LESSON MAKER PRO

Energy in Motion

Calculate energy as objects rise, move, and stop.

HIGH SCHOOL · PHS.7

PHS.7 "Students will examine different forms of energy and energy transformations. Using digital resources, explore forms of energy (e.g., potential, kinetic, mechanical, chemical, electrical, thermal, radiant, and nuclear)..."

NAME _____ DATE _____

TWO ENERGY EQUATIONS

Gravitational potential energy depends on mass and height: PE = mgh. Kinetic energy depends on mass and speed: KE = 1/2 mv^2. Energy can change form, but the total amount is conserved; use g = 10 m/s^2 for every problem.

WORKED EXAMPLE

A 3 kg model car moves at 7 m/s. What is its kinetic energy?

1. KE = 1/2 mv^2
2. KE = 1/2 × 3 × 7^2
3. KE = 1/2 × 3 × 49 = 73.5 J

Answer: 73.5 J

PRACTICE 6 problems

1 A 2 kg backpack is held 5 m above the ground on a climbing platform. What is its gravitational potential energy?

ANSWER _____

2 A storage lift holds a 6 kg bicycle 4 m above the ground. What is the bicycle's gravitational potential energy?

ANSWER _____

3 An 8 kg stage light has 320 J of gravitational potential energy. How high is it above the floor?

ANSWER _____

4 A 2 kg drone flies at 6 m/s. What is its kinetic energy?

ANSWER _____

5 A 4 kg bowling ball rolls at 5 m/s. What is its kinetic energy?

ANSWER _____

6 An 8 kg equipment cart has 64 J of kinetic energy. What is its speed?

ANSWER _____

APPLY IT Show your work

1 At a skate park, a rider and skateboard have a combined mass of 40 kg. They start from rest 5 m above the bottom of a ramp. If no energy changes to other forms, what is their speed at the bottom?

WORK SPACE

ANSWER _____

2 An electric scooter and its rider have a combined mass of 80 kg and travel at 5 m/s. When they brake to a stop, 200 J of energy is stored chemically in the battery. If all remaining kinetic energy becomes thermal energy, how much thermal energy is produced?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A 2 kg model coaster car starts from rest at a height of 10 m. At a height of 4 m, its kinetic energy is 100 J. Assume no energy was added and all energy that is no longer gravitational potential or kinetic energy became thermal energy. How much thermal energy was produced? Show how you know.

WORK SPACE AND ANSWER

Energy in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A 2 kg backpack is held 5 m above the ground on a climbing platform. What is its gravitational potential energy?	**100 J**
2	A storage lift holds a 6 kg bicycle 4 m above the ground. What is the bicycle's gravitational potential energy?	**240 J**
3	An 8 kg stage light has 320 J of gravitational potential energy. How high is it above the floor?	**4 m**
4	A 2 kg drone flies at 6 m/s. What is its kinetic energy?	**36 J**
5	A 4 kg bowling ball rolls at 5 m/s. What is its kinetic energy?	**50 J**
6	An 8 kg equipment cart has 64 J of kinetic energy. What is its speed?	**4 m/s**

PART 2 · APPLY IT

1. **10 m/s** Initial PE = 40 × 10 × 5 = 2,000 J, so KE at the bottom is 2,000 J. Solve 2,000 = 1/2 × 40 × v^2 to get v = 10 m/s.
2. **800 J** Initial KE = 1/2 × 80 × 5^2 = 1,000 J. Subtract the 200 J stored in the battery to get 800 J of thermal energy.

CHALLENGE

20 J. Initial PE = 2 × 10 × 10 = 200 J. At 4 m, PE = 2 × 10 × 4 = 80 J. Thermal energy = 200 J − 80 J − 100 J = 20 J.

Accept equivalent equations with correct units. For speed, accept only the nonnegative value.