Exploring Condensation

OVERVIEW

In this activity you will observe condensation collect on a cup of ice water in real time.

WHAT ARE WE LEARNING?

This activity helps students understand there is water in the air and can be part of lessons on the water cycle.

Materials

- Cup, clear if possible
- Ice and water
- Timer or clock
- Tissue paper
- "Exploring Condensation" worksheet or blank paper to record notes
- Pencil

Image 1: Essential materials (water, worksheet, and pencil not pictured).

Optional Materials for Additional Experiments

- Extra cup and warm water
- Plastic wrap
- Rubber band
- Food coloring or liquid water colors
- Other liquids to test
- Thermos

Note: Consider reading "Further Exploration" ideas before starting in case you wish to incorporate any other ideas into your initial experiment.

INSTRUCTIONS

1. Download and (if possible) print the "Exploring Condensation" worksheet. The worksheet is simple, so if you do not have a printer, simply copy the worksheet onto your own piece of paper, or use it as a guide.
2. Optional: Review the water cycle!
3. Prepare your materials. Get your ice and water ready, and have your timer in-hand or clock nearby. You will want your water and ice to fill roughly 2/3rds of the cup. (Not filling it all the way will give you an easily observable waterline).
4. Make observations of your empty cup. Yes it might seem like there is not much to say! But it's important to at least note if the cup is wet or dry.

Image 2: Cup has been fillied with ice and water and timer has been started!

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INSTRUCTIONS (CONT)

5. Put the ice and water in the cup (about ~2/3rds full) and start the timer or note the time on the clock immediately!

Note: After putting in water and ice - do not grab the outside of the cup!

6. After one minute, make your observations - has anything happened to the outside of the cup below the water line? What about above the water line? What about *inside* the cup above the water line? You might gently and carefully tilt your cup (without touching the outside of the cup) to see the condensation more clearly, as in image 3. Tear a tiny piece of tissue and place it on a small spot on the outside of the cup. Did it get wet? Write down your notes on your worksheet or paper.

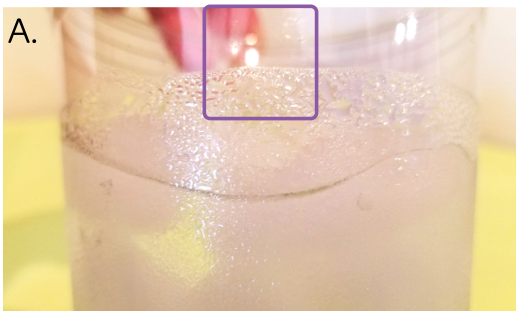

Image 3: Look carefully! Image A is a picture of the cup being tilted back to to allow us to see the condensation line more clearly. Image B is the purple box in A blown up. Can you see the condensation that occured below the water line and stopped above it?

7. Continue to make your observations at different time intervals. We recommend 4 min, 7 min, and 15 min, but you can let it go as long as you'd like.

8. Answer the questions on the worksheet. Students should try to logic out answers themselves, but you can see "The Science" section for help.

9. (Optional) Decide what "Further Exploration" you'd like to do!

FURTHER EXPLORATION

This activity lends itself to further exploration! Which ideas is your child interested in testing? Make predictions of what will happen in each case - then test!

Ideas

- Try using warm or (safely) hot water instead of ice water. If you get the temperature just right (not too hot) you can see steam on the INSIDE of cup without melting the cup. Does condensation happen with warm water?

- Does your child think maybe the water is coming from inside the cup? Place plastic wrap and a rubber band on top and run the experiment again! See image 4.

Image 4: Use a rubber band to secure plastic wrap to the top of the cup. Does this effect condensation?

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FURTHER EXPLORATION (CONT)

- Does your child suspect water is leaking out of the cup? Put food dye or liquid watercolors in the cup (we suggest making it really saturated) and see if the water collecting outside the cup is also dyed. See image 5.

- Another way to test for "leaking" is to wrap plastic wrap tightly around the cup prior to putting in the water and ice. Where will condensation collect? If your child understands the concept they should be able to predict that the *outside* of the plastic wrap - exposed to the air - will become wet, but the inside, exposed to only the cup - will stay dry. See image 6.

- Try the activity with an insulated thermos. Will condensation occur? Why or why not? See image 7.

- Start with only a small amount of ice and water, and then add more during the course of the experiment (without touching the outside of the cup!) Can you see "layers" of condensation? See image 8.

- Try the experiment on different days or different times during the day. Record the temperature and humidity at every time period and record how long it takes for the condensation to appear on the cup. Can you see any patterns? This is especially good to do in areas that have swings in humidity. (Note - it can get so dry that no noticeable condensation occurs. If this happens, can you create a humid environment?).

- Try with different liquids, or only ice in the cup. Can you get condensation with soda or milk?

- Can you think of other ideas to test?

Image 5: Put dye in the water. Is the condensation colored?

Image 6: Look carefully and you can see the cup is wrapped tightly with plastic wrap. Will condensation appear between the plastic wrap and cup, or on the outside of the plastic wrap?

Image 7: Will condensation occur on the outside of an insulated thermos?

Image 8: Start with a small amount of ice water. Add a new layer after several minutes, and then another. Can you observe layers of condensation?

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THE SCIENCE

When we talk about "water" in everyday conversation we are usually talking about the liquid, but of course water can exist as a solid (ice), liquid (water), and gas (water vapor)! When liquid water turns into water vapor it is called "evaporation." To some students, it might seem like evaporated water has disappeared, but in fact there is water vapor all around you - it is in the air!

It turns out that warm air can hold more water vapor than cold air - and when the air is cold the water vapor in it can start to turn into liquid water (this is what happens in rain clouds). The cup used in this experiment contained ice water. The air immediately surrounding the cup therefore was also cooled down. The water vapor in the air immediately around and on the cup started turning to liquid water!

When water vapor turns into liquid water it is called condensation.

Studying invisible things can be a challenge especially for younger learners, but activities like this one can help make abstract concepts become more concrete.

This activity can also help students understand many aspects of the water cycle!

THE STANDARDS

This activity relates to the 5th grade standard 5-ESS2-1 in the Next Generation Science Standards (used in many states) - "Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact." See further clarification below in red. For other states, this activity can fit into work on the water cycle or weather and is best suited for supporting learning in older elementary and middle school.

[Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

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ADVICE FOR DOING SCIENCE WITH YOUR KIDS

- Encourage exploration and curiosity - science is about a lot more than facts and content (although these things are important too!)

- Consider writing down your child's questions and ideas during the activity. You may be able to turn these into a future research project or activity!

- You might consider getting a dedicated science journal for your child where they can keep all their thoughts and ideas and notes on their experiments.

- Do not worry about not knowing the answer to questions. Many "simple" kids science activities have very complicated, or even unknown(!) science behind them. Even scientists will often not know the answers to questions outside their field. No one knows everything! Be honest about not knowing the answer and suggest trying to figure it out together.

- Deviations from exact instructions can often be fruitful - especially if the child has been inspired and wants to try out another line of investigation.

- In many states, the science standards are called the "Next Generation Science Standards," or "NGSS." They are a little complicated to parse through but in essence they want student to learn not only content (called "disciplinary core ideas" or "DCI") but also the practices scientists and engineers use ("scientific and engineering practices" or "SEP") and also concepts that cut across all fields ("crosscutting concepts" or "CCC").