Physics 112

Quiz Tuesday

→ Work

→ momentum / Conservation of momentum

→ KE, PE, TE

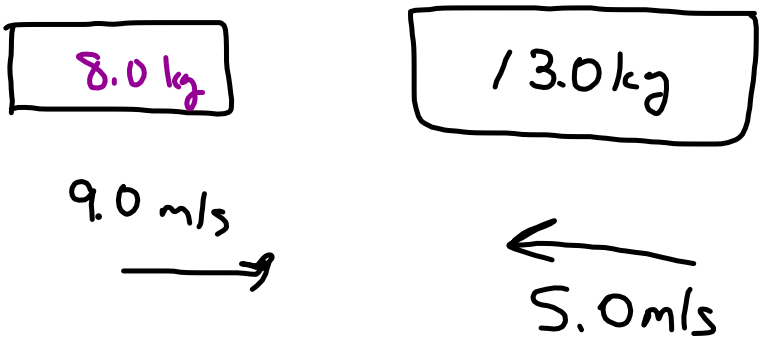
- $W = Fd$
- $W = \Delta KE = KE_2 - KE_1$

$$Fd = KE_2 - KE_1$$

$KE = \frac{1}{2} m v^2$ $\qquad$ $TE = KE + PE$

$PE = mgh$

1.



If the 13.0 kg moves at 2.0 m/s →, determine the velocity of the 8.0 kg block immediately after the collision.

Momentum Before = Momentum After

$A + B = A + B$

$8\ kg\ (9\ m/s) + 13\ kg(-5\ m/s) = 8\ kg(v) + 13\ kg(2\ m/s)$

$72\ kg\cdot m/s - 65\ kg\cdot m/s = 8\ kg(v) + 26\ kg\cdot m/s$

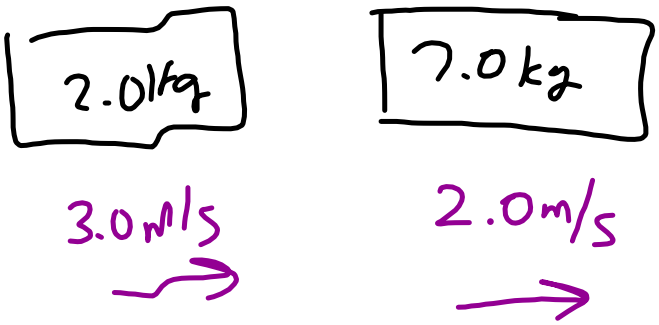
$-19\ kg\cdot m/s = 8\ kg(v)$

$\frac{-19\ kg\cdot m/s}{8\ kg} = v$

$-2.4\ m/s = v$

$v = 2.4\ m/s \leftarrow$

2.



If the 2.0 kg comes to a stop, determine the after collision velocity of the 7.0kg block.

Before = After

$A + B = A + B$

$2(3) + 7(2) = 2(0) + 7v$

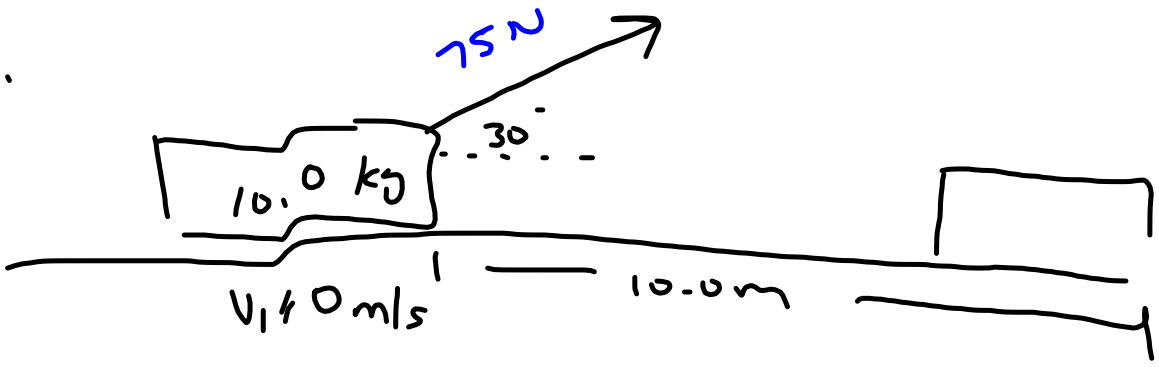
$6 + 14 = 0 + 7v$

$20 = 7v$

$+2.9\ m/s = v$

$v = 2.9\ m/s \rightarrow$

3.



a) How much work is done moving the block 10.0 m?

b) What is the block's velocity at this time?

4.

a) $W = F\,d$

$= (75 \cos 60)(10.0\ m)$

$= 65\ N\ (10.0\ m)$

$= 650\ N \cdot m$

or

$650\ J$

b) $W = \Delta KE$

$W = KE_2 - KE_1$ → 0 J, not moving

$W = \frac{1}{2} m v^2$

$650\ J = \frac{1}{2}(10.0\ kg)\, v^2$

$130 = v^2$

$11.4\ m/s = V$

$11.4\ m/s \rightarrow$

4. A 2000 kg car moving at 12.0 m/s hits a wall. Determine the size of the force the wall exerted on the car if the car's front end was pushed in 50cm.

$KE_1 = \frac{1}{2}mv^2$

$= \frac{1}{2}(2000)(12)^2$

$= 144\,000\ J$

$KE_2 = \frac{1}{2}mv^2$

$= 0$

stopped

$\Delta KE = KE_2 - KE_1$

$= 0 - 144\,000\ J$

$\Delta KE = -144\,000\ J$

$\Delta KE = W$

$-144000\ J = W$

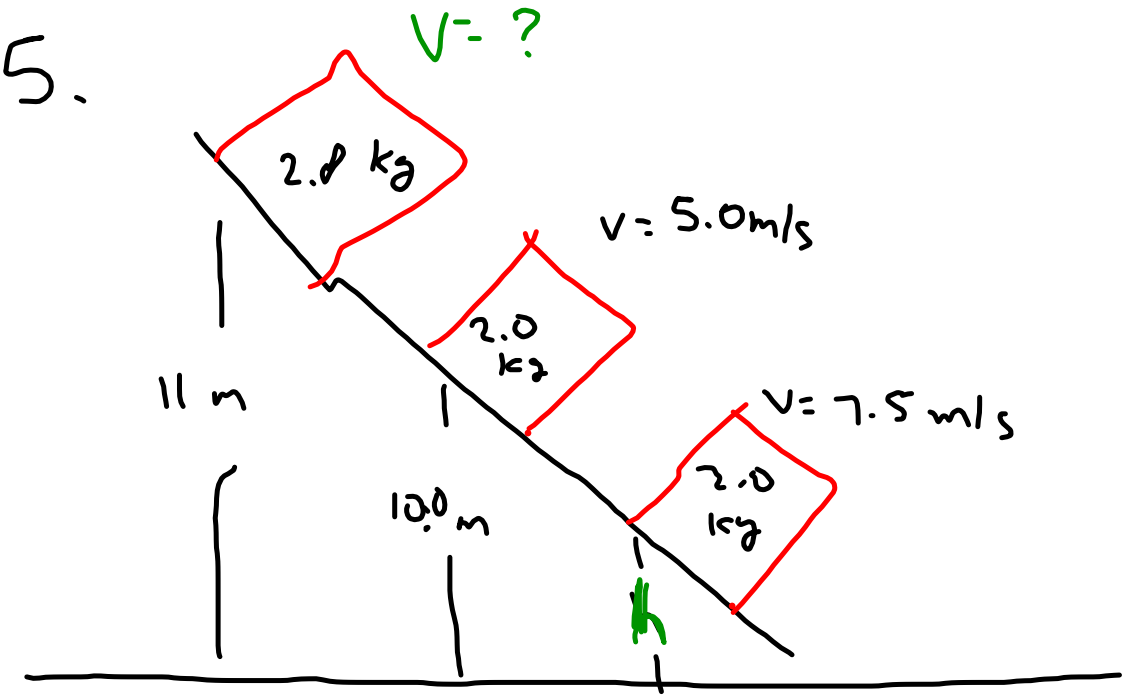
$W = Fd$

$-144\,000\ J = F(0.5)$

$-288\,000\ N = F$

288 000 N in the opposite direction to which the car was originally moving.

5.



Conservation of energy.

height differences & speed differences

middle

$KE = \frac{1}{2}mv^2$

$= \frac{1}{2}(2.0)5.0^2$

$= 25.0\,J$

$PE = mgh$

$= 2.0(9.81)(10.0)$

$= 196\,J$

$TE = KE + PE$

$= 25.0\,J + 196\,J$

$TE = 221\,J$

Top

$TE = 221\ J$

$PE = mgh$

$= 2(9.81)(11)$

$= 215\ J$

$KE = 6\ J$

$KE = \frac{1}{2}mv^2$

$6 = \frac{1}{2}(2)v^2$

$2.5\ \frac{m}{s} = v$

Bottom

$TE = 221\ J$

$KE = \frac{1}{2} m v^2$

$= \frac{1}{2}(2)\ 7.5^2$

$KE = 56\ J$

$PE = 221 - 56$

$= 165\ J$

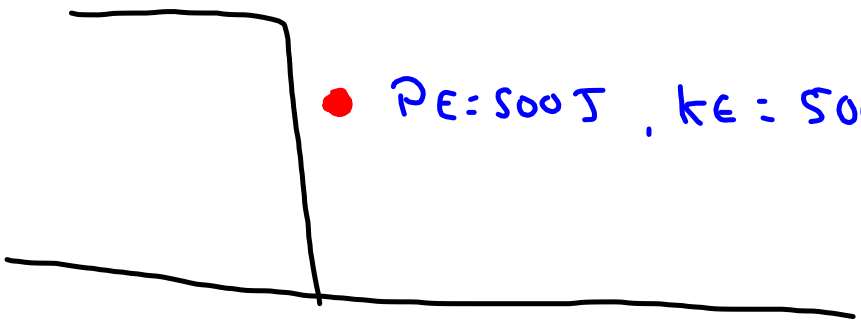
$PE = mgh$

$165 = 2(9.81)h$

$8.4m = h$

6.

At a certain height while falling, a 2.0 kg object's PE = 500 J and KE = 500 J. Determine the speed on the object at half this height.



(A)

$KE = 500\ J$

$PE = 500\ J$

$TE = 1000\ J$

(B) 1/2 height

$PE = \frac{500\ J}{2}$

$= 250\ J$

$TE = 1000\ J$

$KE = 750\ J$

$KE = \frac{1}{2} m v^2$

$750\ J = \frac{1}{2}(2.0) v^2$

$27\ m/s = v$