-If traveling at 60 km/hr, your car can brake to a stop within a distance of 20 m.

-One morning you're running late for school, flying down the road at 120 km/hr, and you come up to a stop light.

-What is your braking distance? Hint: set the 2 equations for work equal to each other and use proportional reasoning. (Assume braking force is the same)

POTENTIAL ENERGY

How much energy an object has by virtue of its position or configuration

i.e. When you wind a wind-up toy, you do work on the toy and put energy into the system, which it then releases over time

GRAVITATIONAL POTENTIAL ENERGY

Ash Ketchum (mass 33.5 kg) carries 2 pokemon (mass 6.0 kg and 49.5 kg) up a cliff. If the cliff is 5.0 m from the ground, how much work does Ash do?

$W = mgh = 89 \text{ kg} \times 9.8 \text{ m/s}^2 \times 5 \text{ m} = 4361 \text{ J}$

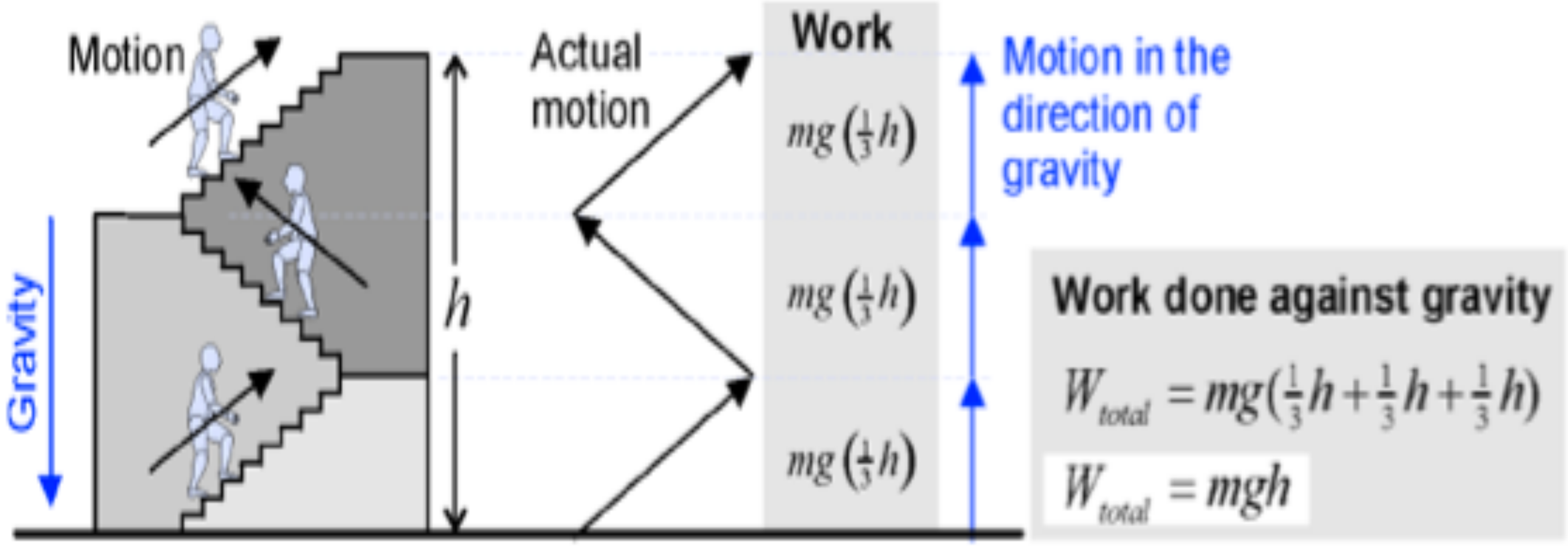
GRAVITATIONAL POTENTIAL ENERGY

$PE_G = mgh$

$=$ weight x height h above some reference point

$W_G = -\Delta PE_G$

PATH DOESN'T MATTER



You and your friend (same mass) need to get to the third floor of the high school. You run up the stairwell while your friend takes the elevator. Who has the greater gravitational potential energy (PE_G) when you both reach the top?

1. You
2. Your friend
3. Both will be the same
4. Need more information

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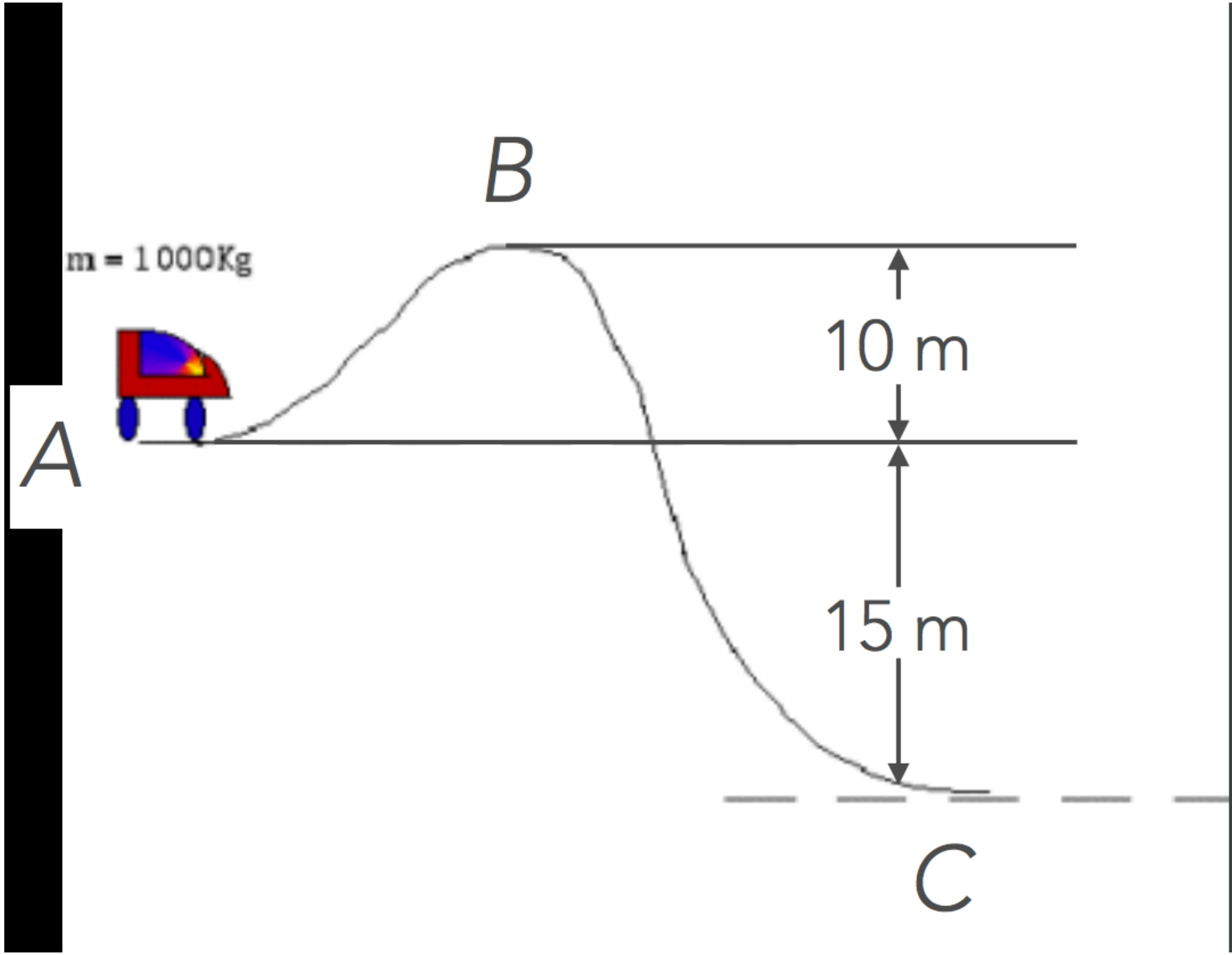
1. You
2. Your friend
3. **Both will be the same**
4. Need more information

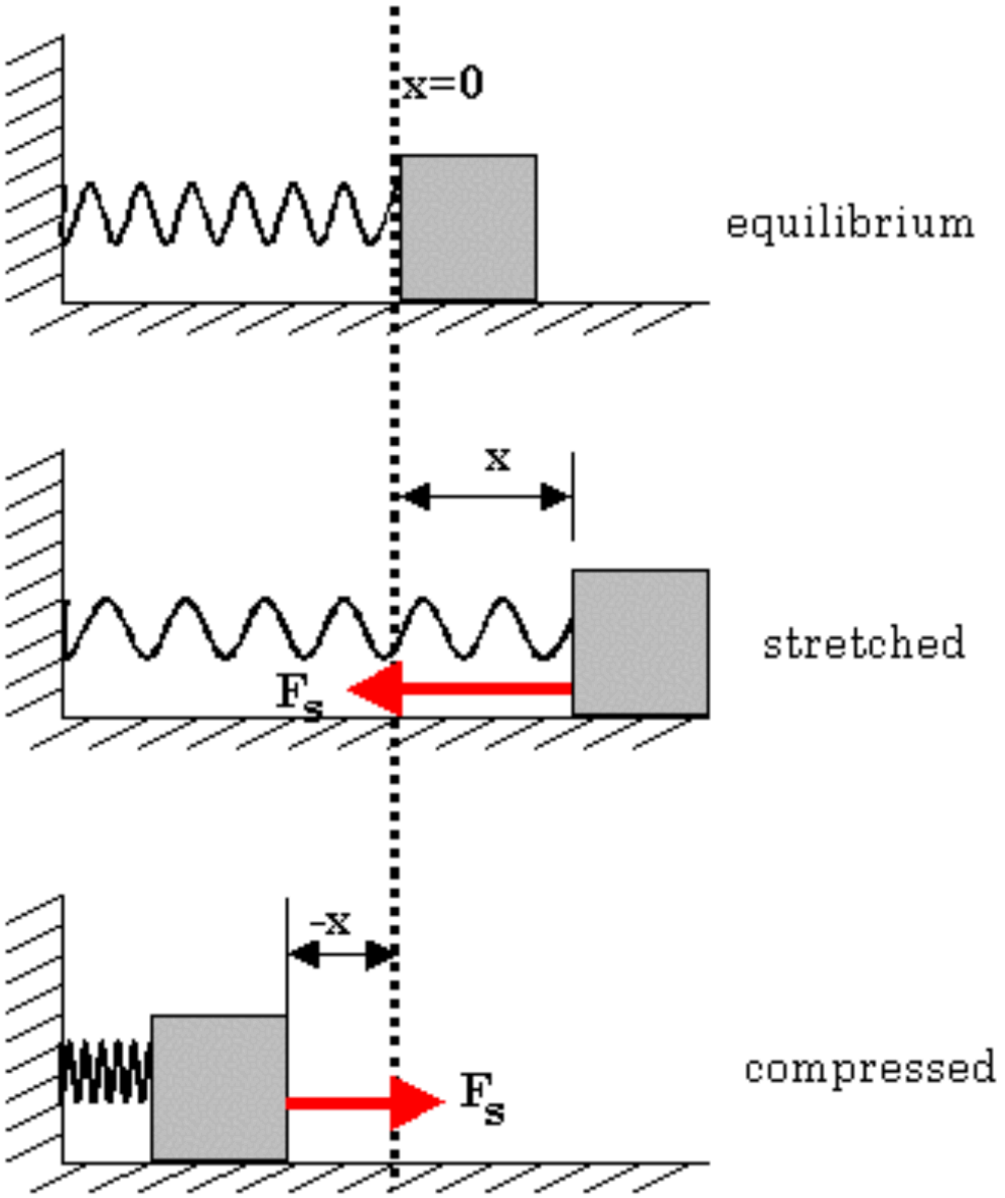
- If y= 0 at point A, what is the PE of the car at point B and point C relative to point A?
- What is the change in PE between B and C?



SPRING FORCE (F_S)

Hooke's Law

$F_s = -kx$

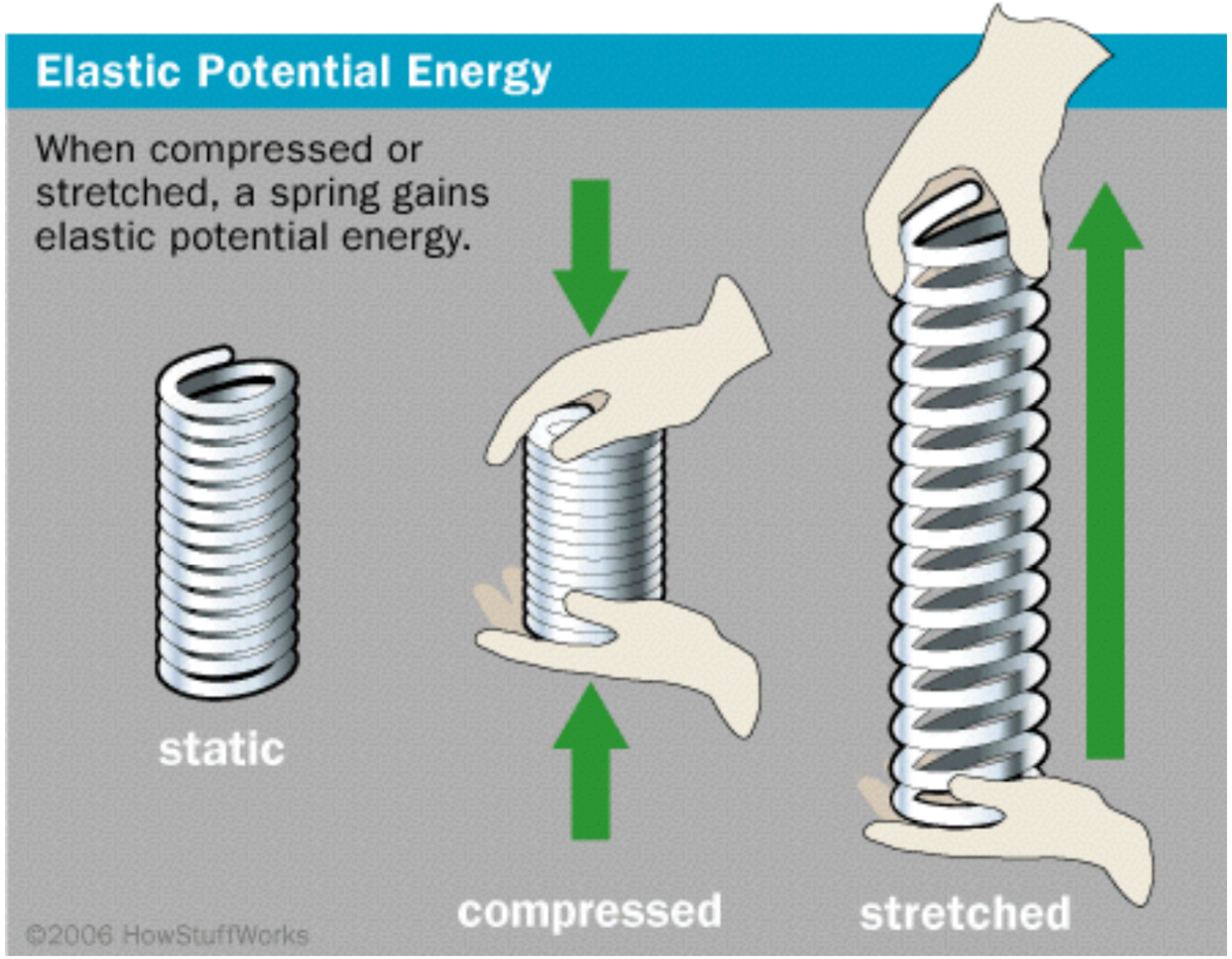


How much work is needed to stretch or compress a spring?

Not $W = F_s x$

Why?

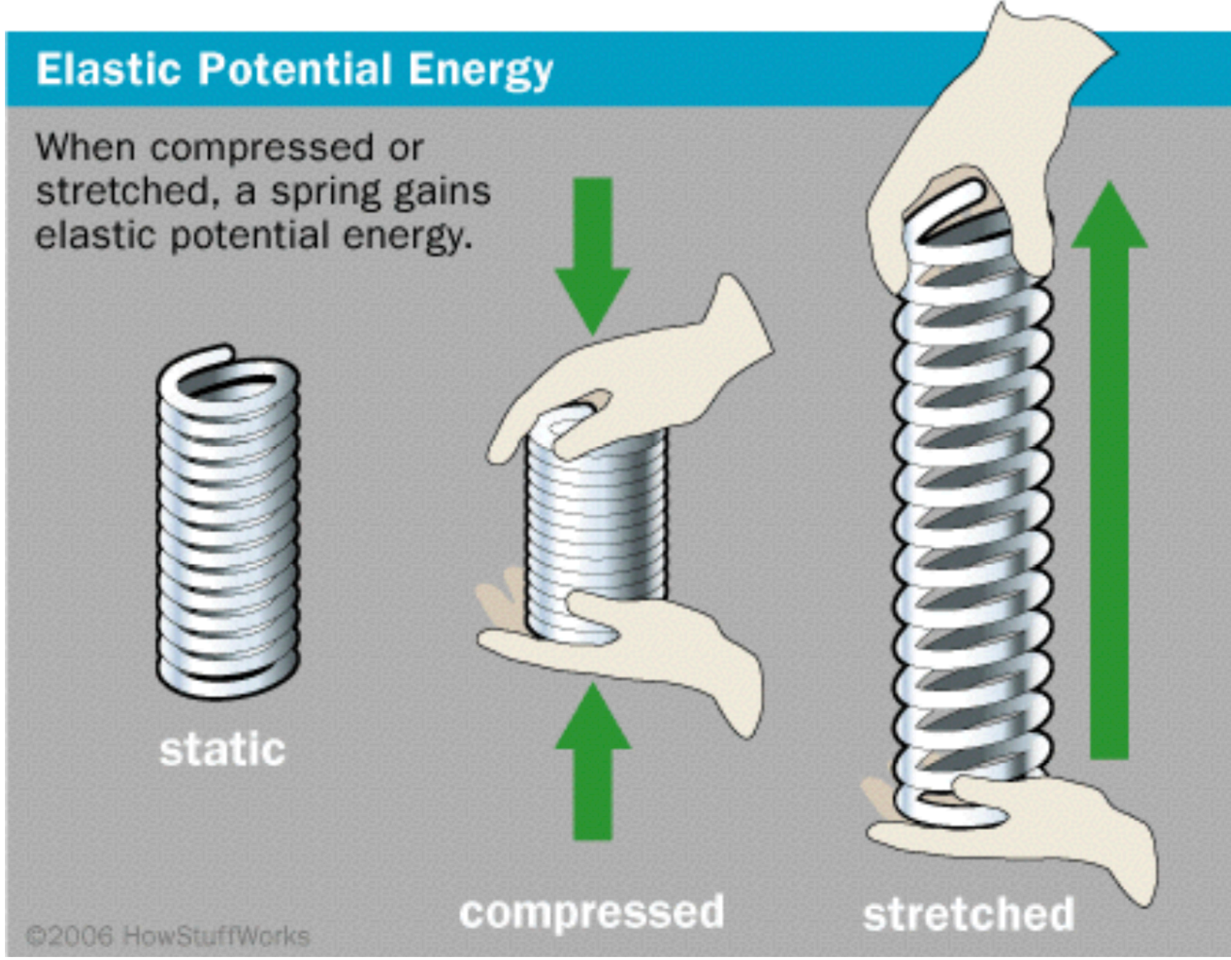
Variable force!



F_A VS. X

$$F_A = -F_s = kx$$

A SPRING HAS A SPRING CONSTANT *K* OF 440 N/M. HOW MUCH MUST THIS SPRING BE STRETCHED TO STORE 25 J OF PE?



CONSERVATIVE VS. NONCONSERVATIVE FORCES

Work done against gravity does *not* depend on the path taken

Forces for which work done doesn't depend on path but only on initial and final positions are called **conservative forces**

I.e. gravitational, elastic (spring), electric

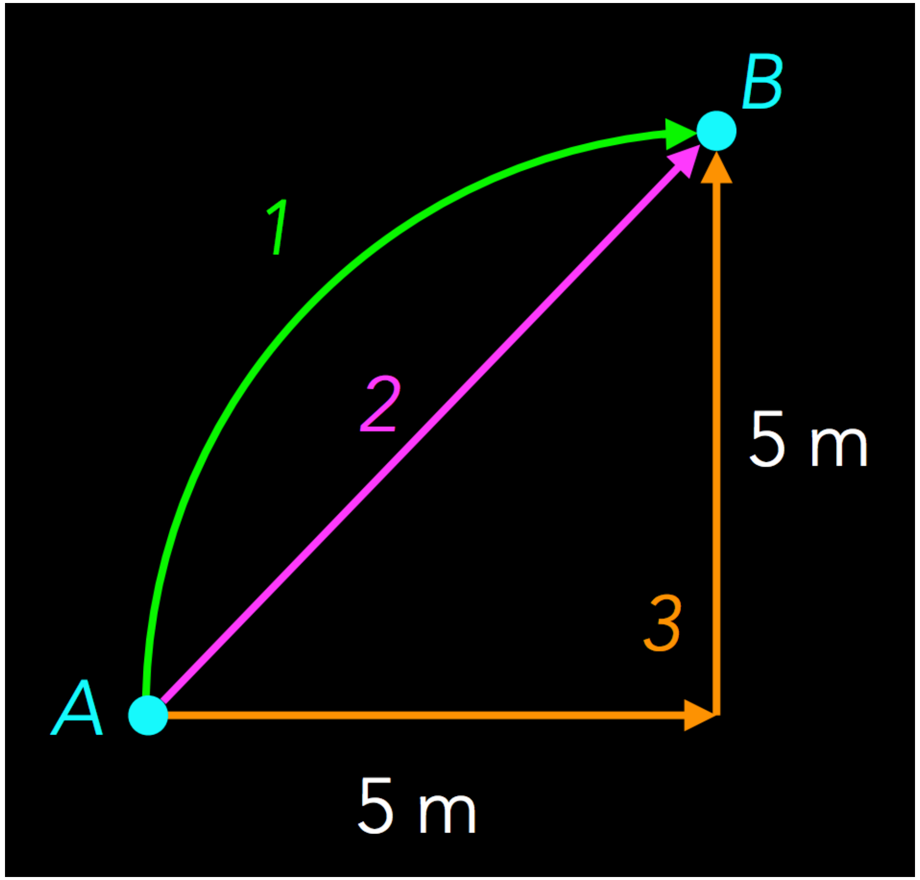
CONSERVATIVE VS. NONCONSERVATIVE FORCES

Nonconservative forces *do* depend on the path

I.e. friction, air resistance, tension, push or pull

FRICTION

50N of friction act on a box that is dragged across the floor from A to B. How much work is done by friction along the three paths shown to the right?



1: (.5 xπx 5m) x -50N = -393 J

2: (5√5m) x -50N = -354 J

3: 10m x -50 N = -500 J

CONSERVATIVE FORCES AND PE

Potential energy is the energy associated with position or configuration

Only makes sense if it can be stated uniquely for a given point

Can't be done with nonconservative forces

Potential energy can be defined only for a conservative force

WORK-ENERGY THEOREM REVISITED

$W_{net} = W_C + W_{NC}$

$W_{net} = \Delta KE$

$W_C = -\Delta PE$

$W_{NC} = \Delta KE + \Delta PE$

Note: make sure to include <u>every</u> force acting on a system