

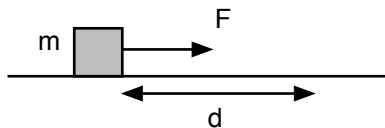
## Work

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- A. What is the definition of work?
- B. How is work related to energy?
- C. What are the units for work?
- D. Can a force do negative work?
- E. If a force is perpendicular to the distance an object moves, how much work would the force do on the object?

### Calculations

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*The diagram above shows a block being pulled across a floor or table by a horizontal force  $F$ .*

1. If the force was a constant 20 N, how much work was done by the force pulling the object 5 m?
2. If the force was a constant 20 N, how much work was done by the force pulling the object 15 m?
3. How far would a force of 15 N have to pull the object to do 100 J of work?

## Work

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4. If the distance pulled was 8 meters and the total work done was 90 J, what was the force?
  
  
  
  
  
  
  
  
  
5. If there was a friction force of 5 N, and the object was still pulled to the right 7 meters, how much work did friction do?
  
  
  
  
  
  
  
  
  
6. If friction did  $-75$  J of work, and the object was pulled 8 meters, what was the force of friction?
  
  
  
  
  
  
  
  
  
7. Can friction ever do positive work? Explain.
  
  
  
  
  
  
  
  
  
8. A 35 N force is pulling a box to the right. There is also a frictional force of 15 N acting on the box. The box is pulled a total of 5 meters.
  - a. How much work did the 35 N force do?
  
  
  
  
  
  
  
  
  
  - b. How much work did friction do?
  
  
  
  
  
  
  
  
  
  - c. How much total work was done on the box?
  
  
  
  
  
  
  
  
  
9. A 50 N force is pulling a box to the right a distance of 12 meters. Friction does  $-200$  J of work on the box.
  - a. How much work did the 50 N force do?
  
  
  
  
  
  
  
  
  
  - b. What was the force of friction?

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**Work**

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- c. How much total work was done on the box?

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*Now Involving Energy!*

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10. Starting from rest, a 2000 kg car accelerates to 30 m/s.  
a. How much kinetic energy does the car end up with?

- b. How much work was done on the car?

- c. How much work would it take to stop the car?

11. A 4 kg box is lifted 3 meters.  
a. How much potential energy does the box gain?

- b. How much work was done on the box?

12. A 3 kg box has an initial speed of 4 m/s. It slides to a stop in a distance of 1.5 meters.  
a. How much kinetic energy does the box have at the start?

- b. How much work does friction have to do to stop the box?

- c. What was the force of friction while sliding to a stop?

## Work

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*Answers:*

- 1) 100 J      2) 300 J      3) 6.7 m      4) 11.25 N      5) -35 J      6) -9.4 N  
7) No! b/c always opposite the motion      8.a) 175 J      b) -75 J      c) 100 J  
9. a) 600 J      b) -16.7 N      c) 400 J  
10. a) 900,000 J      b) 900,000 J      c) -900,000 J  
11. a) 120 J      b) 120 J      12. a) 24 J      b) -24 J      c) -16 N