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ACTIVITY TITLE: Cold Glow: Make a Lava Lamp Without Heat

Activity code:ncATRV01

DURATION	70 minutes
AGE RANGE	13–14
TOPICS	Chemistry Design Creativity Science Polarity

Description of the project

In this fun, hands-on STEAM activity, students will become creative chemists as they design and build their own homemade lava lamps—without using any heat! Through simple yet engaging materials like oil, water, food coloring, and effervescent tablets, students will investigate key scientific phenomena such as density, polarity, and gas formation.

The goal of this activity is to blend scientific exploration with visual creativity. Students will experiment with mixtures, observe how chemical reactions generate motion, and apply artistic design elements to personalize their lamp's appearance. Throughout the process, they will be encouraged to use inclusive language and symbolism to reflect diverse perspectives in science and design.

To wrap up, teams will present their creations in a peer-led visual gallery, where each group will explain the science behind their lamp, describe their design choices, and reflect on how art and chemistry came together in their work.

By the end of the session, students will have created a fully functioning, visually expressive lava lamp that demonstrates their understanding of chemical reactions—while also showcasing their creativity and communication skills.

Objectives: What will I learn?

- **Understand how density and polarity influence chemical behavior** by conducting a hands-on experiment with oil, water, and effervescent tablets, in order to explain the visual reactions observed in their lava lamp.
- **Develop scientific observation and prediction skills** by documenting their hypotheses

and testing outcomes throughout the experiment, to strengthen their ability to interpret chemical phenomena in real-world contexts.

- **Apply artistic expression and design thinking** while decorating and customizing their lava lamps, in order to transform scientific content into a personalized and creative visual artifact.
- **Recognize the contributions of women in STEAM** by exploring examples and integrating gender-inclusive symbolism into their designs, to foster awareness and appreciation of diversity in science and innovation.
- **Communicate scientific findings and creative processes** through peer presentations and visual storytelling, in order to build confidence in public speaking and collaborative learning.

Materials: What do I need?

1. **Provided by Teacher/Institution:**
   - Clear plastic bottles (250–500ml)
   - Vegetable oil
   - Water
   - Food coloring
   - Effervescent tablets (Alka-Seltzer or similar)
   - Funnels, spoons, paper towels
   - Printed Lava Lamp Instructions, Design Labels, and Fact Cards about Women in

Chemistry **2. Provided by Students:**

- Curiosity, collaboration, and creativity

2. **Downloadable Resources:**
   - [Lava Lamp Guide for Students]
   - [Women in Color Chemistry poster]
   - [Printable decorative labels]

Previous preparation

Print and organize materials:

- Print Lava Lamp Guide for Students, Women in Color Chemistry poster and Printable decorative labels

Prepare a demo and workspace:

- Build one fully functional lava lamp sample to demonstrate the final outcome.
- Test materials in advance (ensure oil and tablets react properly).
- Set up tables with all required materials: oil, water, food coloring, tablets, bottles, funnels, and decorative supplies.

Prepare student groups:

- Form small, mixed-ability groups of 3–4 students.
- Encourage inclusive role distribution with options such as Mixer (handles materials), Observer (records observations), Designer (leads decoration), and Presenter (shares final product).
- Allow role rotation if time allows to promote equitable participation.

Review context and connect prior knowledge:

- Begin with a brief discussion on what students already know about liquids, mixtures, and bubbles.
- Use the sample lamp to spark curiosity and make predictions.
- Introduce a brief story or biography of a female scientist or innovator related to chemistry or visual design (e.g., Marie Curie or Beulah Louise Henry).

Set up the presentation space:

- Designate a table or wall space for the final "Lava Lamp Gallery Walk" where students will display and discuss their creations.

RESEARCH

Have a look at these resources

Why This Matters – Context and Relevance

Lava lamps are more than just decorative fun, they are hands-on science models that help students understand density, polarity, and chemical reactions in an accessible and engaging way. Through playful experimentation, students learn how different substances interact, a foundation for chemistry, environmental science, and even material engineering.

Most importantly, this activity supports creative exploration, teamwork, and inclusive design. It invites all learners—regardless of prior science confidence—to build, explain, and reflect. Plus, it offers a low-cost way to engage with science outside of textbooks or screens.

Real- World Examples

- In environmental cleanup efforts, engineers use the principle of liquid polarity to separate oil from water in ocean spill response systems.
- Lava lamp-like models are used in classrooms and labs to teach fluid dynamics**,** a key concept in weather forecasting, engineering, and medical devices like IV drips.
- Artist-innovators have used chemical reactions to create interactive art installations, bridging science and design to engage public audiences.

Prompt Questions to spark discussion or reflection:

- What real-life situations involve liquids that don't mix—like oil and water?
- Why do some substances sink while others float?
- What might happen if you changed one of the materials in your lava lamp?
- How could you use this experiment to teach someone else about science?
- How does being creative help, you understand a scientific idea?
  - Can science also be art? Why or why not?

CREATE

Some things you need before beginning

- Oil and water don't mix because they have different chemical structures, this is called *polarity*. It's the same reason why soap can clean grease off your hands or dishes, it helps oil mix with water!
- The bubbling effect is caused by carbon dioxide (CO_2) gas, just like the fizz in soda. When the effervescent tablet hits water, it starts a chemical reaction that creates those dancing bubbles!
- Lava lamps work because of density differences, heavier liquids sink, lighter ones float. This concept is used in engineering, weather forecasting, and even blood separation in medical labs.
- Lava lamps may seem like toys, but they're connected to real science: chemical reactions, fluid dynamics, and visual experimentation are used in everything from oil spill cleanup to volcanic research.
- Artists and designers use science and color interaction to create liquid art installations, colorful motion in film effects, and mood lighting.
- Making your own lava lamp teaches sustainability, you're reusing bottles, avoiding electric lamps and understanding how materials work before you throw them away.
- This experiment connects to the work of women chemists who discovered new reactions, materials, and dyes that are still used in science and fashion today.
- Understanding how everyday substances interact helps us make smarter, safer choices in our homes, from the cleaning products we use to how we dispose of oil and waste.

Now, follow these steps

Step 1. Warm-up and Curiosity Spark

- Shows a demo lamp or a short video clip of a lava lamp.
- Driving question: "Can you make a lava lamp without using heat?"
- Students engage in a brief Think-Pair-Hare to predict what might make the lava lamp work
- Show a video of how a lava lamp can be made

Step 2. Build the Lava Lamp (materials per group: Clear plastic bottle, vegetable oil, water, food coloring, effervescent tablet, funnel)

- Ask students to note what they see and make quick predictions about why it happens.
- Fill bottle ¾ with vegetable oil.
- Slowly pour in water until nearly full—observe how it separates.
- Add several drops of food coloring; watch how it mixes with the water but not the oil.
- Drop in the effervescent tablet and observe the bubbling reaction.

Step 3. Guided Discussion – Why Does the Lava Lamp Work This Way?

- Ask:
  - *Why do you think the oil and water didn't mix?*
    - Answer: Oil and water don't mix because they have different polarities. Water is polar and oil is non-polar, which means their molecules don't attract each other, they actually repel. Also, oil is less dense, so it floats on top.
  - *What happened when we added the food coloring? Why didn't it stay in the oil?*
    - Answer: Food coloring is water-based, so it doesn't mix with oil either, but it sinks through the oil and mixes with the water below. That's why you saw those little colored drops fall straight down until they burst into the water layer.
  - *And what about the tablet—why did it make bubbles go up and down?*
    - Answer: The tablet reacts with the water and produces carbon dioxide gas. The gas forms bubbles that grab some colored water and float upward. When the bubbles reach the top and the gas escapes, the heavier water drops back down. That's what creates the rising and falling motion, just like a real lava lamp!
  - *What would happen if we tried this with just oil and no water?*
    - Answer: There wouldn't be a reaction because the tablet only reacts in water. No water, no bubbles, no movement. That's why each ingredient matters!
  - How does the use of recycled materials connect to the global issue of plastic

pollution? Can design be part of the solution to environmental or access challenges?

- By using recycled materials in our decoration, we can show how creativity and design can help reduce waste. This connects to real environmental challenges like plastic pollution. Designers, scientists, and engineers work on creating eco-friendly solutions, and our lava lamp could be a small example of how science and art can work together to make a difference.

Step 4. Artistic Personalization

- Students personalize their lava lamp with a designed label, including:
  - A creative name.
  - Decorations (e.g., tape, stickers, recycled scraps).
- A tribute to a scientist or engineer who inspired them (therefore give students *the Women in Color Chemistry poster* to inspire)
- They may be inspired by real scientists, colors they love, or visual effects.
- Emphasize eco-conscious design: "Today we're not just building a lava lamp—we're also thinking like eco-designers. In real-world chemistry and engineering, designing sustainably means using fewer new materials, reusing what we already have, and reducing waste. This is part of what's called a circular design mindset, where materials don't get thrown away, but instead get reused or reimagined."
- Challenge students to:
  - Use found or recycled materials for the decoration, like wrappers, newspaper, cloth scraps, or labels.
  - Add a sustainability symbol or message to the design (e.g., recycling icon, "Reuse Me!", or your own invented eco-symbol).
- Go further! Challenge students to add a visual or symbolic element in their label design inspired by a cultural or traditional pattern, artwork, or motif they connect with. For example:
  - Japanese wave motifs (like *The Great Wave off Kanagawa*) to symbolize water and energy.
  - Islamic geometric designs to represent precision, symmetry, and structure.
- Challenge them also to think about how their chosen colors, symbols, or decorations reflect a culture's way of seeing or celebrating science, nature, or design. For instance:
  - Using green and blue to show harmony with nature in Indigenous beliefs.
  - Incorporating suns, spirals, or stars found in ancient astronomy symbols.

Step 5. Group Reflection

- Ask the following questions so students discuss:
  - What surprised you about how the liquids reacted?
  - What would you change next time?
  - Which lamp inspired you most—and why?

COMMUNICATE

Once students have built and personalized their lava lamps, they will engage in a Science and Design Circle, a collaborative space for sharing, listening, and reflecting as a class.

- **Part A: Student Presentations**

  Each student or group takes a turn sharing their work using these guided questions:

  - What's happening inside your lava lamp? *(Students explain the roles of density, polarity, and gas formation.)*
  - Why did you choose your lamp's name and decorations? *(Connections to scientists, symbolism, or personal inspiration.)*
  - Did you reuse or repurpose anything in your design? Why did that matter to you? *(Students highlight how they minimized waste or used recycled materials.)*
  - What part of the experiment or design surprised you the most or was hardest? *(Encourages honest reflection and learning from experimentation.)*
  - Does your lava lamp's decoration include any artistic influences or cultural styles? What inspired you? *(Encourages reflection on cultural expression and how design connects to identity or tradition.)*

- **Part B: Peer Feedback Round**
  - After each presentation, classmates offer live feedback to each group
- **Part C: Whole-Class Reflection**
  - What's one science concept you understand better now?
  - What inspired you from someone else's design or explanation?
  - If we did this again, how could we reduce waste even more?
  - Can creativity help us explain scientific ideas more clearly?"

Upload lamp photos and labels on school pages or use hashtags:

#STEAMlamp #ColorScience

It is time to share!

Share your amazing work and inspire others!

#ColdGlow:MakeaLavaLampWithoutHeat

- LinkedIn: https://www.linkedin.com/company/steambrace-project/posts/?feedView=all
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://www.instagram.com/steambrace_eu/

KEEP ON LEARNING

How can I make a similar project by myself?

- What was the biggest scientific challenge your group faced—and how did you solve it?
- How could you redesign this experiment to make it more efficient, creative, or eco-friendly?
- If you had more time or materials, what would you improve or try differently? Why?
- What everyday objects use the same scientific principles (density, polarity, gas release)?
- How could you use recycled or natural materials to create a different kind of visual reaction?
- Why do you think simple experiments like this can be important in science education or outreach?
- Could you use the lava lamp idea to explain a science concept to younger students? How?
- Can you think of another problem in your community where creativity and science could be combined to design a solution?
- What kind of message would you include in a new science-art project to raise awareness about an issue you care about?

Which are other connected projects?

Examples:

1. Color Chemistry Challenge

Experiment with new ingredients like natural dyes (e.g., beet juice, turmeric, spirulina) or plant-based oils. Compare how the reactions change. Students could create a chart to compare results across natural and synthetic materials.

2. Lava Lamp 2.0 – Visual Effects Lab

Add glitter, different-shaped containers, glow-in-the-dark paint, or UV light to explore how light and shape change perception. Design a “Mood Lamp” with symbolic colors or meanings.

3. Science Fair Extension – “Which Factors Affect the Reaction?”

Turn this project into a full scientific investigation. Students can test variables like:

- Tablet type (citric acid content)
- Water temperatura
- Oil thickness
- Bottle shape

They'll record results, graph outcomes, and present claims supported by data.

LINKS FOR FURTHER INFORMATION

- **American Chemical Society (ACS):** Activities and videos on chemical reactions, safe experiments, and at-home science. https://www.acs.org/education/students.html
- **Science Buddies – Chemistry Projects:** Accessible guides for student-driven science with everyday materials. www.sciencebuddies.org
- **UNESCO STEM Inclusion Toolkit:** Resources for making STEAM education gender-sensitive and inclusive. en.unesco.org