Power & Work

11SCI - Mechanics

Finn LeSueur

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2018 Exam

Giovanni has a mass of $75kg$ and is doing a ski jump. At the top of his flight he has $3200J$ of gravitational potential energy.

1. Calculate his downward (vertical) speed just before he lands (assuming energy is conserved).
2. Explain why Giovanni's actual speed is lower than calculated in 1.

Work

When you lift your backpack off the ground you are transferring some **chemical potential energy** in your muscles into **gravitational potential energy** in the backpack.

This transfer of energy is called **work**.

Other examples including the launching of a rocket, the falling of a skydiver, the riding of a rollercoaster.

Example 1

Sam has decided to take up weight lifting and starts by deadlifting a $20kg$ mass from the ground to a height of $1m$. Calculate the work done for Sam to lift the weight.

Hint: Calculate the gravitational potential energy at the start and end of the lift.

Example 2

Jack has gone hiking up Avalanche Peak. He has a mass of $55kg$ and reaches a height of $1833m$, starting from $733m$. How much work has Jack done to reach the top?

2018 Exam

Sophie is snow skiing and uses a ski tow to get to the top of the slope. The ski tow pulls Marama up the slope to a height of 46.2 m. The combined mass of Sophie and her ski gear is 62 kg.

Calculate the work done for Marama to reach the top of the slope.

Calculating Work

Recall: Work is the amount of energy transferred

In the vertical direction, work can be calculated using this formula

$$work = force \times distance$$
$$W = F \times d$$

If you are uncomfortable using this formula:

$$W = F \times d$$

just use the potential energy calculation because they are just different expressions of each other.

$$E_p = m \times g \times \Delta h$$

Starter

A rocket is launched with an acceleration of $90ms^{-2}$. It has a mass of $5kg$ and it accelerates until it reaches a height of 2000m. How much work is the rocket thruster doing?

Power

- Power is the rate at which energy is transferred.
- This is different to work which is the **amount** of energy transferred.
- A higher power means more energy is transferred each second.
- A lower power means less energy is transferred each second.

- Power is measured in Joules per second (J/s).
- Since Joules is the unit for energy, we know this means energy per second.

$$power = \frac{work}{time}$$

$$P = \frac{W}{t}$$
