

Energy Data Detectives

Read data closely to graph mass, speed, and height relationships.

S8P2.a "Analyze and interpret data to create graphical displays that illustrate the relationships of kinetic energy to mass and speed, and potential energy to mass and height of an object."

NAME _____ DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Mark the changing and held-constant variables. Use the sample data to make and compare energy graphs.

Reading Energy Data

- ① These simulated classroom datasets model controlled energy comparisons. Kinetic energy is $KE = \frac{1}{2}mv^2$, with mass in kilograms, speed in meters per second and energy in joules. The rolling-cart speed trials use a constant mass of 2 kg. To compare mass instead, hold speed at 2 m/s: masses 1,2,3 kg have KE 2,4,6 J.

ROLLING CART TRIALS

Speed (m/s)	Kinetic Energy (J)
1	1
2	4
3	9
4	16

- ② Potential energy relative to a chosen zero height is $PE = mgh$. Use the classroom approximation $g = 10 \text{ N/kg}$ throughout. At a constant height of 2 m, masses 1,2,3 kg have PE 20,40,60 J. At a constant mass of 3 kg, heights 1,2,3 m have PE 30,60,90 J. Each comparison changes only one variable.
- ③ A graph must show the changing variable on the horizontal axis and energy on the vertical axis, with labels, units and equal-interval scales. Graph each comparison separately. Describe what the data show about equal increases and doubling; do not assume all increasing patterns have the same shape.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 In the cart trials, which variable changes, and which variable stays steady?

2 Compare the trials at 2 m/s and 4 m/s. How many times greater is the kinetic energy?

3 What belongs on the horizontal and vertical axes for a graph of the cart table?

4 Compare PE at masses 1 kg and 3 kg when height is fixed at 2 m. What must be held constant for this mass comparison?

3 YOUR TURN _____ Your own words

On a separate sheet supplied by your teacher, construct four labeled graphs: KE versus mass, KE versus speed (use the cart table), PE versus mass, and PE versus height. Use every supplied pair. In the two panels below, summarize the KE and PE comparisons: identify held-constant variables, compare doubling, and describe whether equal increases produce equal energy gains.

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PART 1 • READ AND MARK

Mark the changing and held-constant variables. Use the sample data to make and compare energy graphs. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	In the cart trials, which variable changes, and which variable stays steady?	Speed changes. Mass stays steady at 2 kg.
2	Compare the trials at 2 m/s and 4 m/s. How many times greater is the kinetic energy?	The kinetic energy is 4 times greater, from 4 J to 16 J.
3	What belongs on the horizontal and vertical axes for a graph of the cart table?	Horizontal axis: speed (m/s). Vertical axis: kinetic energy (J).
4	Compare PE at masses 1 kg and 3 kg when height is fixed at 2 m. What must be held constant for this mass comparison?	PE rises from 20 J to 60 J (threefold). Height remains 2 m and gravity remains 10 N/kg.

PART 3 • YOUR TURN (SAMPLE ANSWER)

KE/mass points (1,2),(2,4),(3,6), constant speed 2 m/s: straight pattern. KE/speed (1,1),(2,4),(3,9),(4,16), constant mass 2 kg: increasing gains; doubling speed quadruples KE. PE/mass (1,20),(2,40),(3,60) at height 2 m; PE/height (1,30),(2,60),(3,90) at mass 3 kg, both straight patterns. Gravity 10 N/kg throughout; doubling mass or height doubles PE with the other fixed.

Supply graph paper for four plots. Require student construction, all paired observations, scale/axis units, the held-constant variables and comparative reasoning. Do not accept a description of a graph in place of the actual graph. These are model data, not claims of measured trials.