

# Work & Energy

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## Work

- Work done on an object by a constant force is defined to be the product of the magnitude of the displacement times the component of the force parallel to the displacement.

$$W = F_{\parallel}d$$

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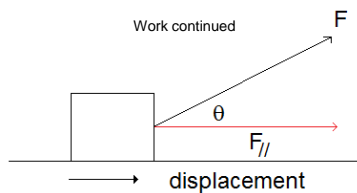
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- So, we can write:

$$W = Fd \cos \theta$$

Units = Nm = Joules

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### Example #1

- A 50. kg crate is pulled 40. m along a horizontal floor by a constant force of 100. N exerted by a person at an angle of  $37^\circ$  from the horizontal. The floor is rough and exerts a friction force of 50. N. Determine the work done by each force acting on the crate and the net work done on the crate.

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### Example #2

- A hiker is carrying a 15.0 kg backpack up a hill with a height of 10.0 m. Determine:  
(a) the work the hiker must do on the backpack.  
(b) the work done by gravity on the backpack.  
(c) the net work on the backpack.  
Note: assume the hiker is travelling at a constant velocity.

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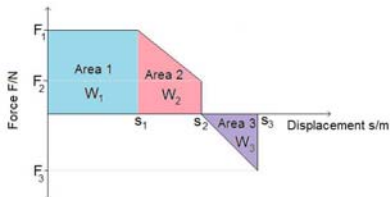
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### One more note about work...

- If the force varies, then the work must be calculated from the area under a force vs. displacement curve.



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