

Solutions

2.1 Answer: B. Divide $Mg(L/2)\sin\theta$ by $ML^2/3$.

Compare the rejected options: $g \sin\theta/L$; $3g \cos\theta/(2L)$; $6g \sin\theta/L$; $g/(2L)$. Use the stated model and conditions.

2.2 Answer: C. Use $\beta/(1+\beta)=(2/5)/(7/5)=2/7$.

Compare the rejected options: $2/5$; $1/2$; $5/7$; $1/5$. Use the stated model and conditions.

2.3 3. The ratio is $\sqrt{9}$.

2.4 False. Drag balances the effective weight; it is generally nonzero.

3.1 Energy gives $Mgh = \frac{1}{2}Mv^2(1+2/5)$, hence $v = \sqrt{10gh/7}$. The slider has $v_s = \sqrt{2gh}$, so $v/v_s = \sqrt{5/7} < 1$. Slipping breaks $v = R\omega$ and can dissipate energy through kinetic friction. Award energy relation, speed, comparison and the constraint/loss distinction.