Work and Energy

1. How much work is required to stop a 1500kg car moving at a speed of 25 m/s?

$m = 1500\,kg$

$v = 25\,m/s$

$$W_{net} = \Delta KE$$

$$W_{net} = KE_{Final} - KE_{initial}$$

$$W_{net} = 0 - KE_{initial}$$

$KE_{initial} = \frac{1}{2} m v_0^2$

$$-\frac{1}{2}(1500\,kg)(25\,m/s)^2 = -468.750\,J$$

2. How much work is required to lift a 40kg crate 20m high?

$$PE = mgh$$

$$W = mg\Delta h$$

$$W = (40\,kg)(9.8\,m/s^2)(20\,m) =$$

$$= 7840\,J = 7.840\,kJ$$

3. How much work is required to stretch a spring from 25cm beyond its natural length to 85cm beyond its natural lengt given a spring constant of 500N/m ?

$$W = \Delta PE = PE_F - PE_I$$

$$W = \frac{1}{2}kX_F^2 - \frac{1}{2}kX_I^2$$

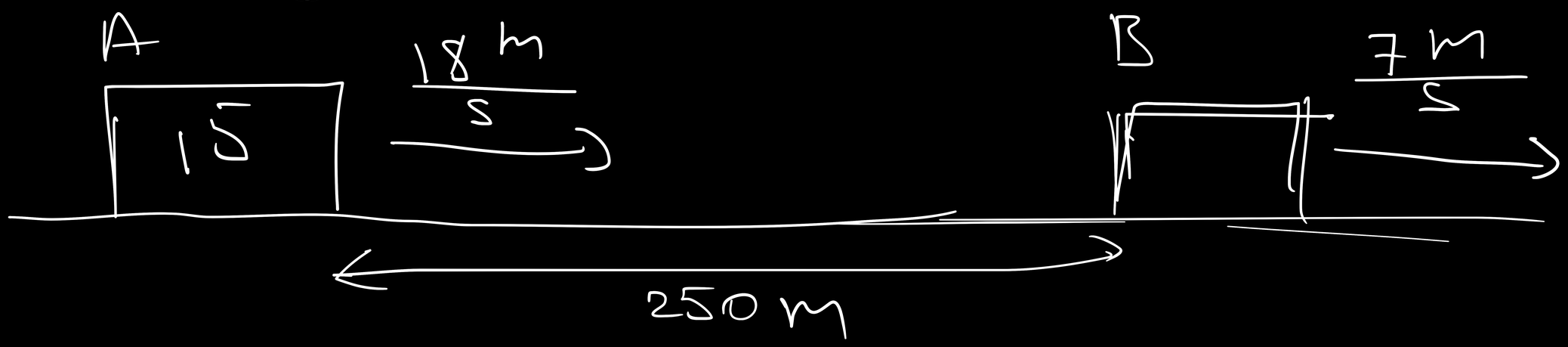
$$W = \frac{1}{2}k\left(X_F^2 - X_I^2\right)$$

$$W = \frac{1}{2}(500)\left(85^2 - 25^2\right)$$

$$W = \underline{165\ J}$$

4. A 15kg block slides on a horizontal surface with an initial speed of 18 m/s. The speed of the block is 7 m/s after traveling a distance of 250m. (a) How much work was done by friction on the block? (b) Calculate the average frictional force acting on the block. (c) What is the coefficient of kinetic friction between the block and the surface?

$m = 15\ kg$



$W_{net} = \Delta KE$

$F_{net} \cdot d = KE_f - KE_I$

$W_{net} = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_I^2 =$

$= \frac{1}{2}(10)(7^2 - 18^2) = 5(-275\ J) = \underline{-1375\ J}$

$$W_{net} = F_{net} * d$$

$$W_{net} = F_k * d$$

$$F_k = \frac{W_{net}}{d}$$

$$F_k = \frac{-1375}{250\,m} = \underline{-5.5\ N}$$

$$F_k = \mu_K F_n \qquad F_k = \mu_k mg$$

$$\mu_k = \frac{F_k}{mg} = \frac{-5.5\ N}{15\ kg\,(-9.8)} = \boxed{0.0374}$$

Power

$$P = \frac{\text{work}}{\text{time}}$$