Warm-Up | Introduction to Machines

Lesson Question

Lesson Goals

Explain how machines make work _____.

Describe what a _____ is and what it does.

Calculate _____ advantage.

Calculate _____.

Words to Know

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

_____	input	A. a comparison of two amounts calculated by dividing one amount by the other
_____	output	B. the amount of something put into a machine or system
_____	ratio	C. the amount of something that comes out of a machine or system
_____	efficiency	D. the ratio of output force to input force
_____	machine	E. the ratio of output work to input work expressed as a percentage
_____	mechanical advantage	F. a device that makes work easier

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Work

- Work is done by a _____ on an object.
- For work to be done, the object must _____ in the direction of the force.
- The formula for work is _____.
- Work is measured in _____ (J).

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Machines and Work

- A [ ] is any device that makes work easier.
- Machines change the way a force is [ ].
- Machines do not change the amount of [ ] done.

- A machine makes work [ ] by changing:
  - the [ ] of a force.
  - the [ ] of force exerted.
  - the [ ] over which a force is exerted.

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Inputs and Outputs

- The force applied to a machine is the [ ] force.
- The force the machine applies on an object is the [ ] force.
- Input work is the amount of work done on a [ ].
- Output work is the amount of work the machine does on an [ ].

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Mechanical Advantage

- The number of times a machine increases the input force is known as its _____.
- A _____ is the comparison of two amounts calculated by dividing one amount by the other.
- Mechanical advantage is the _____ of output force to input force.

$$\text{mechanical advantage} = \frac{\text{output force}}{\text{input force}}$$

Mechanical Advantage: Example

Nina pulls on the handle of a hammer with a _____ of 15 N. The claw end of the hammer exerts a force of 90 N on a nail. What is the mechanical advantage of the hammer?

MA = _____

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Input and Output Forces

- When mechanical advantage and input force are known, the _____ force can be calculated.
- When mechanical advantage and output force are known, the _____ force can be calculated.
- **Example:** A machine has a mechanical advantage of 2.7. What input force is needed to create an _____ of 1,350 N?

  input force = _____

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Machines and Friction

- The output work of a machine can never be _____ than the input work.
- _____ uses some of the input work.
  - The output work can be _____ by reducing the amount of friction.

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Efficiency

- The ratio of the output work to input work is the machine's _____.
- Efficiency is expressed as a _____.
- Some work is always lost to friction, so efficiency is always _____ than _____.

$$\text{efficiency} = \frac{\text{output work}}{\text{input work}} \times 100\%$$

Efficiency: Example

An Olympic bicyclist does 7,500 J of work on his bike while the bike does 7,350 J of work. What is the efficiency of the bike?

efficiency = _____

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Lesson Question

How do machines make work easier?

Answer

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Review: Key Concepts

- Machines make work easier by changing the way a [ ] is applied.
- A machine can change:
  - the [ ] of a force.
  - the [ ] of force applied.
  - the [ ] over which a force is applied.
- Machines do not change the amount of [ ] done.

	Definition	Equation
Mechanical advantage	The ratio of a machine's output force to input force	Mechanical advantage = [ ]
Efficiency	The ratio of a machine's output work to input work expressed as a percentage	efficiency = [ ]

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Use this space to write any questions or thoughts about this lesson.