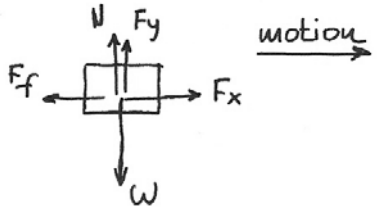
ENERGY: MOCK EXAM

① ✱ First, let's determine the value of each force



$W = 500\,Kg \times 10\frac{m}{s^2} = 5000N$

$F_x = 1000N \times \cos 30° = 866N$

$F_y = 1000N \times \sin 30° = 500N$

$N + F_y = W \rightarrow N = W - F_y = 4500N$

$F_f = \mu \times N = 0.15 \times 4500N = 675N$

✱ The work done by each force is:

$W_W = 5000N \times 50m \times \cos 90° = 0$

$W_F \nearrow W_F = 1000N \times 50m \times \cos 30° = 43300J$

$W_F \searrow W_{F_x} = 866N \times 50m \times \cos 0° = 43300J$

$W_N = 4500N \times 50m \times \cos 90° = 0$

$W_{F_f} = 675N \times 50m \times \cos 180° = -33750J$

✱ The total work is

$W_{TOTAL} = W_F + W_{F_f} + W_W + W_N = 43300J - 33750J =$

$= 9550J$

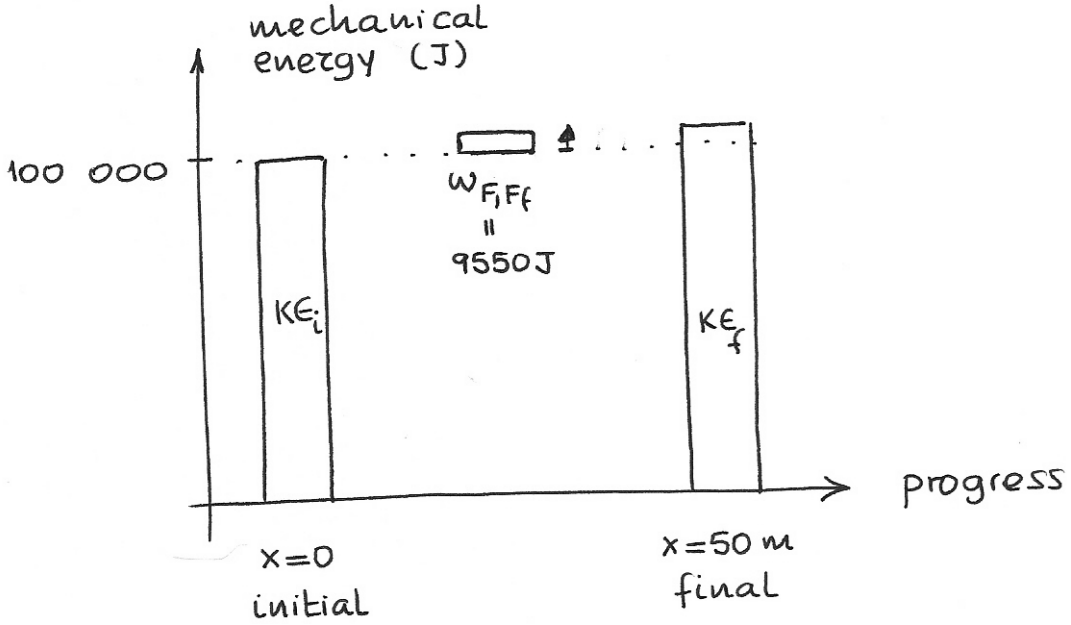
✱ The final velocity

$W_{TOTAL} = \Delta KE \rightarrow W_{TOTAL} = KE_{final} - KE_{initial}$

$9550J = \frac{1}{2} \times 500Kg \times V_f^2 - \frac{1}{2} \times 500Kg \times \left(20\frac{m}{s}\right)^2$

$9550J = 250Kg \times V_f^2 - 100000J$

$V_f = \sqrt{\frac{109550J}{250Kg}} \rightarrow V_f = 20.9\frac{m}{s}$


mechanical energy (J)
100 000
$W_{F_i F_f}$ = 9550J
KE_i
KE_f
progress
x=0 initial
x=50 m final

(2) a) The initial and final mechanical energies

$E_i = PE_i + KE_i \longrightarrow E_i = mgh = 10Kg \times 10\frac{m}{s^2} \times 20m = \boxed{2000\,J}$

↑ initially at rest

$v_0 = 0 \rightarrow KE_i = 0$

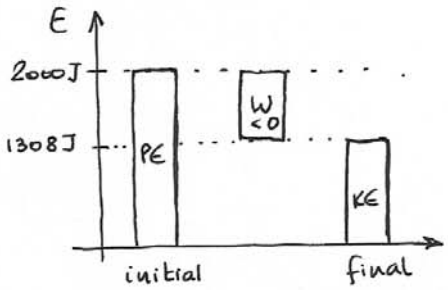
$W_{F,F_f} = F_f \times d \times \cos 180° = 17.3N \times 40m \times (-1) = \boxed{-692\,J}$

↑ $\sin 30° = \frac{h}{d}$; $d = 40m$

$F_f = \mu N = 0.2 \times 86.6N = 17.3\,N$

↑ $N = W_y = W \times \cos 30° = 86.6N$

$W_{F,F_f} = \Delta E = E_f - E_i \longrightarrow -692\,J = E_f - 2000J \rightarrow \boxed{E_f = 1308J}$



b) Final velocity

$KE_f = 1308\,J = \frac{1}{2} \times 10Kg \times v_f^2 \longrightarrow \boxed{v_f = 16.2\frac{m}{s}}$

c) Acceleration

c1) $F_{net} = m.a \rightarrow -F_f + W_x = m.a \rightarrow$

$\rightarrow -17.3N + 50N = 10Kg \times a \rightarrow \boxed{a = 3.27\frac{m}{s^2}}$

c2) $V_{average} = \frac{0 + 16.2\,m/s}{2} = 8.1\frac{m}{s}$

$t = \frac{d}{V_{av}} = \frac{40m}{8.1\,m/s} = 4.94s \rightarrow a = \frac{\Delta v}{t} = \frac{16.2\,m/s - 0}{4.94s} \rightarrow$

$\rightarrow \boxed{a = 3.28\frac{m}{s^2}}$