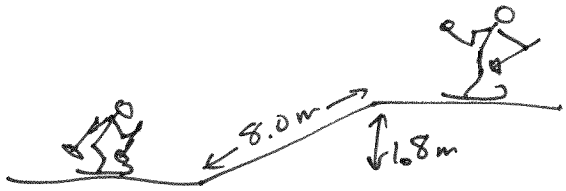
$m = 100\,kg$

$v_0 = 8.0\,m/s$

$\Delta h = 1.8\,m$



a) Assume no friction, what is the velocity at the top of the slope?

Since the skier coasts, he is doing no work.

By ~~conver~~ conservation of energy

$$K_0 + U_0 = K_f + U_f$$

$$\tfrac{1}{2}mv_0^2 + mg(0) = \tfrac{1}{2}mv_f^2 + mgy$$

solving for v_f gives

$$\tfrac{1}{2}mv_0^2 - mgy = \tfrac{1}{2}mv_f^2$$

$$\frac{\tfrac{1}{2}mv_0^2 - mgy}{\tfrac{1}{2}m} = v_f^2$$

$$v_0^2 - 2gy = v_f^2$$

$$v_f = \sqrt{v_0^2 - 2gy} = \sqrt{(8.0\,m/s)^2 - 2\left(9.80\,\tfrac{m}{s^2}\right)(1.8\,m)}$$

$$= \sqrt{28.72} = \boxed{5.36\,m/s}$$

b) If a frictional force acts on the skis $F_f = 80N$ what is his speed?

Work of friction $W_{fr} = F_f \Delta r_{(\text{along the slope})} = (80N)(8.0m)$

$= -640\,J$

This reduces the energy so

$$W_{fric} + K_0 = K_f + U_f$$

b) If a frictional force acts on the skiis, what is his speed at the top of the slope?

$F_f = 80N$

notice this is the actual distance traveled on the slope

Work of friction

$$W_{fr} = \vec{F}_{fr} \cdot \Delta\vec{r} = F_{fr} \cdot \Delta r \cdot \cos\theta = (80N)(8.0m)\cos 180$$

$$W_{fr} = -640\,J$$

from the work-energy theorem

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

$$W_{non\text{-}cons} + W_{cons} = \Delta K$$

$$W_{non\text{-}cons} = \Delta K - W_{cons} = \Delta K + \Delta U$$

* The $W_{non\text{-}cons}$ is the work done by friction

at the bottom of the slope $K_0 = \frac{1}{2}mv_0^2$ $U_0 = 0$

at the top of the slope $K_f = \frac{1}{2}mv_f^2$ $U_f = mgh$

Then $W_{fr} = K_f - K_0 + U_f - U_0$

$$W_{fr} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2 + mgh - 0$$

Solving for v_f gives

$$W_{fr} + \frac{1}{2}mv_0^2 - mgh = \frac{1}{2}mv_f^2$$

$$\frac{2}{m}W_{fr} + v_0^2 - 2gh = v_f^2$$

$$v_f = \sqrt{\frac{2}{m}W_{fr} + v_0^2 - 2gh}$$

$$= \sqrt{\frac{2}{(100kg)}(-640J) + (8.0m/s)^2 - 2(9.80m/s^2)(1.8m)}$$

$$= \sqrt{-12.8 + 64 - 35.3}$$

$$\boxed{v_f = 3.99\ m/s}$$