

Solutions

2.1 C $a=10/5=2 \text{ m/s}^2$ and $T=m_1a=8 \text{ N}$.

Compare the rejected options: 10 N; 2 N; 40 N; 0 N. Use the stated model and conditions.

2.2 A Horizontal velocities cancel; vertical relative speed is $gt=20 \text{ m/s}$ downward.

Compare the rejected options: 20 m/s forward; 40 m/s downward; Zero; The aircraft speed forward plus 20 m/s downward. Use the stated model and conditions.

2.3 0.5. $a=m_2g/(m_1+m_2)=g/2$.

2.4 True. Net forces are m_1a and m_2a ; equal acceleration does not imply equal masses or forces.

3.1 $T_1 = m_1a$; $m_2g - T_2 = m_2a$; $(T_2 - T_1)R = I\alpha$. With $I = MR^2/2$ and $\alpha = a/R$, $T_2 - T_1 = Ma/2$. Thus $a = m_2g/(m_1 + m_2 + M/2)$, $T_1 = m_1m_2g/(m_1 + m_2 + M/2)$ and $T_2 = m_2(g - a)$. At $M = 0$ tensions become equal and the ideal result returns. Award body equations, torque/constraint, acceleration, tensions and limit.