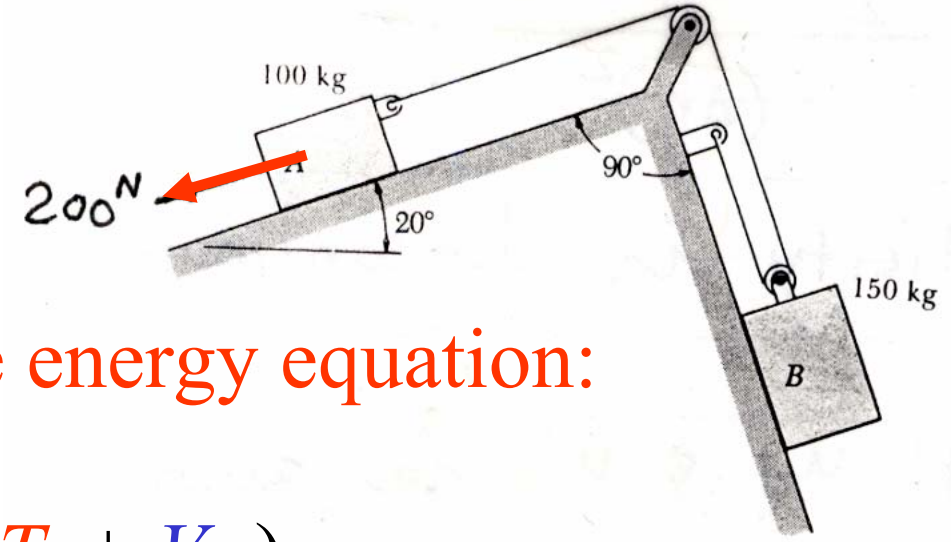
Non-Conservative Force Example 1

Example: The two blocks are initially at rest. An external force of 200 N acts on block A in a downward direction along the 20^o incline. Determine the velocity of block A after it has moves a distance of 1.6 m along the inclined.

Gravity-force potential

$V = m_A g\, y_A + m_B g\, y_B$

200 N is the non-conservative force that is not included in the above force potential.



Hence, $\mathbf{F_n} = 200$ N in the energy equation:

$$\int_1^2 \mathbf{F_n} \cdot d\mathbf{r} = (T_2 + V_2) - (T_1 + V_1)$$

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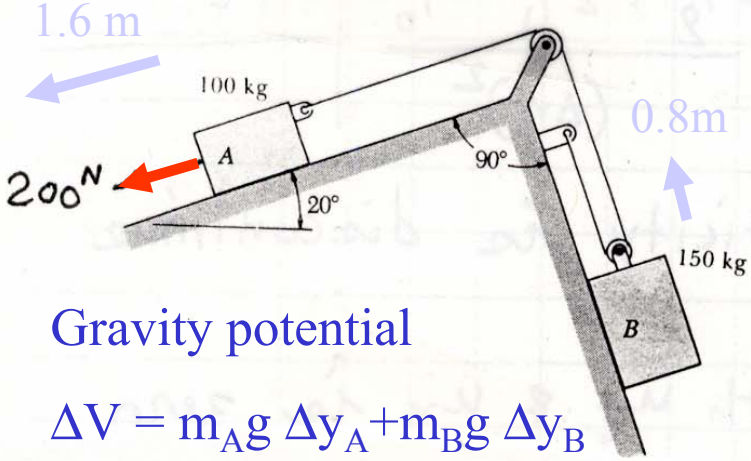
$$\int_{r_1}^{r_2} \mathbf{F_n} \cdot d\mathbf{r} = (V_2 + T_2) - (V_1 + T_1)$$

$$\boxed{\int_{r_1}^{r_2} \mathbf{F_n} \cdot d\mathbf{r} = \Delta V + \Delta T}$$

Assumed that block A moves down along the incline by 1.6 m,

ΔV =



Gravity potential

$\Delta V = m_A g\, \Delta y_A + m_B g\, \Delta y_B$

$\Delta y_A = -1.6 \sin 20^o < 0$

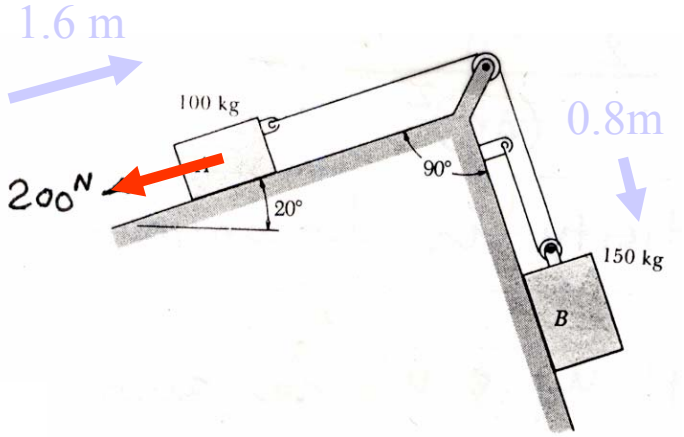
$\Delta y_B = +0.8 \sin 70^o > 0$

$\mathbf{F_n}$ = 200 N is the non-conservative force that does positive work

Assume now block A moves upward

$\mathbf{F_n}$ = 200 N become the non-conservative force that does negative work

$$\int_1^2 \mathbf{F_n} \cdot d\mathbf{r} = (T_2 + V_2) - (T_1 + V_1)$$



Gravity potential

$\Delta V = m_A g\, \Delta y_A + m_B g\, \Delta y_B$

$$\int_{r_1}^{r_2} \mathbf{F_n} \cdot d\mathbf{r} = -200 \times 1.6 = -320 \text{ J}$$

$\Delta y_A = +1.6 \sin 20^o > 0$

$\Delta y_B = -0.8 \sin 70^o < 0$