Work Calculations

Lesson Notes

Learning Outcomes

- What is the equation for work?
- How do you use the equation to calculate the work done on an object?

The Work Equation:

The work done (**W**) depends on three variables:

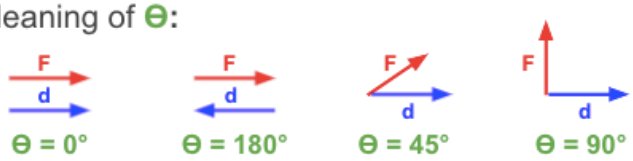
1. The amount of force (**F**).
2. The amount of displacement (**d**).
3. The angle between the force and displacement (**Θ**).

Work = Force • Displacement • Cosine (Θ)

$$W = F \cdot d \cdot \cos(\Theta)$$

In the Work equation, the angle *theta* (Θ) is the angle between the fore and the displacement vectors.

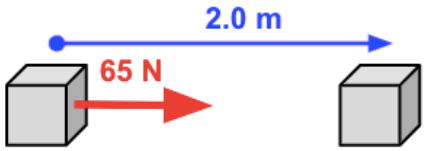
Meaning of Θ:



For the following example problems, show the solution for the calculation of the work.\

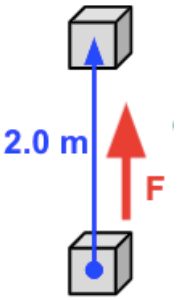
Example 1 - Plug-and-Chug:

Determine the work done when a rightward force of 65 N displaces a 15-kg box 2.0 m to the right.



Example 2 - Lifting:

How much work does an upward force do when lifting a 15-kg box a distance of 2.0 m above its starting location at constant speed?

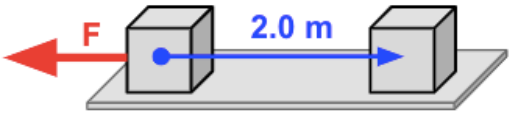


Example 3 - Θ is Important:

A 65-N force is exerted at 30° above the horizontal to displace a 15-kg box a horizontal distance of 2.0 m. Determine the work done.

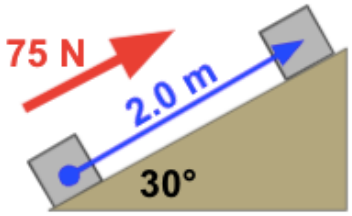
Example 4 - Sliding Friction:

How much work is done by friction (μ=0.40) when stopping a 15-kg box over a distance of 2.0 m?



Example 5 - Up a Hill:

How much work is done by a 75-N force applied parallel to a 30° inclined plane to move a 15-kg box along the incline a distance of 2.0 m?



Example 6 - Total Work:

A 10-N force is applied to push a ~2-kg block across a friction free surface for a displacement of 5 m to the right. Determine the total amount of work.