablespoons) of water to an empty Al can.
- Place the can on a hot plate.
- When the water is steaming nicely, quickly flip the can over into a pan of ice water.
- The water vapor that has filled the can condenses creating a lower pressure system in the can. The air in the room crushes the can.
- If you go too slowly or the water bath is warm, it might not crush the can. However water will be forced into the can from the rooms higher air pressure still.

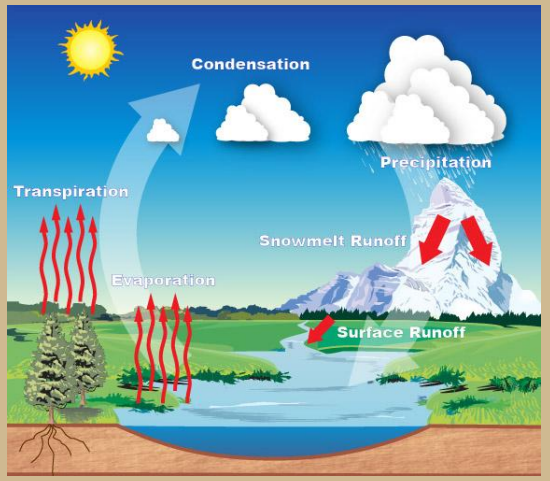


PURDUE UNIVERSITY

Person crush:

States of Matter

- Put a person in a large lawn and garden trash bag. Don’t cover their head!
- Using a shop vac, evacuate the air from the bag.
- The air in the room will press against the person in the bag and “vacumeseal” them in the bag.



PURDUE UNIVERSITY

Convection Currents

There are a number of ways to show the convection currents. The way we generally do it is:

- Fill a clear tub most of the way with room temperature water.
- Gently add a container of hot water and red food coloring that has a hole close to the bottom and on the top.
- Place a baggie filled with ice and water on the other side of the container. We put a hole in the bottom of the baggie and use a binder clip to hold it up on the side of the container.
- I like this as it allows observers to watch the hot water rise, cold water sink, and when the hot water gets cold it sinks and just the opposite for the cold.

Model of the phases of the moon

- Use 2 clear cups.
- In the first cup, cut a piece of black paper and place it on the inside. Put a small round sticker on the outside.
- Place the first cup into the second cup
- On the second cup, trace out the circle and rotate the cup to trace it again and again. Fill one circle completely to represent the new moon. Make each of the other phases of the moon, filling in the appropriate amount of the circle.
- Have students rotate their outer cup to show how the moon goes from one phase to the next.

Engineering - Build a clinometer

Here is a good site for this:
https://www.globe.gov/documents/355050/355099/Biosphere+Investigation+Instruments+-+Clinometer/ba6cd381-02be-4525-8fd4-f061515b9862

We build them onto a clipboard.

For younger students we try and make sure we are on level ground and just use a 45 degree angle so that the math is east and you do not have to use the table of tangents.

PURDUE UNIVERSITY

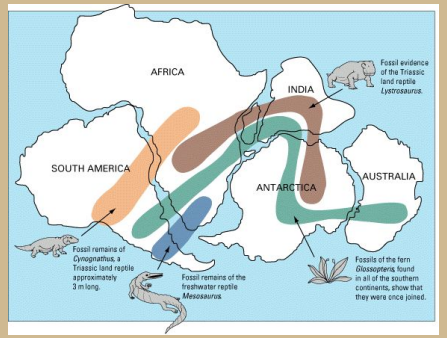
Plate Tectonics

Magazine sort

- Take a page from a magazine and tear it into pieces. Note, you can cut it into a shape before tearing it up to remove the straight edge pieces.
- Have each group piece their page back together and justify why they believe is goes together that way. Discuss clues to their decision.

Iris map

- Cut a map of the plates and discuss how they go together. Also include indicator fossils.
- https://pubs.usgs.gov/gip/dynamic/continents.html has nice resources for this.



PURDUE UNIVERSITY

Investigate properties of minerals

Crayon shavings

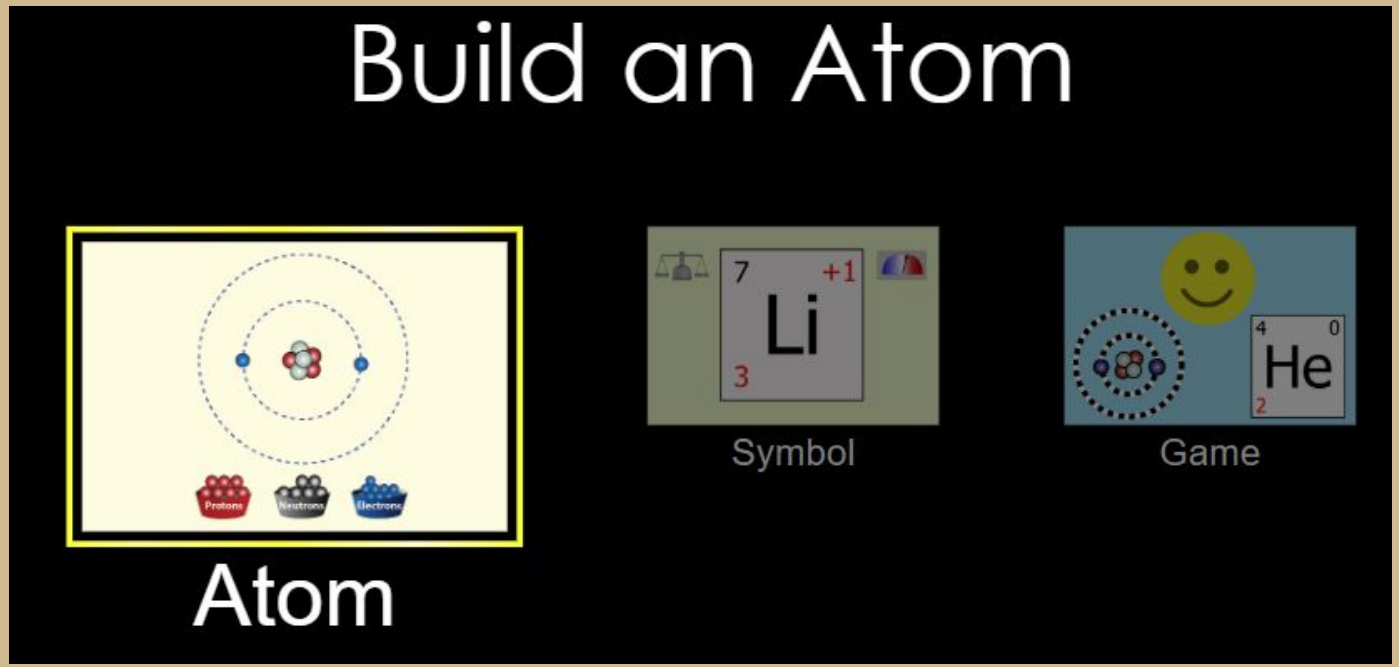
- Take a baggie and have students use a crayon sharpener to put a layer of one color after another in it. This is sediment
- Press it with a book and it becomes a solid modeling sedimentary rock.
- Have a student place it under a book on their chair and sit on is for the hour. At the end of the hour, it will begin to change due to the pressure. This is metamorphic.
- The next day, using a pan and hot plate, melt the mass completely and alow it to cool. This is igneous.

Stream Table

- No need for an expensive set up!
- Get a long tub that is not too high.
- Drill a hole in one end to allow it to drain
- Place a bucket on that end to catch the water draining.
- Elevate the other end and place some sediment in it.
- You can slowly pour water in the tub or make the stream by using a small bucket with a hole drilled close to the bottom.
- If you would like to add tubing, get hollow lamp rod from a hardware store. Also get washers and nuts for it. Cut the rod into short sections. Put the rod through the hole and add a washer and nut to each side. Add tubing to the outside part of the rod and have it drain into the long tub.

Atom

http://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html



PURDUE UNIVERSITY

Join us at Purdue this July 2020!

We will be teaching additional demos based on feedback we receive from you through the survey: bit.ly/2020middle

You are invited to join us at Purdue University - West Lafayette, July 2020!

6th grade: July 20-21 **7th grade:** July 23-24 **8th grade:** July 27-28

Fee: $20 for EACH 2-day PD sesion.

Registration Link: bit.ly/2020MiddleSchool

The deadline to register for these two-day PD sessions at Purdue is Friday, July 10, 2020.

PURDUE UNIVERSITY