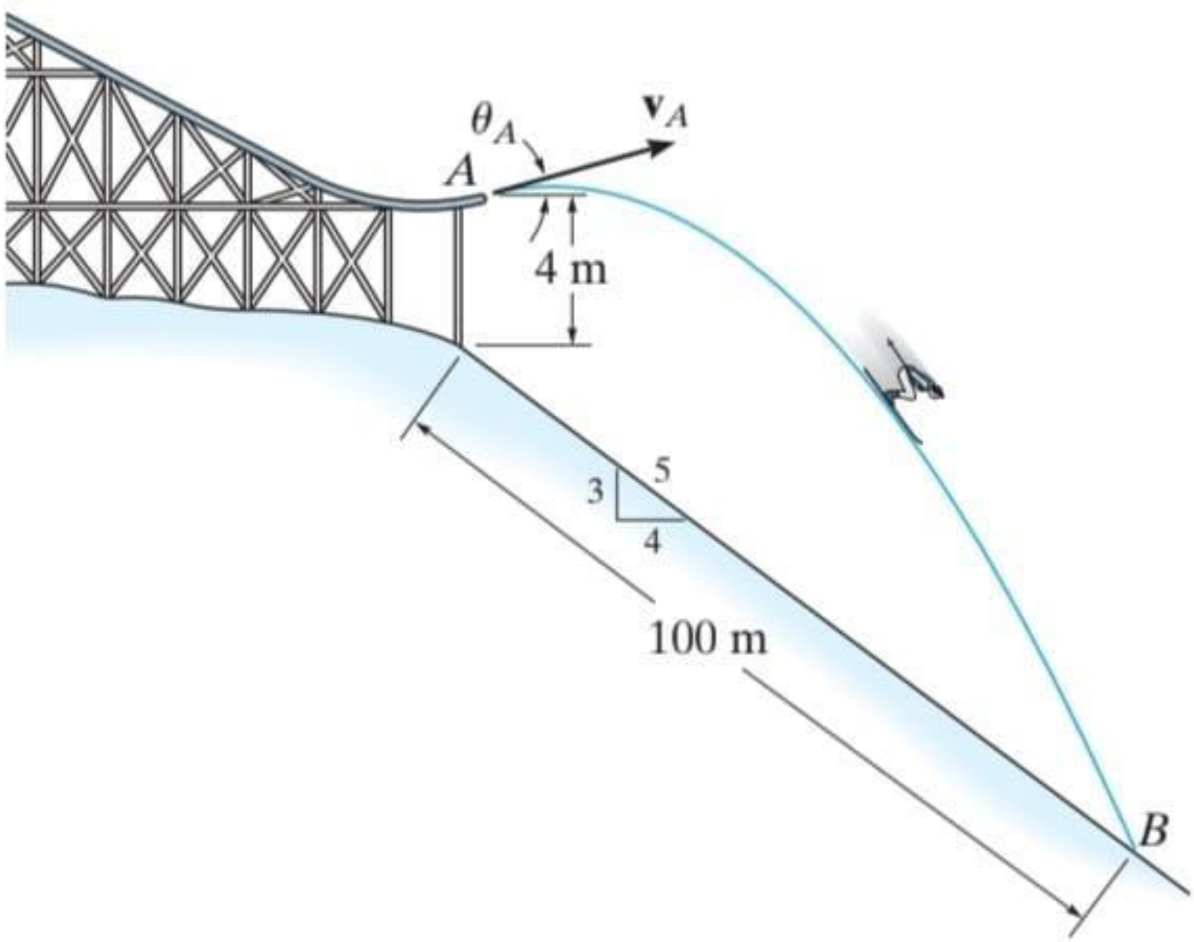
12–97. It is observed that the skier leaves the ramp A at an angle $\theta_A = 25°$ with the horizontal. If he strikes the ground at B, determine his initial speed v_A and the speed at which he strikes the ground.



Probs. 12–96/97

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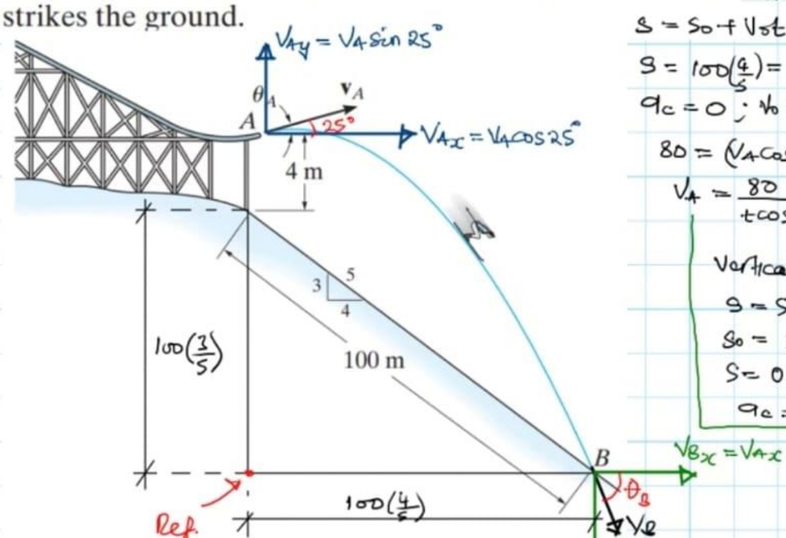


Probs. 12–96/97

$v = \frac{ds}{dt}$

$a = \frac{dv}{dt}$

$a\,ds = v\,dv$

$a = a_c$; $t = 0$; s_0, v_0

$s = s_0 + v_0 t + \frac{1}{2} a_c t^2$ ✓

$v = v_0 + a_c t$ ✓

$v^2 = v_0^2 + 2a_c(s - s_0)$

Case 12-96

Horizontal motion

$s = s_0 + v_0 t + \frac{1}{2} a_c t^2$

$s = 100\left(\frac{4}{5}\right) = 80$; $s_0 = 0$

$a_c = 0$; $v_0 = V_{Ax} = V_A \cos 25°$

$80 = (V_A \cos 25°)t$

$V_A = \frac{80}{t \cos 25°}$

Vertical motion

$s = s_0 + v_0 t + \frac{1}{2} a_c t^2$

$s_0 = 100\left(\frac{3}{5}\right) + 4 = 64$

$s = 0$; $v_0 = V_{Ay} = V_A \sin 25$

$a_c = -9.81$

$0 = 64 + (V_A \sin 25°)t - \frac{1}{2}(9.81)t^2$

$4.905t^2 = 64 + \frac{80}{t \cos 25}(\sin 25)t$

$t = 4.54$ secs

Time of flight for $t_{AB} = 4.54$ secs

$V_A = \frac{80}{t \cos 25°}$; $t = 4.54$; $V_A = 19.44$ m/s

Case 12-97

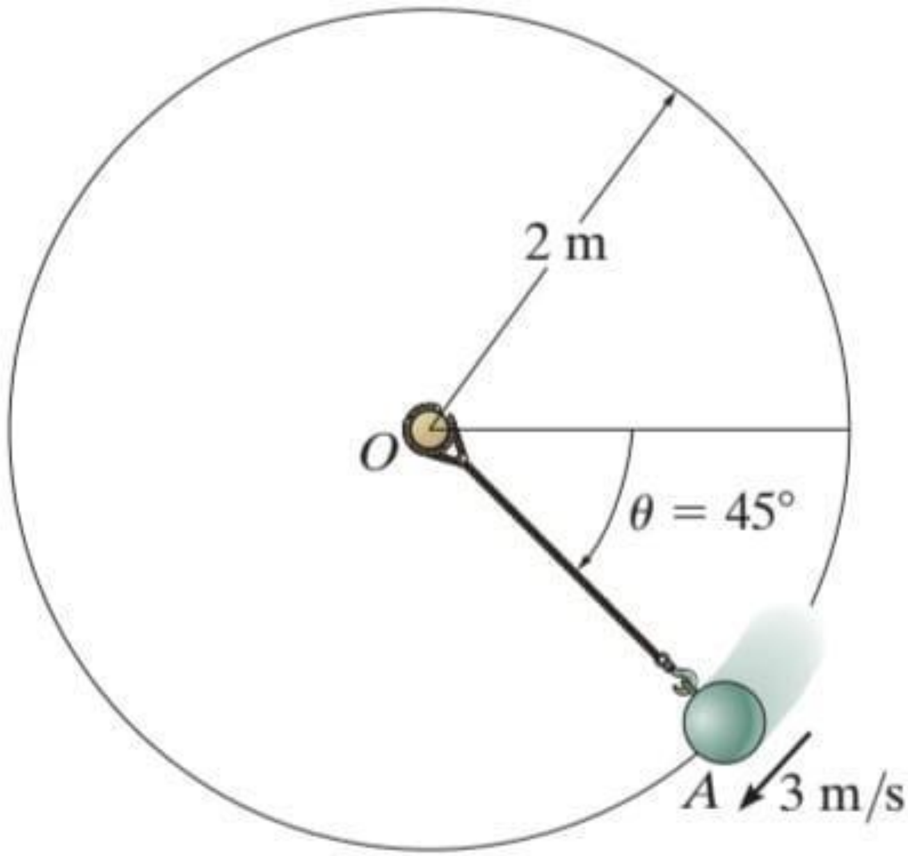
Using $v = v_0 + a_c t$ to find V_{By} (vertical motion)

$V_{By} = 19.44 \sin 25° - 9.81(4.54)$

$V_{By} = -36.32$ m/s ; $V_{Bx} = V_{Ax} = 19.44 \cos 25°$

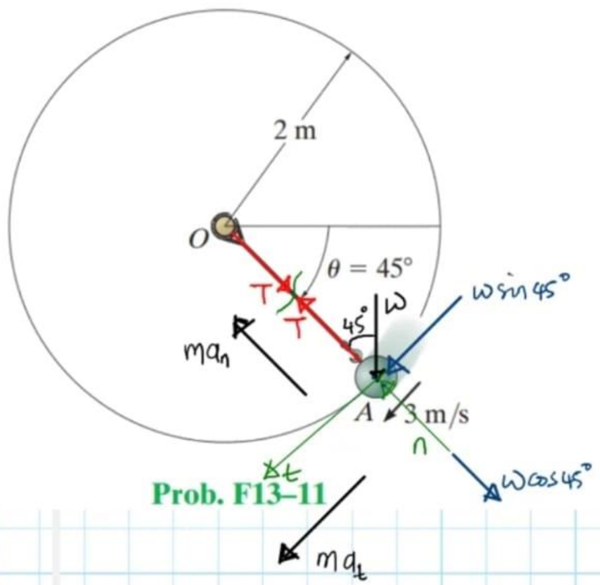
$V_B = \sqrt{V_{Bx}^2 + V_{By}^2}$; $V_B = 40.37$ m/s

F13–11. If the 10-kg ball has a velocity of 3 m/s when it is at the position A, along the vertical path, determine the tension in the cord and the increase in the speed of the ball at this position.



Prob. F13–11

F13–11. If the 10-kg ball has a velocity of 3 m/s when it is at the position A, along the vertical path, determine the tension in the cord and the increase in the speed of the ball at this position.



Prob. F13–11

$$\nwarrow + \Sigma F_n = m a_n \; ; \; a_n = \frac{v^2}{\rho} \; ; \; m = 10 \; ; \; \rho = 2$$

$$w = mg = (10)(9.81)$$

$$v = v_t = 3$$

$$T - w\cos 45° = m a_n$$

$$T = \frac{mv^2}{\rho} + w\cos 45° = \frac{mv^2}{\rho} + mg\cos 45°$$

$$T = 10\left(\frac{3^2}{2} + 9.81\cos 45°\right)$$

$$\boxed{T = 114.38\ N}$$

$$\swarrow + \Sigma F_t = m a_t$$

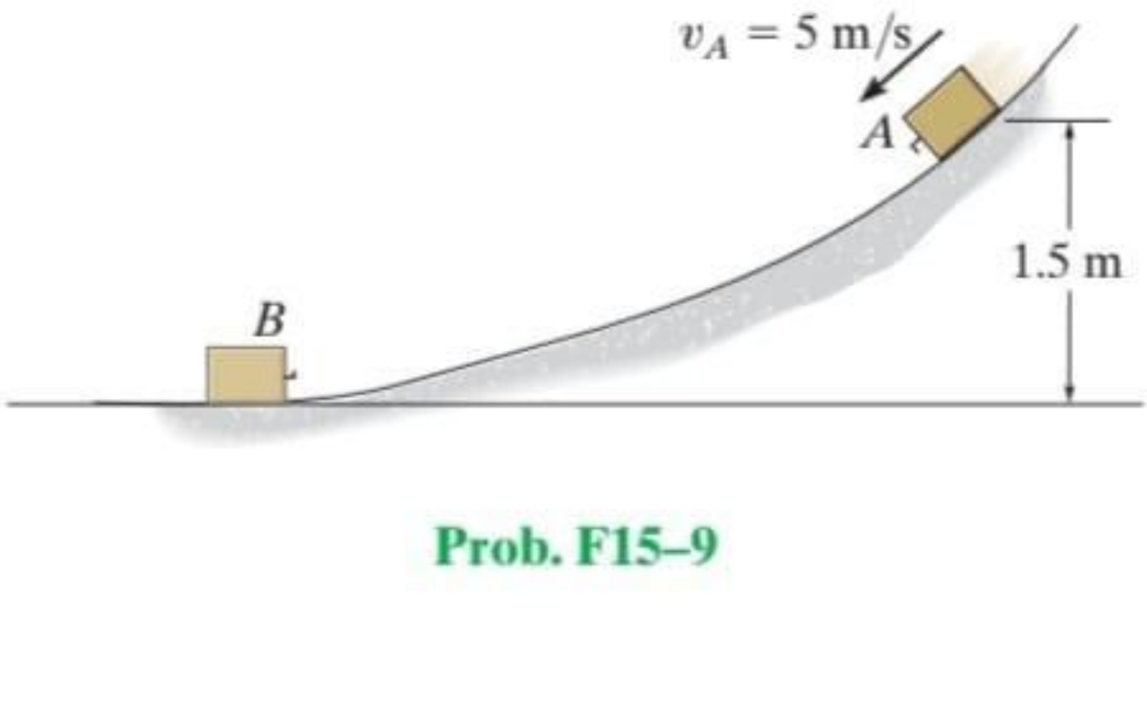
$$w\sin 45° = m a_t \; ; \; w = mg$$

$$a_t = \frac{w\sin 45°}{m} = \frac{mg}{m}\sin 45°$$

$$a_t = 9.81\sin 45°$$

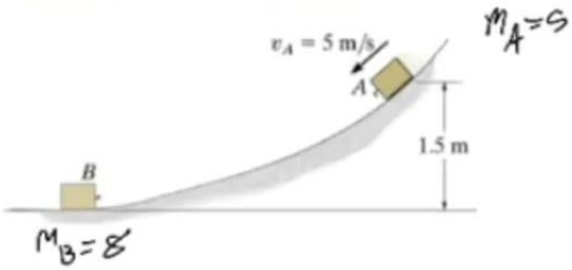
$$\boxed{a_t = 6.94\ m/s^2}$$

F15–9. The 5-kg block A has an initial speed of 5 m/s as it slides down the smooth ramp, after which it collides with the stationary block B of mass 8 kg. If the two blocks couple together after collision, determine their common velocity immediately after collision.



Prob. F15–9

F15–9. The 5-kg block A has an initial speed of 5 m/s as it slides down the smooth ramp, after which it collides with the stationary block B of mass **8 kg**. If the two blocks couple together after collision, determine their common velocity immediately after collision.



$$\Delta K = -\Delta U = -mg\Delta h$$

$$\tfrac{1}{2}(m_A+m_B)v_f^2 - \tfrac{1}{2}m_A v_i^2 = -m_A g\Delta h$$

$$\tfrac{1}{2}(m_A+m_B)v_f^2 = \tfrac{1}{2}m_A v_i^2 - mg\Delta h$$

$$v_f^2 = \frac{m_A(v_i^2 - g\Delta h)}{m_A+m_B} = \frac{5\,(5^2 + 9.81\times 1.5)}{13}$$

$$v_f^2 = 20.93\ \text{m}^2/\text{s}^2 \;\Rightarrow\; 4.58\ \text{m/s}$$

$$m_A v_A = (m_A+m_B)v_f$$

$$v_f = v_A\left(\frac{m_A}{m_A+m_B}\right)$$

$$= (7.378\ \text{m/s})\left[\frac{5\ \text{kg}}{5+8\ \text{kg}}\right]$$

$$\boxed{v_f = 2.84\ \text{m/s}}$$

$$\Delta K = -\Delta U$$

$$\tfrac{1}{2}m_A(v_A^2 - v_i^2) = -m_A g\Delta h$$

$$v_A^2 = v_i^2 - 2g\Delta h = (5\ \text{m/s})^2 - 2(9.81\ \text{m/s}^2)(-1.5\ \text{m})$$

$$v_A^2 = 54.43\ \text{m}^2/\text{s}^2 \;\Rightarrow\; v_A = 7.378\ \text{m/s}$$