

High school | Height into Motion

Name: _____ Date: _____

Goal: Defend a qualitative energy comparison, separate evidence from a model, and transfer the reasoning to changed endpoints. No formulas or online reading are required. Use a pencil; no apparatus is needed.

A claim worth testing

Quinn can move a release mark, move the catch cup, or redesign the route. These changes might look similar on camera, but do they ask the same physics question? The diagram represents alternative releases of the same marble, both without a shove.

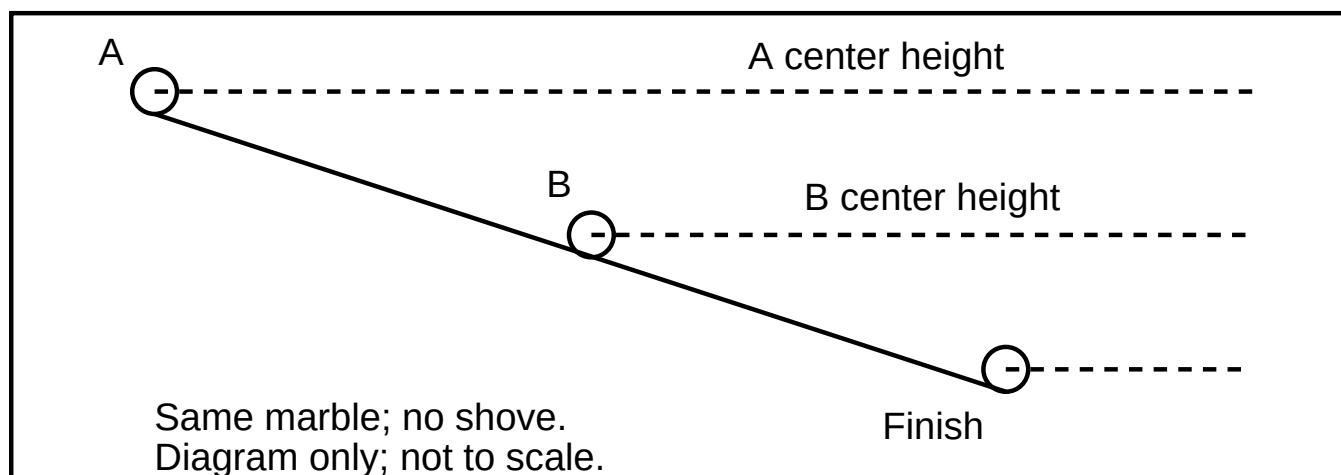


Diagram description: A is higher than B on one ramp. Dashed horizontal guides mark the marble-center heights at A, B and the shared finish. The picture has no measured scale.

HS01. Predict which release supplies less gravitational energy before reading page 2. Describe the measurement you would use, the conditions you would hold fixed, and one thing this diagram cannot tell you.

HS02. Someone measures along the ramp and uses that distance as the drop height. Explain the flaw, and describe how to repair the measurement using marble centers.

Make the model do exactly its job

For the same marble near Earth, gravitational energy supplied by descent depends on the vertical separation of the starting and finishing center heights. Larger separation supplies more. This stored energy belongs to the marble-Earth system; choosing the finish as a reference is a convenience, not a claim that all energy disappears there. A route length is not a vertical drop. Real cup retention still requires observing the actual track and catch arrangement.

HS03. Evaluate two hypothetical claims: (a) "We moved only the finish higher, below the same release, so the drop supplies less energy." (b) "We left both endpoint heights unchanged but made the route longer, so gravity supplies more energy." For each, say supported or unsupported and justify from endpoint heights. Do not predict a real finish speed.

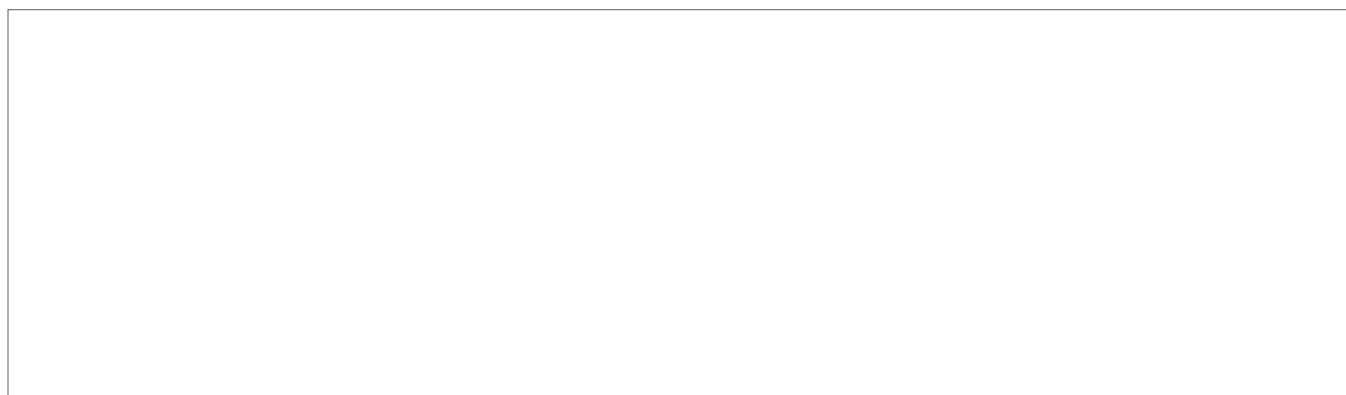
HS04. Suppose a single real run from the lower mark stays in the cup once. This is a hypothetical case, not supplied trial data. Does that observation establish that release height alone determines every catch? Design a comparison to investigate the effect of release mark. State constants, observations to record, and a limit that remains after repetitions. This is a paper plan, not an instruction to build.

Transfer challenge: keep the energy comparison

Hypothetical design brief: the finish has moved to a lower shelf. You may move the release mark down an existing ramp too. The marble stays the same and is released without a shove. Your aim is to preserve the old vertical drop, rather than merely preserve the old release position.

HS05. Sketch old and new start/finish center heights. Show how moving the start could preserve their separation. Explain (a) the energy comparison you can defend and (b) why the same successful catch is still not guaranteed. Label your sketch as a proposed model, not measured results.

Sketch: old and new endpoints (no numerical scale required)



If you want a further question

If two routes supply the same gravitational energy, what additional information would you need to compare their actual catches? Your sketch and explanation above are a complete stopping point.

Optional reading and sources

Height into Motion is the source micro-lesson for this worksheet. You can complete this activity offline using the explanation here.

One More Take: Quinn compares release marks, then adjusts the start when the finish moves. This story is optional.

[Read or revisit Height into Motion](#)

[Read or return to One More Take](#)

[MIT: Potential Energy and Conservation of Energy \(sections 14.2 and 14.4.1\)](#)

[OpenStax: Gravitational Potential Energy \(section 7.3\)](#)