LESSON MAKER PRO

Energy in Motion

Read the graphs to see how mass and speed affect kinetic energy.

GRADE 8 · 8.13

8.13 "Analyze graphical displays of data to describe the relationship of mass and velocity of an object to its kinetic energy (KE)."

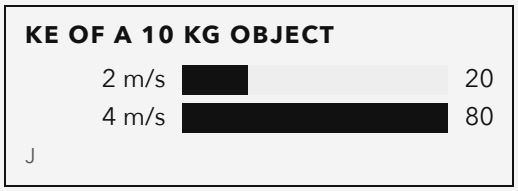
NAME _____ DATE _____

THE BIG IDEA

Kinetic energy, or KE, is the energy of motion. Use KE = 1/2 × mass × speed^2 when mass is in kilograms and speed is in meters per second. Doubling mass doubles KE, but doubling speed makes KE four times as large.

WORKED EXAMPLE

A 10 kg object moves at two speeds. Use the graph to find how its KE changes when its speed doubles.

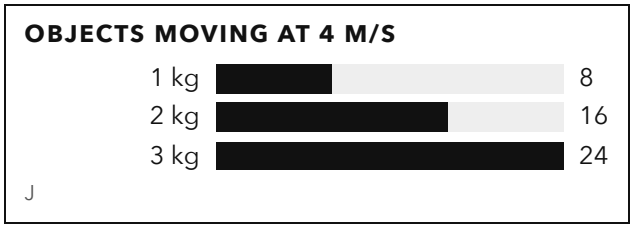


1. Read the bars: KE rises from 20 J to 80 J.
2. Divide: 80 / 20 = 4.

Answer: The KE becomes 4 times as large.

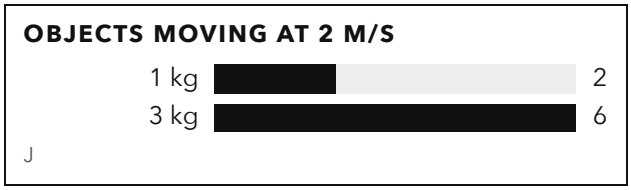
PRACTICE 6 problems

1 What is the KE of the 3 kg object?



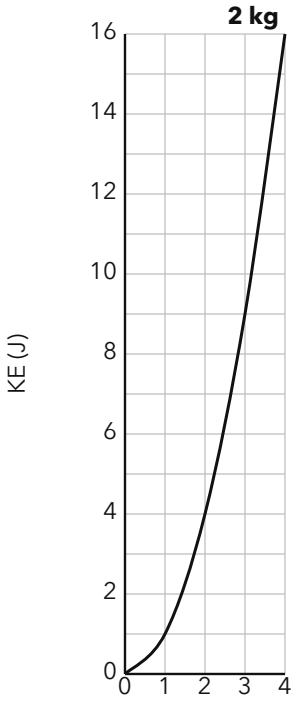
ANSWER _____

2 When mass changes from 1 kg to 3 kg, how many times as large does KE become?



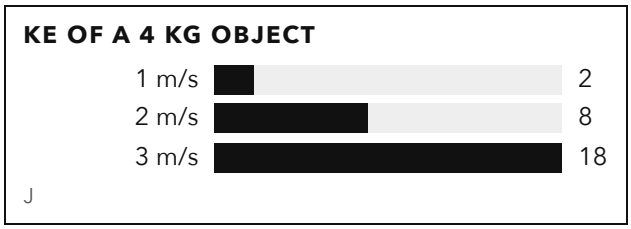
ANSWER _____

3 Use the graph to find the KE at 3 m/s.



ANSWER _____

4 When speed changes from 1 m/s to 3 m/s, how many times as large does KE become?



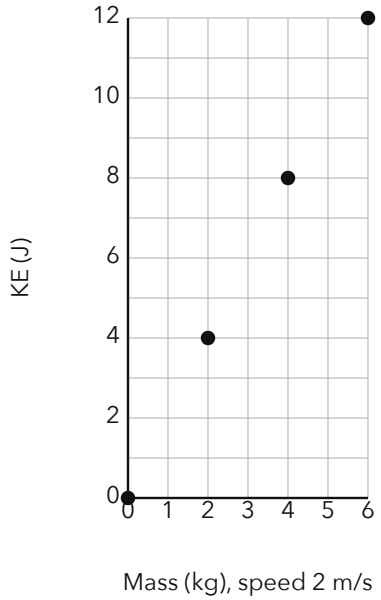
ANSWER _____

5 Which two objects have the same KE? Give the mass and speed of each.



ANSWER _____

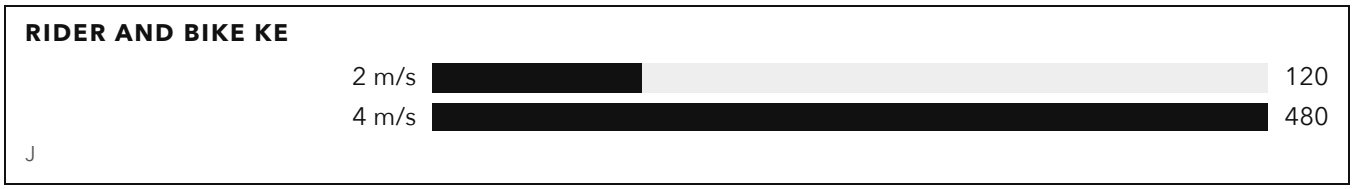
6 Use the pattern in the graph to predict the KE of a 5 kg object moving at 2 m/s.



ANSWER _____

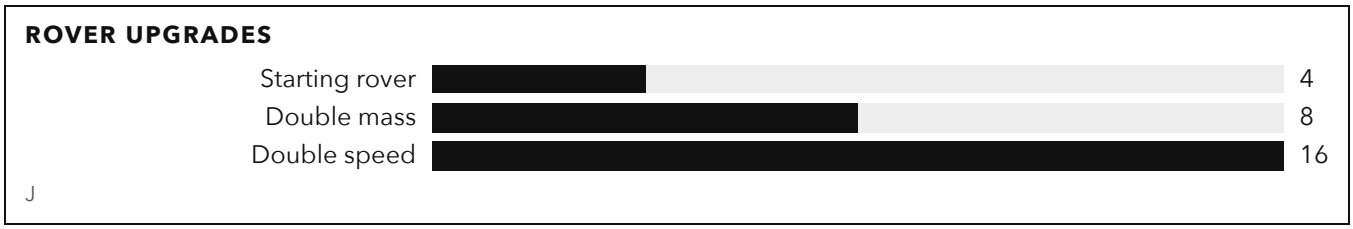
APPLY IT Show your work

1 A biking app models the rider and bike as one 60 kg object. How many more joules of KE do they have at 4 m/s than at 2 m/s?



ANSWER _____

2 In a game, a 2 kg rover moves at 2 m/s. You can double its mass or double its speed. Which upgrade increases KE more, and by how many joules more than the other upgrade?



ANSWER _____

CHALLENGE One step up

The graph shows KE for a 4 kg robot. Predict the KE of a 6 kg robot moving at 4 m/s. Explain how changing speed and mass supports your prediction.



WORK SPACE AND ANSWER

Energy in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	What is the KE of the 3 kg object?	**24 J**
2	When mass changes from 1 kg to 3 kg, how many times as large does KE become?	**3 times as large**
3	Use the graph to find the KE at 3 m/s.	**9 J**
4	When speed changes from 1 m/s to 3 m/s, how many times as large does KE become?	**9 times as large**
5	Which two objects have the same KE? Give the mass and speed of each.	**The 2 kg object at 4 m/s and the 8 kg object at 2 m/s each have 16 J of KE.**
6	Use the pattern in the graph to predict the KE of a 5 kg object moving at 2 m/s.	**10 J**

PART 2 · APPLY IT

1. **360 J more** Read 120 J and 480 J from the graph. Subtract: 480 − 120 = 360 J.
2. **Doubling speed increases KE by 8 J more than doubling mass.** Doubling speed adds 16 − 4 = 12 J, while doubling mass adds 8 − 4 = 4 J. The difference between those increases is 8 J.

CHALLENGE

48 J. Doubling speed from 2 m/s to 4 m/s makes the 4 kg robot's KE four times 8 J, or 32 J. Increasing mass from 4 kg to 6 kg multiplies KE by 6 / 4, giving 48 J.

Accept equivalent wording for comparisons, such as "triples" for "3 times as large." For the challenge, also accept KE = 1/2 × 6 × 4^2 = 48 J if the student connects the calculation to the graph.