QUESTION:

Lora (of mass 57.9 kg) is an expert skier. She starts at 3.3 m/s at the top of the lynx run, which is 126 m above the bottom.

1) What is her final kinetic energy at the bottom of the ski run?Answer in units of J

2.) What is her speed at the bottom? Answer in units of m/s

SOLUTION:

According to the energy conservation law, Lora's final mechanical energy is equal to her initial mechanical energy. When she is at the bottom of the ski run, her potential energy transforms to her kinetic energy. Hence:

$$E_{initial} = \frac{m_{Lora}\upsilon_{initial}^2}{2} + m_{Lora}gh$$

$$E_{final} = \frac{m_{Lora}\upsilon_{final}^2}{2}$$

Hence, her final kinetic energy at the bottom of the ski run is

$$E_k = E_{final}$$

$$E_{final} = E_{initial}$$

$$E_k = \frac{m_{Lora}\upsilon_{initial}^2}{2} + m_{Lora}gh$$

$$E_k = \frac{57.9 \cdot 3.3^2}{2} + 57.9 \cdot 9.8 \cdot 126 = 71810 \text{ J}$$

Analogically:

$$E_{final} = E_{initial}$$

$$\frac{m_{Lora}\upsilon_{final}^2}{2} = \frac{m_{Lora}\upsilon_{initial}^2}{2} + m_{Lora}gh$$

$$\upsilon_{final}^2 = \upsilon_{initial}^2 + 2gh$$

$$\upsilon_{final} = \sqrt{\upsilon_{initial}^2 + 2gh}$$

$$\upsilon_{final} = \sqrt{3.3^2 + 2 \cdot 9.8 \cdot 126}$$

$$\upsilon_{final} = 49.8 \ m/s$$

ANSWER

1) 71810 J

2) $49.8 \ m/s$