

Chapter 14 Work, Power, and Machines

Calculating Work and Power

Calculate the power of a machine that exerts a force of 800.0 N over a distance of 6.0 m in 2.0 s.

1. Read and Understand

What information are you given?

$$\text{Force} = 800.0 \text{ N}$$

$$\text{Distance} = 6.0 \text{ m}$$

$$\text{Time} = 2.0 \text{ s}$$

2. Plan and Solve

What variable are you trying to determine?

$$\text{Power} = ?$$

What formula contains the given quantities and the unknown?

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \times \text{Distance}}{\text{Time}}$$

$$\text{Power} = \frac{800.0 \text{ N} \times 6.0 \text{ m}}{2.0 \text{ s}}$$

$$\text{Power} = \frac{4800 \text{ J}}{2.0 \text{ s}} = 2400 \text{ J/s} = 2400 \text{ W}$$

3. Look Back and Check

Is your answer reasonable?

$$\text{Work} = (2400 \text{ J/s}) \times 2.0 \text{ s} = 4800 \text{ J}$$

This is a reasonable answer. Substituting power and time back into the power equation yields the original value for work.

Math Practice

On a separate sheet of paper, solve the following problems.

- Suppose 900.0 J of work are done by a light bulb in 15.0 s. What is the power of the light bulb?
- What is the power of a machine if an output force of 500.0 N is exerted over an output distance of 8.0 m in 4.0 s?
- The power of a machine is $6.0 \times 10^3 \text{ J/s}$. This machine is scheduled for design improvements. What would its power be if the same work could be done in half the time?

**Math Skill:
Formulas and
Equations**

You may want to read more about this **Math Skill** in the **Skills and Reference Handbook** at the end of your textbook.

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WordWise

Answer the question or identify the clue by writing the correct vocabulary term in the blanks. Use the circled letter(s) in each term to find the hidden vocabulary word. Then, write a definition for the hidden word.

Clues

$$\frac{\text{Work output}}{\text{Work input}} \times 100\%$$

A mechanical watch is an example of this.

One way to determine this is to divide output work by output force.

This is the SI unit of work.

On a lever, it is the distance between the fulcrum and the input force.

The IMA of this machine increases as its thickness decreases relative to its length.

This is exerted on a jack handle to lift a car.

This unit equals about 746 joules.

This is the distance between the output force and the fulcrum.

This SI unit of power is used to describe light bulbs.

The IMA of this machine is the distance along its surface divided by the change in height.

A device that can change the size of the force required to do work.

This quantity is equal to Work/Time.

Vocabulary Terms

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Hidden words: _____

Definition: _____