Galilean Moons Hands-On Experiments

This pack gives you two worksheet versions of each experiment:

- Ages 7–11 (Primary): short steps, big boxes, low writing demand
- Ages 11–16 (Secondary): prediction, variables, results table, conclusion

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Experiment 1 (Io): “Tidal Heating” Warm-Up Squeeze Demo

Ages 7–11 Worksheet (Primary)

Name: _____ Date: _____

What are we learning? Io gets hot inside because it is squeezed by gravity.

You will need

- Paperclip or a strip of aluminium foil (folded into a thin strip)
- Timer (optional)

Steps

1. Hold your paperclip/foil.
2. Bend it back and forth in the same spot for 30–60 seconds.
3. Carefully feel it (or hold it near your cheek) to see if it feels warmer.

Draw what you did (large blank box)

What I noticed (circle one)

- It felt warmer
- It felt the same
- I’m not sure

Talk or write one sentence Squeezing can make heat because _____.

Safety: Stop if it hurts or becomes sharp.

Ages 11–16 Worksheet (Secondary)

Name: _____ Date: _____

Aim To model how repeated bending/squeezing can transfer energy and produce heat (a simple analogy for tidal heating).

Equipment

- Paperclip (preferred) or folded foil strip
- Timer

Prediction I predict the metal will feel _____ because _____.

Method

1. Bend the paperclip at the same point repeatedly for 60 seconds.
2. Immediately test temperature change (touch carefully or compare to an unbent paperclip).
3. Repeat for a second trial.

Results

Trial	Time bending (s)	Warmer / Same / Cooler	Notes
1	60		
2	60		

Variables

- Independent: time bending / number of bends
- Dependent: perceived temperature change
- Controls: same paperclip type, same bending point, same room conditions

Conclusion (2–3 sentences)

Link to Io Explain how gravity can “squeeze” Io and create heat:

Experiment 2 (Europa): “Ice Cracks” Frozen Surface Model

Ages 7–11 Worksheet (Primary)

Name: _____ Date: _____

What are we learning? Europa has ice with cracks. Scientists think there might be an ocean under the ice.

You will need

- Shallow tray
- Water
- Freezer time
- Food colouring (optional)

Steps

1. Pour a thin layer of water into the tray.
2. Freeze it until it becomes ice.
3. Take it out and wait 2–3 minutes.
4. Gently press the ice (or gently flex the tray) to make cracks.
5. Optional: drip a tiny bit of coloured water to show the crack lines.

Draw your cracked ice (large blank box)

What I noticed (tick)

- I saw cracks
- The cracks spread
- The ice changed as it warmed

Talk or write Europa might crack because _____.

Ages 11–16 Worksheet (Secondary)

Name: _____ Date: _____

Aim To model how a brittle surface layer can crack as conditions change (temperature/pressure), similar to Europa’s ice shell.

Equipment

- Tray, water, freezer
- Optional: food colouring

Prediction I predict the ice will crack more when _____ because _____.

Method

1. Freeze a thin ice layer in a tray.
2. Remove and allow to warm for 2–3 minutes.
3. Apply gentle pressure or flex the tray to create stress.
4. Optional: add a drop of coloured water to highlight fractures.

Results

Condition tested	What you did	Crack amount (low/med/high)	Notes
Warmed 2 min			
Warmed 4 min (optional)			

Variables

- Independent: warming time / applied pressure
- Dependent: crack amount/length
- Controls: same tray, same ice thickness, same room

Conclusion

Link to Europa Give two reasons Europa is interesting to scientists:

Experiment 3 (Ganymede): “Magnetic Field” Compass + Magnet

Ages 7–11 Worksheet (Primary)

Name: _____ Date: _____

What are we learning? Ganymede has a magnetic field.

You will need

- Compass
- Magnet

Steps

1. Put the compass on the table.
2. Bring the magnet near it slowly.
3. Watch the compass needle move.

Draw what happened (large blank box)

What I noticed (circle one)

- The needle moved a lot
- The needle moved a little
- The needle didn’t move

One sentence A magnetic field is _____.

Ages 11–16 Worksheet (Secondary)

Name: _____ Date: _____

Aim To observe how a magnetic field affects a compass needle and relate this to how spacecraft detect magnetic fields.

Equipment

- Compass
- Bar/fridge magnet
- Ruler (optional)

Prediction I predict the compass needle will change direction when the magnet is within _____ cm because _____.

Method

1. Place compass flat on the table.
2. Move magnet towards the compass in small steps.
3. Record the distance where the needle noticeably deflects.
4. Repeat from a different direction.

Results

Trial	Direction approached	Distance at first deflection (cm)	Notes
1			
2			

Variables

- Independent: magnet distance / approach direction
- Dependent: needle deflection
- Controls: same compass, same magnet, same surface

Conclusion

Link to Ganymede Why is it unusual/exciting for a moon to have its own magnetic field?

Experiment 4 (Callisto): “Crater Lab” Impact Marks

Ages 7–11 Worksheet (Primary)

Name: _____ Date: _____

What are we learning? Callisto has lots of craters made by impacts.

You will need

- Tray
- Flour (base)

- Cocoa powder/cinnamon (top dust)
- Marbles/beads/small stones (or rolled foil balls)

Steps

1. Put flour in the tray.
2. Dust a little cocoa/cinnamon on top.
3. Drop one object from a low height.
4. Drop another object from a higher height.
5. Compare the craters.

Draw your best crater (large blank box)

Tick what happened

- Higher drop made a bigger crater
- Heavier object made a bigger crater
- The powder made a splash pattern

One sentence A crater is made when _____.

Ages 11–16 Worksheet (Secondary)

Name: _____ Date: _____

Aim To investigate how impact energy affects crater size and ejecta patterns.

Equipment

- Tray, flour, cocoa/cinnamon
- Objects of different mass/size
- Ruler (optional)

Hypothesis If the drop height increases, then crater diameter will _____ because _____.

Method

1. Prepare the flour base and dust layer.
2. Drop the same object from two different heights.
3. Measure crater diameter (or estimate small/medium/large).
4. Repeat with a different object.

Results

Object	Height (cm)	Crater size (mm or S/M/L)	Ejecta pattern notes

Variables

- Independent: drop height, object mass
- Dependent: crater size/ejecta pattern
- Controls: same flour depth, same tray, same drop method

Conclusion

Link to Callisto Explain how crater counts can be used to estimate surface age:

Teacher Notes (Quick)

- These are models/analogies, not perfect copies of real moon physics.
- Offer alternatives for sensory needs:
  - Flour/cocoa: kinetic sand or playdough
  - Hands-on: teacher demo + learner observation sheet
- Encourage choice of response: speak, draw, tick, or record audio.