4th Grade Lesson Plan

Teacher Name: Tirré Logston Subject: STEM (Science, Math) Date: Oct 13th-17th

Lesson: Jumping Spider Catapults – Exploring Energy Transfer

State Standards:

E4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the design problem.

4.MD.A.1: Know relative sizes of measurement units within one system of units, including km, m, cm; express measurements in a larger unit in terms of a smaller unit.

I can/Learning Target:

- I can design and test a catapult that transfers stored energy into motion.
- I can measure and record how far my jumping spider travels in centimeters.
- I can improve my design by making changes and retesting.

Lesson structure:

Warm Up:

Quick discussion: "How do jumping spiders catch their prey?" Show a short picture or remind them that spiders leap by storing and releasing energy. Connect this to catapults by saying, "Today, you'll be engineers building your own spider launchers."

I do:

Demonstrate how to assemble a simple catapult with tongue depressors, a spoon, and rubber bands. Show how stored elastic energy is released to launch the spider. Demonstrate how to measure the spider's jump distance accurately with a tape measure.

We do:

As a class, launch one spider together and measure its distance. Record the measurement on the board. Ask: "What might make it go farther? How can we change our design?" Brainstorm possibilities.

You do:

Students build their own catapults, test their spider's jump, and record results in centimeters. They then use the engineering design process to make changes, retest, and record new data. They compare results to see if their changes improved the design.

Learner Readiness: (I know/I need to know - including vocab)

Students have been studying energy transfer in their classrooms and have listened to I'm Trying to Love Spiders in the library. They are ready to connect energy transfer concepts with hands-on engineering, using their background knowledge of spiders as a real-world connection.

Energy
Force
Elastic Energy
Motion
Catapult
Engineering Process
Criteria
Constraints
Distance
Measurement

Materials:

- Tongue depressors and popsicle sticks
- Plastic spoons
- Rubber bands
- Pom-pom spiders
- Tape measures
- Recording sheets

Differentiation:

- Provide clear step-by-step visuals of the catapult-building process so students can follow along more easily.
- Building, measuring, and recording distances will be a paired activity, allowing struggling learners to work with peers who can help them measure and write down results accurately.

Enrichment:

- Write a short explanation describing why their spider traveled farther (or did not travel farther) after redesigning their catapult.
- Convert their recorded distances from centimeters into meters, applying unit conversion to extend their math learning.

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Lesson Steps:

0:00 – 2:00 Warm-Up Discussion
Gather students and ask: "How do jumping spiders catch their prey?" Encourage quick responses. Reinforce that jumping spiders store energy in their legs before they spring forward. Connect this to today's project by saying: "Today, you'll build a catapult to launch your very own jumping spider."

2:00 – 6:00 Teacher Model (I Do)
Show students a simple catapult made with tongue depressors, a spoon, and rubber bands. Place a pom-pom spider in the spoon, pull back, and launch. Demonstrate how to measure the distance with a tape measure. Emphasize accuracy: "We always line the tape measure up with the launch point and measure to where the spider lands."

6:00 – 8:00 Guided Practice (We Do)
As a class, launch one spider together. Have volunteers measure the distance in centimeters while the rest of the class observes. Record the result on the board. Ask: "What could we change to make it go farther?" Gather a couple of student ideas.

8:00 – 18:00 Independent Build & First Test (You Do – Round One)
Students use their materials to build their own catapults. Once built, they launch their spider and measure the distance in centimeters. Recording sheets are filled out with their first test result. Teacher circulates to check for accurate measuring and data recording.

18:00 – 23:00 Redesign & Retest (You Do – Round Two)
Students use the engineering design process to improve their catapults. They make changes (adding sticks, changing band placement, adjusting spoon height) and retest their spider jumps. They measure again and record the second distance.

23:00 – 26:00 Partner Share of Results
Students turn to their measurement partner and compare Round One and Round Two results. Advanced learners write a short explanation of why their spider traveled farther (or not) after changes and convert their results into meters.

26:00 – 29:00 Class Discussion & Wrap-Up
Bring the group together and ask: "What changes worked best to make your spider jump farther?" Record a few responses on the board. Highlight the connection: "Just like a spider uses stored energy in its legs, your catapult used stored elastic energy to launch your spider."

29:00 – 30:00 Final Wrap-Up Prompt
"Turn to your partner and share one change you made and how it helped your spider jump farther." Collect a few final shares before dismissal.

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Rubric:

- 3 points: Catapult functions, data recorded in centimeters, redesign shows improvement, and student uses vocabulary correctly.
- 2 points: Catapult functions, some data recorded in centimeters, redesign attempted with partial improvement.
- 1 point: Catapult incomplete or data missing, little evidence of redesign.

Assessment:

Formative:

Student progress is monitored during catapult construction, with attention to correct use of materials and the ability to follow the design steps. Conversations and questions during testing and redesign are used to check for understanding of key concepts such as energy, force, and measurement. Accuracy of measuring and recording distances is reviewed as students work.

Summative:

Recording sheets provide the final measure of learning. Each sheet must include at least two test results measured in centimeters and evidence of redesign. Comparisons between first and second trials demonstrate growth in design and application of energy transfer. Advanced learners also include a written explanation of outcomes and convert distances from centimeters to meters.

Wrap Up:

To close the lesson, the teacher gathers students together and reviews the connection between spiders and catapults. The teacher says: "Jumping spiders store energy in their legs before leaping, and today you used elastic energy in your catapults to make your spiders jump. Both are examples of energy transfer." Students are then asked to turn to a partner and share one change they made to their catapult and how it affected the distance their spider traveled. A few volunteers are invited to share with the whole class before dismissal.

Reflection:

Name

Jumping Spider Catapult Data Sheet

Step 1: Plan

Draw a quick sketch of your catapult design.

Label parts such as the spoon, rubber band, and sticks.

Step 2: Predict

How far do you think your spider will jump?

_____ cm

Step 3: Test #1

Record your first launch distance.

_____ cm

Step 4: Improve

What change did you make to your catapult design?

Step 5: Test #2

Record your second launch distance.

_____ cm

Step 6: Analyze

Did your spider jump farther after your redesign?

Yes ☐ NO ☐

By how much?

_____ cm

Name

In your own words, explain the difference between potential energy and kinetic energy.

If you could change one supply item to make your catapult work better, what would you change and why?

Exit Ticket

Name

In your own words, explain the difference between potential energy and kinetic energy.

If you could change one supply item to make your catapult work better, what would you change and why?