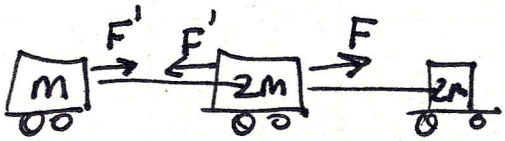
MWF Midterm Test Form A

(1) $a = \left|\frac{\Delta V}{\Delta t}\right| =$ $\quad V_{IN} = +30\ m/s \quad V_{OUT} = -26\ m/s$

$a = \left|\frac{-26-30}{0.02}\right| m/s^2 = 2800\ m/s^2$ **A**

(2)



Want F

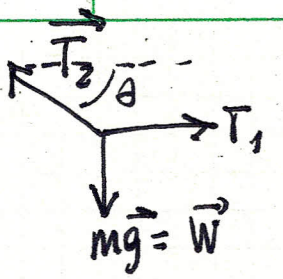
Two ways of doing it

- F must be enough to pull the two back cars with acceleration a $\quad F = 3ma$
- Net force on last car $F' = ma$
  Net force on middle car $F - F' = 2ma \Rightarrow F = 3ma$

$F = 3 \times 1000 \times 5\ N = 15{,}000\ N$ **C**

(3) Above it because the bullet will follow a parabolic trajectory **B**

④ FBD



$\theta = 37°$

$\vec{W} + \vec{T}_1 + \vec{T}_2 = 0$

x component $T_1 - T_2 \cos\theta = 0$

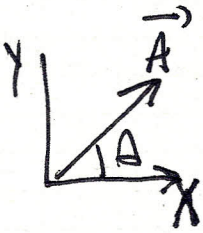
y component $T_2 \sin\theta - mg = 0 \Rightarrow T_2 = \frac{mg}{\sin\theta}$

Substitute into 1st equation

$T_1 - \left(\frac{mg}{\sin\theta}\right)\cos\theta = 0$ $\quad \boxed{T_1 = \frac{mg}{\tan\theta}}$

$T_1 = \frac{5000N}{\tan 37} = 6635N$ $\quad \boxed{D}$

⑤



This vector has $A_x > 0$ $A_y > 0$

θ is between 0° and 90° $\quad \boxed{A}$

⑥ $\boxed{C}$ Because the two masses are the same and $T = mg$ balances the weights

⑦ $V = V_0 - gt$ (positive is up)

$t = \frac{v_0}{g}$ is time to reach top (where $V = 0$)

Time in the air is twice that $\quad \boxed{C}$

8 FBD

Since the elevator is accelerating up, the net force must be up,
$N > W$ **B**

9 $\vec{N} + \vec{S} = \vec{M} \Rightarrow \vec{S} = \vec{M} - \vec{N}$ **B**

10 **E** If the velocity is constant then the acceleration must be zero

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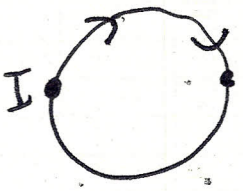

Displacement $= 2R = 60\,m$ **A**

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$$y = y_0 + V_{oy}t - \frac{gt^2}{2} = V_{oy}t - \frac{gt^2}{2}$$

$$y = 0 = V_{oy}t - \frac{gt^2}{2}$$

$$t = \frac{2V_{oy}}{g} = \frac{40}{9.8}\,s = 4.1\,sec$$ **E**

13 $$V = \frac{\Delta x}{\Delta t} = \frac{\Delta x_1 + \Delta x_2}{\Delta t_1 + \Delta t_2} = 6 = \frac{\Delta x_1 + \Delta x_2}{\frac{\Delta x_1}{V_1} + \frac{\Delta x_2}{V_2}} = \frac{6+6}{\frac{6}{50} + \frac{6}{90}}\ kph$$

$V = 64\ Km/hr$ **C**