Family edition

Claw Game Maker: Why Did the Bear Drop?

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

Your child finds out why a claw machine drops a prize, in Claw Game Maker. The point is that the claw squeezes sideways, friction turns that squeeze into a hold, and friction has a limit set by the push.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/clawmaker?lesson=why-did-the-bear-drop&ref=fam-clawmaker-1. No account, no email and nothing to install.
- Optional: a pencil to squeeze between two fingers and lift.

Before you start: try it once yourself

Open mytekdev.com/try/clawmaker?lesson=why-did-the-bear-drop&ref=fam-clawmaker-1. 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. **Play.** Press `Play`, steer with the arrows, press `Drop`. The claw closes, lifts, holds, carries to the chute and lets go.
2. **The replay.** On a loss, press `Why did it drop?`. The last seconds play again at quarter speed with arrows: weight down from the middle, push in from each prong, friction up along the tips, and one sentence.
3. **The bench.** Open `Test`. The Grip Bench puts one bear under the claw at the grip shown. Guess, run it, and read held or slipped with the push and the friction the tips made.
4. **Down and up.** Turn the grip down to 0.6 N: it slips. Up to 0.9 N: it holds. The bear weighs 1.8 N.
5. **One variable.** In `Build`, `Claw`, pick bare metal tips and run the bench at 0.9 N again: it slips. The push is the same; the friction is not.

> The friction the replay draws is what the contact could have made at that push. Whether the prize held is what the physics decided.

The ideas, in plain words

The prongs squeeze the prize sideways. The upward hold is friction, and the most friction a contact can make is the push times how grippy the two surfaces are (the coefficient of friction). A 180 g bear weighs 1.8 N; with three rubber tips on plush, pair friction about 0.7, each tip must push about 0.8 N before friction alone can match the weight. On the bench it holds from about 0.9 N, because the prongs push at a slant.

Curled tips change the story: they can close under a prize and carry it on their shape, so a round capsule ball holds at 0.3 N. That is the next part of this series, Squeeze or Cradle? Here the bear is held by the body, on its back, so friction does the work.

The app's friction numbers are typical values for each surface, averaged for each pair, and the prizes are stiff. Real plush squashes, and the prongs sink in, which helps a grab. How it works in the app says so.

Do it together

1. Open mytekdev.com/try/clawmaker?lesson=why-did-the-bear-drop&ref=fam-clawmaker-1 together. Press Play, steer with the arrow keys and press Drop.

   > **You'll know it worked when:** The claw goes down, closes, lifts and carries whatever it caught toward the chute.

2. When a prize slips, press Why did it drop? and read the sentence together.

   > **If you get stuck:** If you win three times in a row, turn the grips down in Build, Claw.
   >
   > **You'll know it worked when:** Red is the weight, blue the push, yellow the friction.

3. Open Test and the Grip Bench. Guess whether the bear holds, then run it. Turn the grip down until it slips.

   > **You'll know it worked when:** The bear slips somewhere under 1 N even though it weighs 1.8 N; friction is what held it.

4. Swap the tips for bare metal in Build, Claw, and run the same grip.

   > **You'll know it worked when:** Your child can say the same push made less friction on the slippery tips.

Talk about it

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

- Which way does the push arrow point? Which way does the friction arrow point?
- What was the lowest grip that held the bear? What is the bear's weight?
- Why can a push smaller than the weight hold the bear up?
- What changed when you swapped the tips for bare metal?
- What would happen with twice the mass at the same grip?

> The third question is the real test: a child who can say that three tips each make friction, and that friction can be bigger than the push, has it.

For younger and older kids

Younger: For a younger child, set the level to Kid in the header and talk about weak, medium and strong instead of newtons.

Older: For a teenager, switch to High school and work out the friction line from the weight and the grippiness, then check it on the bench.

Keep going

- Work out the friction line: weight divided by three prongs and the grippiness, and compare it with the bench.
- Bench the capsule ball and explain why it holds at a far lower grip than the bear.
- Solve the Hold the bear puzzle under Puzzles.

Bring it into other subjects

- Math: the bear held at 0.9 N and weighs 1.8 N. How many newtons of friction did each of three tips make, at least?
- Engineering: list three ways to make the same claw hold a heavier prize without turning the grip up.
- History: read how the first crane games of the 1920s and 1930s were called diggers, little steam shovels in a glass case.
- English: write the replay sentence for a play of your own, in your own words.

For your records

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

LESSON	Claw Game Maker: Why Did the Bear Drop?
SUBJECTS	Physical science
TIME	45 minutes
WHAT WE DID	Used a claw machine simulation with real physics to show that friction holds a prize up, that the push sets its limit, and tested one variable at a time on a grip bench.
SKILLS PRACTICED	Forces and friction; Reading a force diagram; 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=why-did-the-bear-drop

Essential question: The claw squeezes sideways. What holds the prize up, and what sets the limit?

Warm-up: A claw lifts a bear and it slips out. Why? _____

1. **Vocabulary.** Weight, newton, friction, grip, limit: write each in your own words.

2. **The replay.** After a lost play, press Why did it drop? Copy the reason, and say which arrow ran out.

3. **The bench table.** Six rows: the grip, your guess, held or slipped, the push and the friction. Find the lowest grip that holds the bear.

4. **One variable.** Bare metal tips at the holding grip: _____. Mass doubled at the holding grip: _____.

1. The bear weighs 1.8 N and held at a grip under 1 N. How?

2. What changed when you swapped rubber for bare metal, and why?

Quick check

Name: _____

1. What holds the prize up in the claw? (A) the push from the prongs (B) friction between the tips and the prize (C) the cable

2. The most friction a tip can make depends on (A) the push and how grippy the surfaces are (B) the color of the prize (C) how fast the claw lifts

3. The same grip holds the bear with rubber tips and drops it with bare metal tips. Why?

Answers

QUESTION	ANSWER	WHY
1	B	The push is sideways; friction is the upward force.
2	A	Friction's limit is the push times the coefficient for the pair of surfaces.
3	Metal on plush is less grippy	The same push makes less friction on the slippery pair, so it falls under the weight. A full answer names the push and the limit.

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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