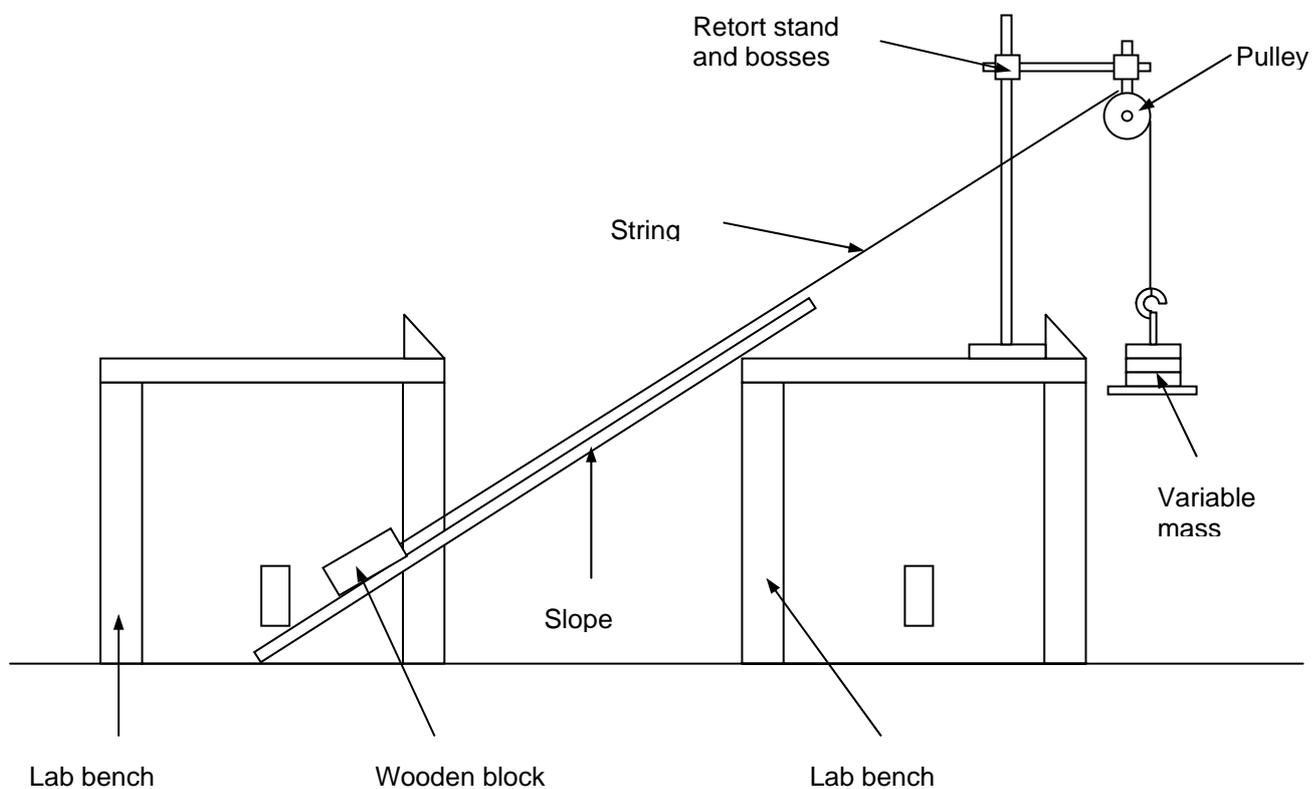


## TAP 214-1: Work done in raising a weight using a ramp

Set up the apparatus as shown in the diagram.

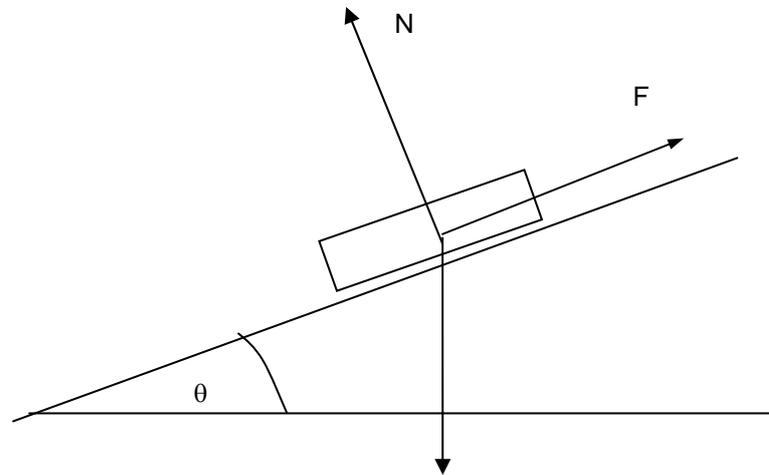


- Measure and record the mass of the wooden block.
- Mark the position of the wooden block at the bottom of the slope.
- Carefully add mass to the end of the string until the wooden block *just* starts to move. Experiment until you are happy that the block is just moving up the slope. Record the pulling mass.
- When the block comes to a rest (usually because the pulling mass has hit the floor) measure how far the block has moved along the slope.
- Calculate the work done in pulling the block up the slope.
- Measure how high the wooden block has been raised (i.e. the vertical distance moved). Think carefully how you might do this accurately.
- Calculate the gravitational potential energy gained by the block.
- Compare the work done by the falling variable mass to the GPE gained. What do you notice? Can you explain this?

Calculate the efficiency of the ramp system in lifting the weight:

$$\text{efficiency} = \frac{\text{potential energy gained}}{\text{work done}} \times 100\%$$

Analysis of forces on the block:



- Copy the diagram above and add the frictional force.
- At equilibrium, when the block is moving up the slope with constant velocity:

magnitude of force  $F$  = magnitude of frictional force + component of  $W$  acting down the slope

Use this relationship to estimate the frictional force acting down the slope.

- Calculate the work done *against friction* in pulling the block up the slope.
- If the block is pulled very slowly up the ramp the expression:

**Potential energy gained + work done against friction = total work done**  
is reasonably accurate.

Test this expression using your results and suggest a reason for any discrepancies.