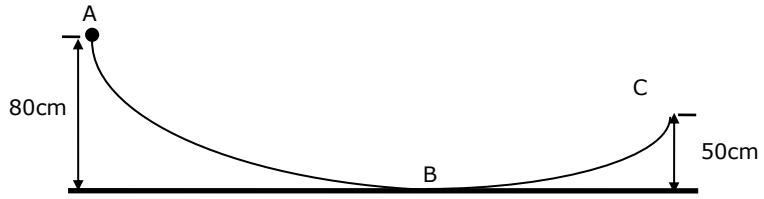
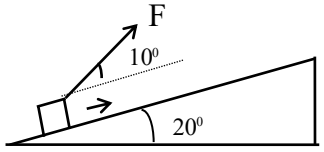
PHY1010 Introductory Physics 2020/2021
Tutorial Sheet 4 Work and Energy.

01. A pump is needed to lift water from a well though a height of 3.0 m at a rate of 0.6kg/min. What must be the minimum power of the pump in watts, and in horsepower?
[Power $= 0.294$ watt or $= 3.94\times10^{-4}\ hp$]

02. A bead of mass 15g is sliding on a wire. It has a speed of 2.0m/s at *A*, and it stops as it reaches the point *C*. The length of the wire from *A* to *C* is 250cm.
How large an average friction force opposed the motion of the bead? [$f = 0.0296$N]



03. A steel block weighing 12N is pulled up an inclined plane 20^0 above the horizontal by a constant force of 7.35 N which makes an angle of 10^0 above the inclined plane.
The block starts from rest and is pulled 2.0 m along the inclined plane.
The coefficient of friction between the block and the inclined plane is 0.20.
Determine: (a) the work done on the block by the force, [$W = 14.48J$]
(b) increase in potential energy of the block [$\Delta PE = 8.21J$]
(c) increase in kinetic energy of the block, and [$KE_{final} = 2.27J$]
(d) amount of work required to overcome the frictional force. [$W_f = W - E = 4J$]

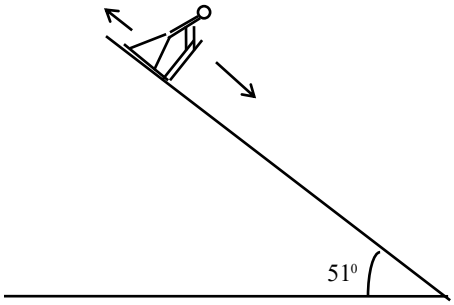


04**. A record skiing speed of 203.1km/h was achieved on a mountain slope inclined downward at 51^0. At this speed, the force of friction on the skier (air and sliding friction) balances the pull of gravity along the slope, so that the motion proceeds at a constant velocity.

(a) What is the rate at which gravity does work on the skier? Assume that the mass of the skier is 75kg. [32227 J/s]

(b) What is the rate at which sliding friction does work? Assume that the coefficient of sliding friction μ_k = 0.03 [783 J/s]

(c) What is the rate at which air friction does work? [31444 J/s]



05. A running man has one-half the kinetic energy that a running boy of half his mass has. The man speeds up by 1.0 m/s and then has the same kinetic energy as the boy.
What were the original speeds of the man and the boy?

$$[v_{man-orig} = 2.42m/s\,,\; v_{boy-orig} = 4.83m/s]$$

06*. The frictionless system shown is released from rest. After the right-hand mass has risen 75 cm, the object of mass 0.50 m falls loose from the system. What is the speed of the right-hand mass when it returns to its original position? $[v_{down} = 1.88\,m/s]$