Warm up 03.23.2018

An experimental train that had a mass of 2.50×10^4 kg was powered across a level track by a jet engine that produced a thrust of 4.90×10^5 N for a distance of 509 m. Assume that air resistance is negligible.

(a) Find the work done on the train.

(b) Find the change in kinetic energy.

(c) Find the final kinetic energy of the train if it started from rest.

(d) Find the final speed of the train if there had been no friction.

$m = 2.5 \times 10^4\ kg$

$F = 4.9 \times 10^5\ N$

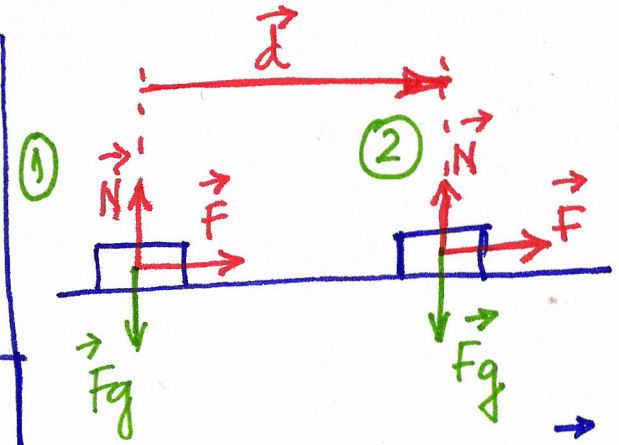
$d = 509\ m$

a) $W = ?$

b) $\Delta KE = ?$

c) $KE_2 = ?$

d) $v_2 = ?$



a) $W = F \cdot d \cdot \cos(\vec{F}, \vec{d})$

$W = F \cdot d \cdot \cos 0°$

$\| \quad 1$

$W = F \cdot d = 4.9 \times 10^5\ N \cdot 509\ m$

$W = 2.5 \times 10^8\ J$

b) $\Delta KE = W$

c) $\Delta KE = KE_2 - KE_1$

$KE_1 = \frac{1}{2} m \cdot v_1^2 = 0\ J$ $\Rightarrow \boxed{KE_2 = \Delta KE}$

d) $KE_2 = \frac{1}{2} m \cdot v_2^2$

$v_2 = \sqrt{\frac{2\,KE_2}{m}} = \sqrt{\frac{2W}{m}}$

$v_2 = \sqrt{\frac{2 \cdot 2.5 \times 10^8}{2.5 \times 10^4}}$

$v_2 = \sqrt{2 \cdot 10^4} = \sqrt{2} \cdot 100\ m/s = 141.4\ m/s$