Family edition

Claw Game Maker: Squeeze or Cradle?

Ages 11-14 · about 45 minutes, in one sitting

Your child finds out how a claw really holds a prize, in Claw Game Maker. The point is that curled tips cradle a prize from below with almost no squeeze, while straight tips can only squeeze, and squeezing a round prize hard pops it out.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/clawmaker?lesson=squeeze-or-cradle&ref=fam-clawmaker-2. No account, no email and nothing to install.
- Optional: a smooth ball to cup and to squeeze.

Before you start: try it once yourself

Open mytekdev.com/try/clawmaker?lesson=squeeze-or-cradle&ref=fam-clawmaker-2. A claw machine in a room, seen the way a player sees it: a 70 cm box, three rubber-padded prongs parked closed over the chute, and a pile of bears, ducks and capsule balls.

1. **The ball.** Open `Test`, pick Ball in a capsule on the bench, set 0.3 N and run it. It holds: the curled tips close under it.
2. **Straight.** Open `Build`, `Claw`, and drag `Tip curl` to nearly straight. The prongs change as you drag. Bench the ball at 0.3 N: it slips. At 12 N it still slips: the squeeze pops it out.
3. **Hooked.** Put the curl back and drag `Pad angle` to hooked. Bench the bear at 0.5 N: cradled.
4. **Metal.** Pick bare metal tips and bench the bear again at 0.5 N with the hooked pads: it still holds. At 0.5 N with straight metal tips it slips at once.

> Every slider on the Claw sub-tab changes the claw while it moves, and the physics follows on release.

The ideas, in plain words

A claw can hold two ways. Squeezing uses friction: the tips push in, and friction up along the tips carries the weight, up to a limit set by the push and the grippiness of the pair of surfaces. Cradling uses shape: the tips close under the prize and carry it the way cupped fingers carry a ball, and the push barely matters.

A 45 g capsule ball has a friction line of about 0.3 N with rubber tips, and it cradles at 0.3 N with curled tips. With straight tips it cannot be held at any grip: a hard sideways squeeze on a smooth ball pushes it out, like a wet bar of soap. A bear has limbs the tips can hook under, so hooked pads cradle it at 0.4 N on the bench, half its friction line.

Real arcade claws have curled tips with rubber pads: the curl for cradling, the pads for friction when it has to squeeze. Children who set the pads to hooked find the honest machine check of Build a Fair Machine easier to pass, and the bench shows why.

Do it together

1. Open mytekdev.com/try/clawmaker?lesson=squeeze-or-cradle&ref=fam-clawmaker-2 together. Open Test and bench the capsule ball at 0.3 N.

   > **You'll know it worked when:** It holds, at a grip far below the bear's.

2. Open Build, Claw, and drag Tip curl to nearly straight. Bench the ball again.

   > **If you get stuck:** Zoom in on the claw with the scroll wheel to see the tips change as you drag.
   >
   > **You'll know it worked when:** It slips: straight tips can only squeeze, and the ball is smooth.

3. Drag Pad angle to hooked and bench the bear at 0.5 N.

   > **You'll know it worked when:** The bear is cradled at a grip that would never squeeze it.

4. Pick bare metal tips and bench the bear again with the hooked pads.

   > **You'll know it worked when:** Your child can say that cradling needs the shape, not the friction.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- What did the tips do under the ball at 0.3 N?
- Why did the ball slip at 12 N with straight tips?
- Why does the bear cradle with hooked pads even on bare metal?
- Which prize would hooked pads not help, and why?
- What do real claws have both the curl and the rubber for?

> The second question is the real test: a child who can say that squeezing a smooth round prize pushes it out has let go of "stronger is better".

For younger and older kids

Younger: For a younger child, cup a ball in your hands and then try to lift it by squeezing its sides with straight fingers.

Older: For a teenager, compare each holding grip with the friction line at the High school level and find which holds are under the line.

Keep going

- Work out the ball's friction line and compare it with the grip that cradled it.
- Find a pad angle at which the bear holds at 0.5 N, then explain why hooked pads fail on the boxed toy.
- Solve the Slippery ball puzzle under Puzzles.

Bring it into other subjects

- Math: the friction line is weight divided by the prongs times the grippiness. Work it out for the ball, the bear and the boxed toy.
- Biology: how do a bird's feet hold a branch while it sleeps? Squeeze or cradle?
- Engineering: sketch a claw for a flat boxed toy, which nothing can get under.
- English: explain cradling to a younger child in three sentences, with a drawing.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Claw Game Maker: Squeeze or Cradle?
SUBJECTS	Physical science
TIME	45 minutes
WHAT WE DID	Used a claw machine simulation to tell holding by friction from holding by shape, changing the tips' curl, the pads and the material one at a time on a grip bench.
SKILLS PRACTICED	Forces and friction; Shape and function; Testing one variable at a time

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/clawmaker?lesson=squeeze-or-cradle

Essential question: When does a claw hold a prize by squeezing, and when by cradling, and what does each need?

Warm-up: A smooth 45 g ball: more grip or less than a 180 g bear? Why? _____

1. **Vocabulary.** Squeeze, cradle, tip curl, pad angle, friction line: write each in your own words.

2. **The guide.** The ball at 0.3 N with curled tips: _____. With straight tips: _____. The bear at 0.5 N with hooked pads: _____.
3. **The settings table.** For the bear and the ball, at straight, curled and hooked tips: the lowest grip that holds.

4. **Bare metal.** The bear at 0.5 N, hooked pads, bare metal tips: _____. Straight metal tips: _____.

1. Why did the ball hold at 0.3 N and slip at 12 N?

2. Why do real claws have curled tips and rubber pads?

Quick check

Name: _____

1. Cradling a prize means (A) squeezing it harder (B) the tips close under it and carry it on their shape (C) lifting it faster

2. A smooth ball with straight tips (A) holds at a high grip (B) pops out when squeezed hard (C) holds at any grip

3. Hooked pads on bare metal tips still cradle the bear. What does that show?

Answers

QUESTION	ANSWER	WHY
1	B	Shape does the holding; the push barely matters.
2	B	A hard sideways squeeze on a smooth round prize pushes it out.
3	Cradling needs the shape, not the friction	Squeezing needs grippy surfaces; cradling carries the prize from below. A full answer says friction still helps when it must squeeze.

If your state or umbrella school asks, this lesson covers NGSS MS-PS2-2.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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