GRID & SILICON

Parent / teacher guide

Liquid Cooling: How AI Chips Stay Cool

Word help: gridandsilicon.com/glossary/

Quick answer key

Time: about 30–40 minutes. **Materials:** Pencil, student sheet and explainer; extension materials are listed below.

- I can trace energy through liquid cooling.
- I can use the model to explain a new situation.
- I can explain one limit or tradeoff.

NGSS connections: 4-PS3-2: energy transfer by heat and electrical currents (concept connection). MS-PS3-3: thermal-transfer ideas (concept connection only; designing and testing a device is not fully assessed). These are partial teaching connections, not certification.

Warm-up: 1. Cold plate · 2. Cooler liquid

Multiple choice: 1. C · 2. A · 3. B · 4. C · 5. B · 6. B · 7. A · 8. A · 9. C

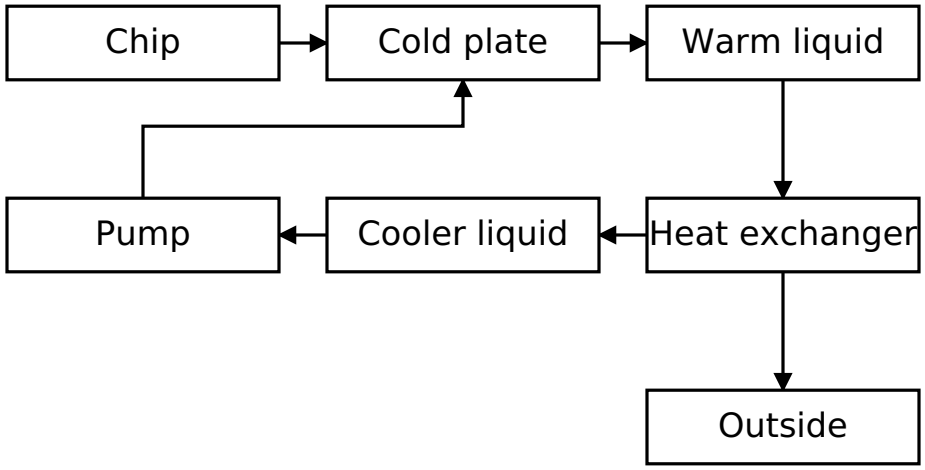
Fill-in: cold plate · pump · heat exchanger

Diagram labels, by number: 1. Chip · 2. Cold plate · 3. Warm liquid · 4. Heat exchanger · 5. Outside · 6. Cooler liquid · 7. Pump

Open responses: accept a clear link between the example and the technology. See the samples below.

The big idea

Computers produce heat while they work. Liquid cooling collects some of that heat close to the chips and carries it away. A pump moves the liquid, and a heat exchanger passes the heat onward. The whole path must work; heat does not disappear.



Words to know

cold plate: A cold plate is a metal part that collects heat from a chip. Like a warm spoon transferring heat to cooler water. · pump: A pump is a machine that pushes liquid through pipes. Like a water pump that keeps flow moving. · loop: That path is called a loop because the liquid returns. Like a circular route that returns to its start. · heat exchanger: It travels to a heat exchanger, which passes heat between separate fluids. Like two separate containers exchanging warmth through a wall.

Question guide

1. A chip warms its metal contact. Which part receives that heat first?

C. Cold plate. Trace heat from the chip before following the liquid.

> **Evidence:** "A cold plate is a metal part that collects heat from a chip."

Other choices: A: The exchanger receives heat later in the path. B: A pump moves liquid rather than touching the chip.

If stuck: Trace heat from the chip before following the liquid.

2. Liquid is standing still in a pipe. Which part normally keeps it moving?

A. Pump. Separate moving liquid from transferring heat.

> **Evidence:** "A pump is a machine that pushes liquid through pipes."

Other choices: B: A cold plate collects heat rather than pushing flow. C: An exchanger transfers heat rather than driving flow.

If stuck: Separate moving liquid from transferring heat.

3. Two liquid circuits must stay separate but pass heat between them. What connects their heat paths?

B. Heat exchanger. Find the part that transfers heat without mixing fluids.

> **Evidence:** "It travels to a heat exchanger, which passes heat between separate fluids."

Other choices: A: A pump moves fluid rather than separating circuits. C: A cold plate collects chip heat, not between circuits.

If stuck: Find the part that transfers heat without mixing fluids.

4. Warm liquid leaves a chip. What has the liquid gained?

C. Heat from the chip. Compare the liquid before and after the plate.

> **Evidence:** "The liquid gets warmer as it takes up that heat."

Other choices: A: The liquid gains heat rather than losing its heat load. B: Collecting chip heat raises, rather than lowers, liquid temperature.

If stuck: Compare the liquid before and after the plate.

5. A designer draws only an outward pipe. What completes the loop?

B. A return pipe to the cold plate. A loop brings the liquid back to collect heat again.

> **Evidence:** "That path is called a loop because the liquid returns."

Other choices: A: Another chip does not bring liquid back. C: Fuel supply does not complete the liquid path.

If stuck: A loop brings the liquid back to collect heat again.

6. Liquid has given up heat at the exchanger. Where should it travel next?

B. Back toward the cold plate. Follow the returning liquid, not the heat leaving the building.

> **Evidence:** "After giving up heat, cooler liquid returns toward the cold plate."

Other choices: A: Fuel lines are separate from the cooling loop. C: Coolant belongs in pipes, not electrical wires.

If stuck: Follow the returning liquid, not the heat leaving the building.

7. A new cooler works well. What do the computing chips still need?

A. Electrical power. Cooling supports computing; it does not supply the chip's electricity.

> **Evidence:** "It does not make the chips stop using electricity."

Other choices: B: Outdoor air carries heat but does not power chips. C: Replacement liquid alone cannot power computing chips.

If stuck: Cooling supports computing; it does not supply the chip's electricity.

8. A room moves heat off its chips but has nowhere to release it. What is missing?

A. A path for heat beyond the chip system. Follow heat all the way to its destination.

> **Evidence:** "The rest of the system still needs to handle it."

Other choices: B: Moving more liquid cannot replace a missing heat outlet. C: Another plate still needs an outlet for its heat.

If stuck: Follow heat all the way to its destination.

9. A pipe blockage slows the flow. What is a likely result?

C. Less heat carried away. Use the link between liquid movement and heat removal.

> **Evidence:** "If liquid stops moving, heat removal at the chip can be reduced."

Other choices: A: Slower flow does not remove the need to transfer heat. B: A chip is not intended as an energy store.

If stuck: Use the link between liquid movement and heat removal.

Warm-ups, vocabulary and labels

Which numbered blank receives heat directly from the chip? Cold plate. What does the return pipe bring back toward the cold plate? Cooler liquid.

Use the labeled diagram to check each numbered blank. Arrows show the path through this technology.

1. cold plate — A cold plate collects heat from a chip.

2. pump — A pump moves liquid through pipes.

3. heat exchanger — A heat exchanger transfers heat between separate fluids.

Think about it: sample answers

Your laptop gets warm. What job does its fan share with a liquid loop? The fan moves heat away from the laptop, as moving liquid carries heat away from chips.

You carry a warm lunch box to another room. How does that help explain why moving heat off a chip is only one step? Moving the box changes where warmth is carried; the heat still needs to reach the surroundings.

Look for a correct connection to the new situation, not a memorized sentence.

Common mix-ups

- A cold plate collects heat from a chip.
- A pump moves liquid through pipes.
- A heat exchanger transfers heat between separate fluids.
- Liquid cooling moves heat; the heat must still leave the system.
- A diagram is a simplified model, not a construction plan.

Exit ticket

1. Name one input and one output.
2. Explain what one part does.
3. Predict what changes if a needed input stops.

Check for a valid input/output, the correct job of a named part, and a prediction that follows the energy path.

How to help

Read aloud, pause after one section, and allow a look back at the model. Praise a useful strategy. If frustration grows, take a break and resume with one manageable step.

Safe at-home extension

With an adult, place a metal spoon in comfortably warm tap water, then move it into cool water. Feel the handle only when safe. Describe where heat moves. Use no boiling water.