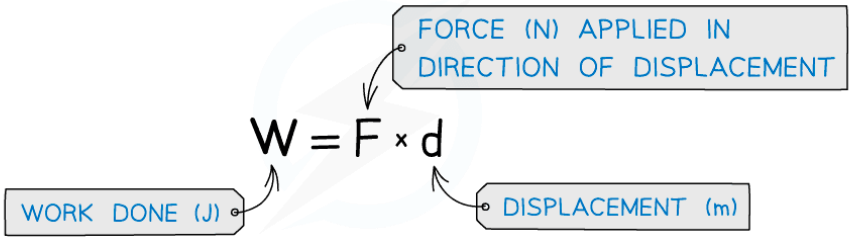
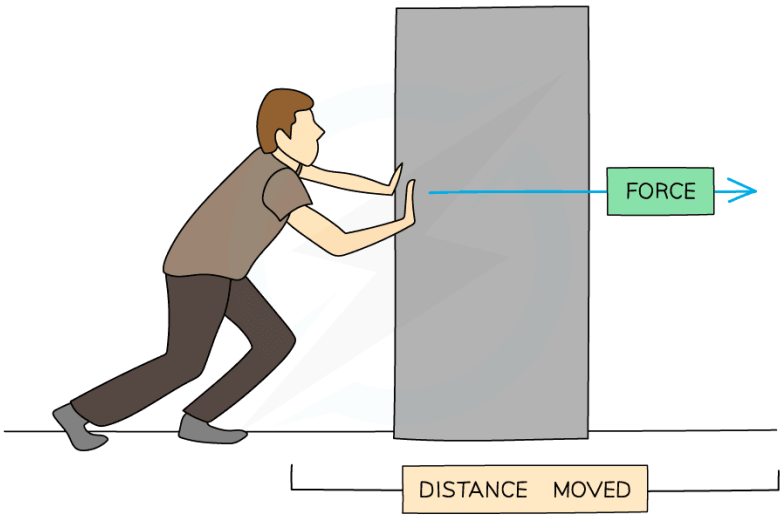
Work done

- In Physics, **work is done** when an **object** is **moved** over a distance by an external force applied in the direction of its displacement



- In the diagram below, the man's pushing force on the block is doing work as it is transferring energy to the block (increasing its kinetic energy)

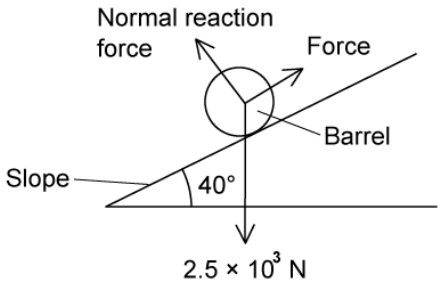


Work is done when a force is used to move an object over a distance

- When work is done, energy is transferred from one object to another
- Work done can be thought of as the amount of **energy transferred**, hence its units are in **Joules (J)**
- Usually, if a **force** acts **in the direction** that an object is moving then the object will **gain energy**
- If the **force** acts in the **opposite direction** to the movement then the object will **lose energy**

Worked example

The diagram shows a barrel of weight 2.5×10^3 N on a frictionless slope inclined at 40° to the horizontal.



A force is applied to the barrel to move it up the slope at constant speed. The force is parallel to the slope.

What is the work done in moving the barrel a distance of 6.0 m up the slope?

A. 7.2×10^3 J **B.** 2.5×10^4 J **C.** 1.1×10^4 J **D.** 9.6×10^3 J

ANSWER: D

STEP 1

WORK DONE EQUATION

$W = F \times d$

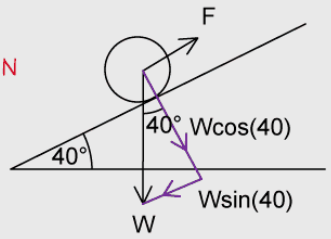
STEP 2

CALCULATE THE FORCE IN THE DIRECTION OF TRAVEL

THE FORCE NEEDED TO PUSH THE BARREL NEEDS TO OVERCOME THE COMPONENT OF THE BARREL'S WEIGHT. SINCE THE FORCE IS PARALLEL TO THE SLOPE, THE COMPONENT OF THE WEIGHT WE NEED IS THE ONE PARALLEL TO THE SLOPE.

$F = W\sin(40) = 2.5 \times 10^3 \times \sin(40) = 1607\ N$

THIS IS THE FORCE IN THE SAME DIRECTION AS THE DISPLACEMENT



STEP 3

SUBSTITUTE F AND d INTO THE WORK DONE EQUATION

$W = 1607\ N \times 6.0\ m = 9.6 \times 10^3\ J$