LESSON MAKER PRO

Energy in Motion

Read graphs to compare mass, speed, and kinetic energy.

GRADE 7 · 7.PS3.1

7.PS3.1 "Construct and interpret graphical displays of data to describe the proportional relationships of kinetic energy to the mass of an object and the speed of an object."

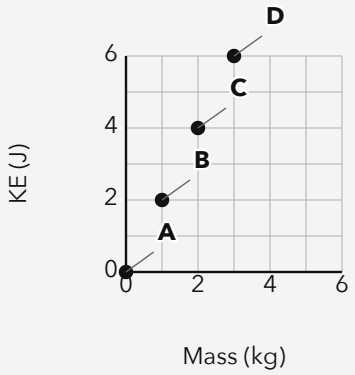
NAME _____ DATE _____

THE BIG IDEA

Kinetic energy, or KE, is the energy of motion. Use KE = $(m \times v^2)/2$, where m is mass in kilograms and v is speed in meters per second. At a fixed speed, KE is proportional to mass. At a fixed mass, KE is proportional to speed squared.

WORKED EXAMPLE

A toy car moves at 2 m/s. Use the graph to compare its KE at 1 kg and 3 kg.



1. Read 2 J at 1 kg and 6 J at 3 kg.
2. Compare the values: 3 kg is three times 1 kg, and 6 J is three times 2 J.

Answer: Tripling the mass triples the KE, from 2 J to 6 J.

PRACTICE 4 problems

1 At one speed, a 5 kg cart has 45 J of KE. What is the KE of a 15 kg cart at that speed?

ANSWER _____

2 A 3 kg robot has 54 J of KE at 6 m/s. What is its KE at 12 m/s?

ANSWER _____

3 At one speed, a 10 kg cart has 50 J of KE. What mass would have 150 J at that speed?

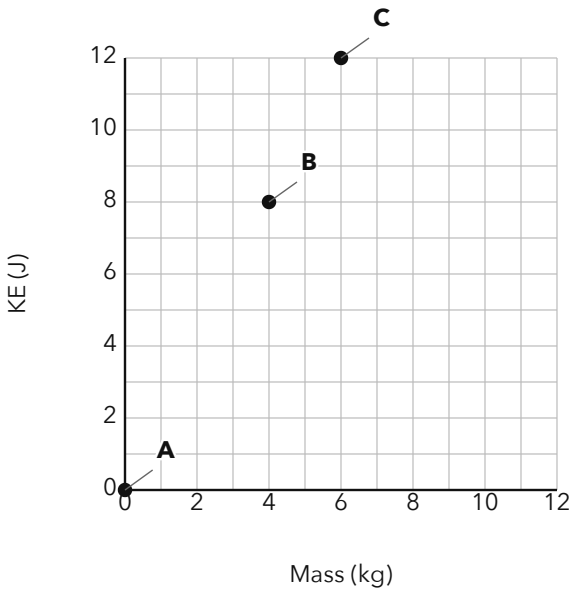
ANSWER _____

4 A model drone has 40 J of KE at 5 m/s. At what speed would it have 160 J if its mass stays the same?

ANSWER _____

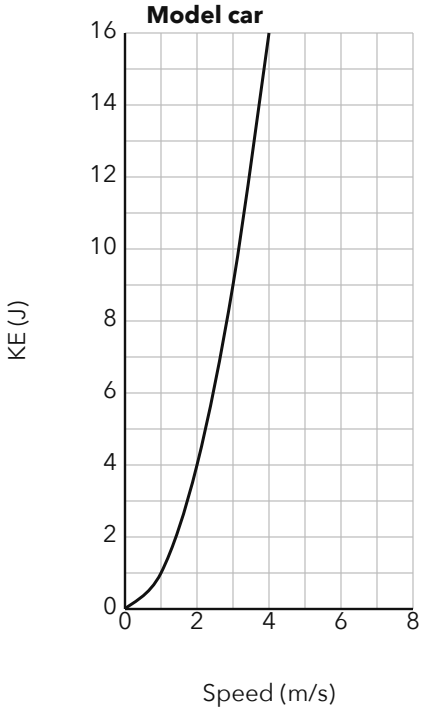
APPLY IT Show your work

1 A club tests rolling robots at the same speed. Plot the point for a 5 kg robot on the graph. What is its KE?



ANSWER _____

2 A game tracks a 2 kg model car. Use the curve to compare its KE at 1 m/s and 3 m/s. How many times as much KE does it have at 3 m/s?



ANSWER _____

CHALLENGE One step up

A classmate says this drone's KE versus speed graph would be a straight line through (0, 0). Use two nonzero rows to explain why not.

DRONE, FIXED MASS OF 2 KG

Speed (m/s)	KE (J)
0	0
3	9
6	36
9	81

WORK SPACE AND ANSWER

ANSWER KEY

Energy in Motion

GRADE 7 · 7.PS3.1

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	At one speed, a 5 kg cart has 45 J of KE. What is the KE of a 15 kg cart at that speed?	**135 J**
2	A 3 kg robot has 54 J of KE at 6 m/s. What is its KE at 12 m/s?	**216 J**
3	At one speed, a 10 kg cart has 50 J of KE. What mass would have 150 J at that speed?	**30 kg**
4	A model drone has 40 J of KE at 5 m/s. At what speed would it have 160 J if its mass stays the same?	**10 m/s**

PART 2 · APPLY IT

1. **Plot (5, 10). The KE is 10 J.** The graph shows 2 J per kilogram. At 5 kg, KE is 5 × 2 = 10 J.
2. **9 times as much** Read 1 J at 1 m/s and 9 J at 3 m/s. Since 9 / 1 = 9, the KE is nine times as much.

CHALLENGE

From 3 to 6 m/s, speed doubles, but KE rises from 9 to 36 J, which is four times as much. A straight line through (0, 0) would give 18 J at 6 m/s, not 36 J.

Accept a clearly marked point at (5, 10) for the first word problem. For the challenge, accept any correct comparison of nonzero rows showing that KE does not increase in direct proportion to speed.