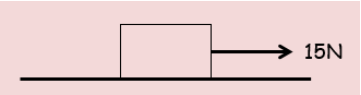
2A Work Done

Work Done:

Work Done Against Gravity:

1. A box is pulled 7m across a horizontal floor by a horizontal force of magnitude 15N. Calculate the work done by the force



2. A packing case is pulled across a horizontal floor by a horizontal rope. The case moves at a constant speed and there is a constant resistance to motion of magnitude R Newtons. When the case has moved a distance of 12m the work done is 96J. Calculate the magnitude of the resistance

3. A bricklayer raises a load of bricks of total mass 30kg at a constant speed by attaching a cable to the bricks.

   Assuming the cable is vertical, calculate the work done when the bricks are raised a distance of 7m

4. A package of mass 2kg is pulled at a constant speed up a rough plane which is inclined at an angle of 30° to the horizontal. The coefficient of friction between the package and the surface is 0.35. The package is pulled 12m up a line of greatest slope of the plane.

   Calculate:

a) The work done against gravity

b) The work done against friction

5. A sledge is pulled 15m across a smooth sheet of ice by a force of magnitude 27N. The force is inclined at 25° to the horizontal. By modelling the sledge as a particle, calculate the work done by the force.

2B Kinetic & Potential Energy

Kinetic Energy:

(Gravitational) Potential Energy

1. A particle of mass 0.3kg is moving at a speed of $9ms^{-1}$. Calculate its kinetic energy.

2. A box of mass 1.5kg is pulled across a smooth horizontal surface by a horizontal force. The initial speed of the box is ums^{-1} and its final speed is $3ms^{-1}$ in the same direction. The work done by the force is 1.8J. Calculate the value of u.

3. A bus of mass 2000kg starts from rest at some traffic lights. After travelling 400m the bus's speed is $12ms^{-1}$. A constant resistance of 500N acts on the bus. Calculate the driving force, P, which can be assumed to be constant.

4. A load of bricks of mass 30kg is lowered vertically to the ground through a distance of 15m. Find the loss in potential energy.

2C Work-Energy Principle

1. A smooth plane is inclined at 30° to the horizontal. A particle of mass 0.5kg slides down the slope. The particle starts from rest at point A and at point B has a speed of $6ms^{-1}$. Find the distance AB.

2. A particle of mass 2kg is projected with speed $8ms^{-1}$ up a rough plane inclined at 45° to the horizontal. The coefficient of friction between the particle and the plane is 0.4. Calculate the distance the particle travels up the plane before it comes to instantaneous rest.

3. A skier passes a point A on a ski-run, moving downhill at $6ms^{-1}$. After descending 50m vertically, the run starts to ascend. When the skier has ascended 25m to point B her speed is $4ms^{-1}$. The skier and skis have a combined mass of 55kg. The total distance travelled from A to B is 1400m. The resistances to motion are constant and have a magnitude of 12N.
   Calculate the work done by the skier.

2D Power

Power:

A key Point: the 'F' in formulae

Work Done 'F' = Total resultant force Power 'F' = a single force (from a motor for example)

1. A truck is being pulled up a slope at a constant speed of $8ms^{-1}$ by a force of magnitude 2000N acting parallel to the direction of motion of the truck. Calculate the power developed in kilowatts.

2. A car of mass 1250kg is travelling along a horizontal road. The car's engine is working at 24kW. The resistance to motion is constant and has magnitude 600N. Calculate:

a) The acceleration of the car when it is travelling at $6ms^{-1}$

b) The maximum speed of the car

3. A car of mass 1100kg is travelling at a constant speed of $15ms^{-1}$ along a straight road which is inclined at 7° to the horizontal. The engine is working at a rate of 24kW.

a) Calculate the magnitude of the non-gravitational resistances to motion

The rate of working of the engine is now increased to 28kW. Assuming the resistances to motion are unchanged:

b) Calculate the initial acceleration of the car