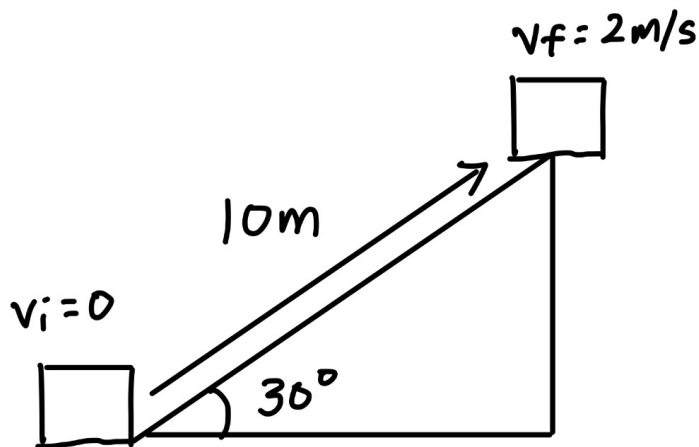


Work

1. A 10 kg box is at rest. It was then accelerated from rest to 10m/s (frictionless).
 - a) How much total energy did the box have at the start?
 - b) How much total energy does the box have at the end?
 - c) Boxes don't just start accelerating out of nowhere. Where did this energy come from?
 - i) Out of nowhere
 - ii) Someone or something did WORK
 - d) Ok, so if the box started with the kinetic energy in a) and ended with kinetic energy in b) then how much work did this someone do?
2. A 10 kg box is on the ground. It was lifted to a height of 2m.
 - a) What is the total energy of the box at the start?
 - b) What is the total energy of the box at the end?
 - c) How much work was done?
3. A box at rest is accelerated up a 30° ramp for a distance of 10m to a final velocity of 2m/s. What was the work done?



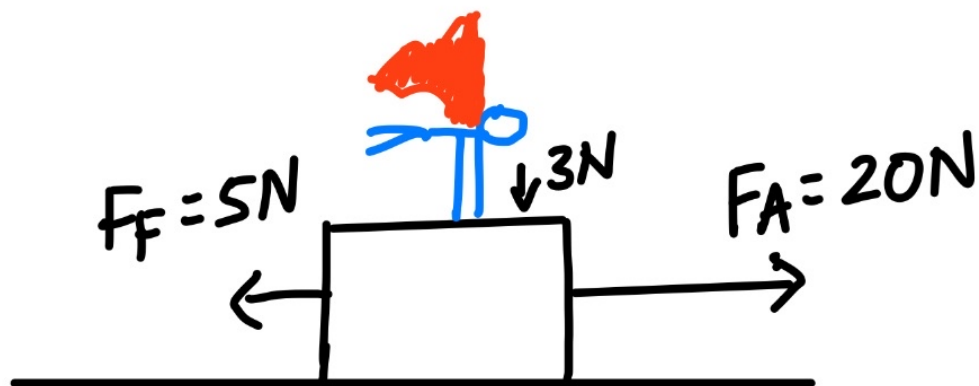
4. A box of mass m is pushed horizontally by a force of F on a frictionless surface. The box travels distance d in time t . The box starts from initial velocity v_i and has a final velocity v_f .

- a) What is the initial kinetic energy?
- b) What is the final kinetic energy?
- c) How much work was done?
- d) For c) the answer should be $0.5m(v_f^2 - v_i^2)$ if you simplify it. Now use a certain kinematics formula to replace the $(v_f^2 - v_i^2)$. Then, you should be able to derive

$$W = Fd$$

5. A 5 kg box is pulled right with an applied force of 20N. A friction force of 5N acts on the box. The box moves a distance 3m right. Superman decides to help by exerting a 3N force downwards on the box (this doesn't change the 5N friction in any way).

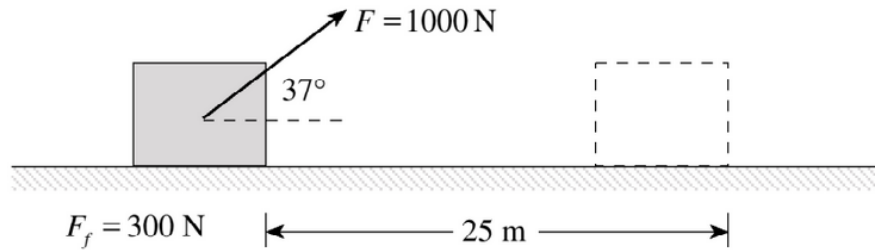
- a) Draw a FBD
- b) How much work did the applied force do?
- c) How much work did the friction force do? (this is a negative number)
- d) How much work did superman do?
- e) What is the total work done?
- f) How much energy did the box gain in total?



6. A weightlifter lifts a 100 kg box up 2m from the ground and lifts it back down. How much work did the weightlifter do?

7.

A 1000 N force is applied to a block as shown. There is 300 N of sliding friction as the block moves 25 m along the surface.



- Separate the 1000N force to its horizontal and vertical components
- Which component does work? Which component doesn't do work?
- How much work was done **by the applied force** in moving this block?