

Section 7.4: Law of Conservation of Energy

The Law of conservation of energy states...

- Energy cannot be created or destroyed, only transferred from one form to another, or one object to another

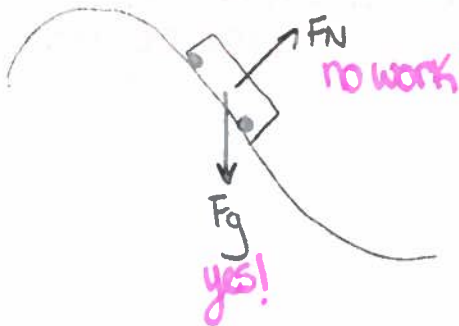
For a single object, we can use the following formula

$$\sum E_i + W_{\text{not gravity}} = \sum E_f$$

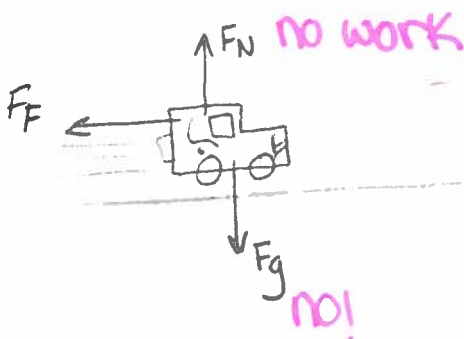
This is particularly useful when gravity is the only force doing work because $W_{\text{not gravity}} = 0$.

In the following situations, is gravity the only force doing work?

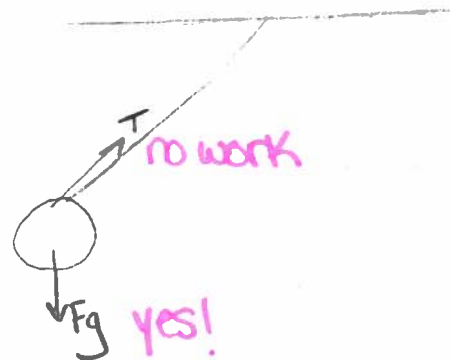
A roller coaster going down a hill.



A car skidding to a stop.



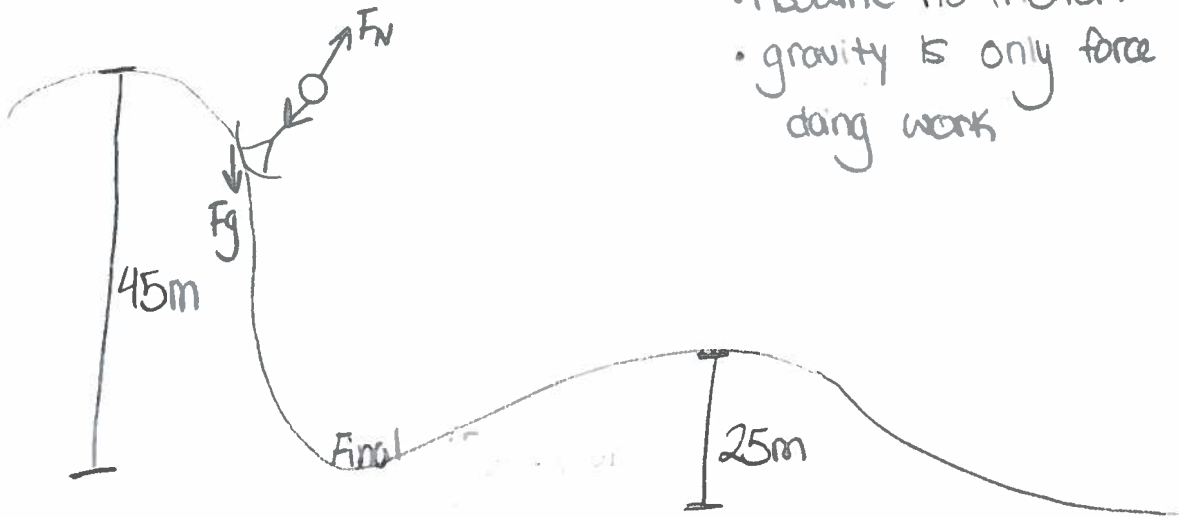
A pendulum swinging back and forth.



A ball flying through the air with air resistance.



Example: A snowboarder starts at rest on a 45 m hill, travels down a hill into a gulley and up to the top of a 25 m hill. Find his speed at the top of the 2nd hill.



- Assume no friction
- gravity is only force doing work

$$\sum E_i + W_{\text{not gravity}} = \sum E_f$$

* divide both sides by m

$$\sum E_i = \sum E_f$$

$$E_p = E_p + E_k$$

$$mgh = (mgh) + \left(\frac{1}{2}mv^2\right)$$

$$(gh) = (gh) + \left(\frac{1}{2}v^2\right)$$

$$(9.8)(45) = (9.8)(25) + (0.5)(v^2)$$

$$v = 19.8 \text{ m/s}$$