SKATER BOWL — CONSERVATION OF MECHANICAL ENERGY

Kinetic energy, gravitational potential energy, and turning points

Name: ____________________________	Period: ____________	Date: ______________

INVESTIGATION QUESTION **Does total mechanical energy remain constant throughout the frictionless bowl?**

TIME	SIMULATION	UNIT 3
30 minutes	BuildPhysics > Skater bowl — conservation of mechanical energy	Work, Energy & Power

Learning targets

- Compare kinetic and gravitational potential energy at key locations.
- Test whether total mechanical energy remains constant.
- Connect release height to speed at the bottom of the bowl.

Model before you measure

The skater starts from rest. Choose the preset's h = 0 reference at the lowest center-of-mass height.	$E_{mech} = K + U_g = \frac{1}{2}mv^2 + mgh$

Important: Use $g = 9.8\ m/s^2$. Friction and drag must remain off for the mechanical-energy model.

Pre-lab prediction | 4 minutes

1. At which location should kinetic energy be greatest?

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2. At a turning point, what is the skater's speed?

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3. Predict whether the skater reaches the same height on the opposite side.

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PART A Track energy during one complete pass

Setup | 3 minutes

- ☐ Load Skater bowl — conservation of mechanical energy.
- ☐ Open Energy and momentum totals and graph gravitational PE, kinetic energy, and total mechanical energy.
- ☐ Run and pause near the starting point, bottom, opposite turning point, and bottom on the return.
- ☐ Record height, speed, and energy values at each location.

Data table | 10 minutes

Location	Height h (m)	Speed (m/s)	Kinetic energy (J)	Gravitational PE (J)	Total mechanical energy (J)
Starting point					
Bottom					
Opposite turning point					
Bottom on return					

Energy bar sketches | 3 minutes

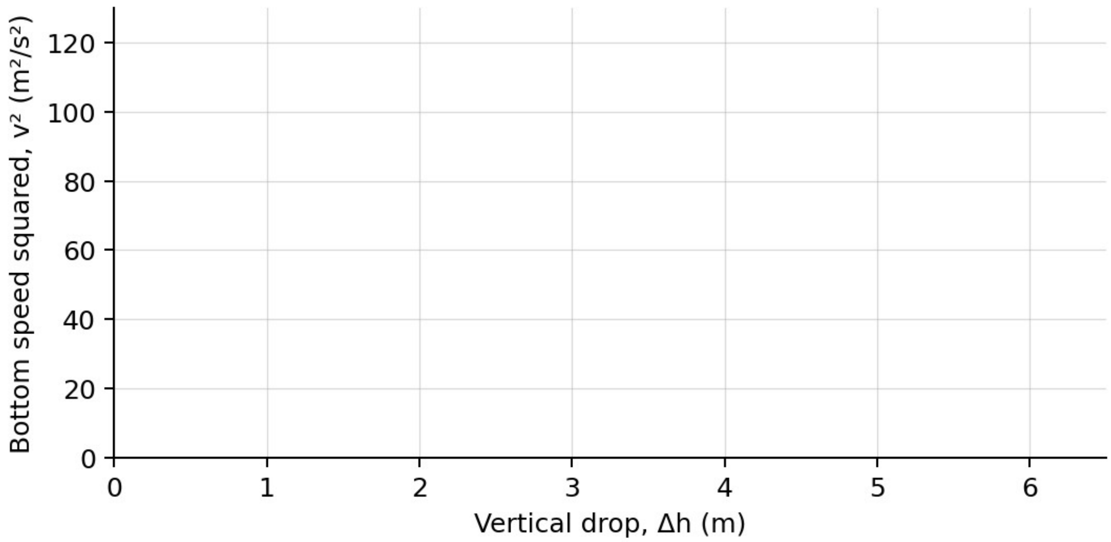
Starting point	Bottom	Opposite turning point
Sketch K and gravitational PE	Sketch K and gravitational PE	Sketch K and gravitational PE

PART B Change release height

Release-height test | 8 minutes

Procedure: Move the skater to four different starting heights, release from rest, and record the vertical drop and bottom speed.

Trial	Starting height (m)	Vertical drop Δh (m)	Bottom speed (m/s)
1			
2			
3			
4			



4. Plot bottom speed squared versus vertical drop. Draw a best-fit line.

Analysis | 6 minutes

5. How did kinetic and gravitational potential energy change between the top and bottom?

6. How constant was total mechanical energy across the four locations?

7. What should the slope of the v^2-versus-Δh graph be? Explain.

8. Why did the skater return to approximately the original release height?

Claim-Evidence-Reasoning conclusion

Evaluate this claim: The skater has no acceleration at the bottom because gravitational potential energy is minimum there.

CLAIM	Accept, reject, or revise the statement.
EVIDENCE	Cite at least two measured trials or graph features.
REASONING	Connect your evidence to the energy model and controlled variables.

Exit ticket

A skater starts from rest 3.0 m above the bottom. Predict the speed at the bottom using $g = 9.8\ m/s^2$.