Newton's Laws Test Review

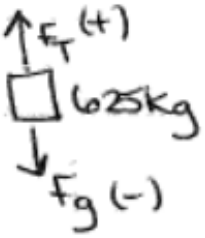
1. The defining characteristic between inertial and non-inertial frames of reference is acceleration. Inertial frames of reference are at rest or in uniform motion, they are not accelerating. Non-inertial frames of reference are accelerating ie/ a ball into a funnel if it is inertial the ball will go out of the tube and back in, if it is non-inertial the ball will not go back in the tube

2. Rocket Launch

1st law - objects @ rest stay @ rest or uniform velocity unless acted on by an external force. The rocket as it starts to launch will be slow, because it has to overcome inertia.

2nd law - $F_{net} = ma$ when the exhaust boosters and rockets are firing the F_{net} is the same, but because the mass of the rocket is changing the acceleration increases as it moves away from the earth

3rd Law - for every reaction there is an equal and opposite reaction. Exhaust comes out downward and the opposite force pushes the rocket upwards. Propelling the rocket upward into space.

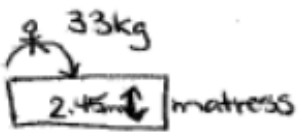
3. 

$a = 0.65 m/s^2$

a) $F_{net} = ma$
$F_{net} = (625)(0.65)$
$F_{net} = 406\ N$

b) $F_g = mg$
$F_g = (625)(9.81)$
$F_g = -6131.25\ N$

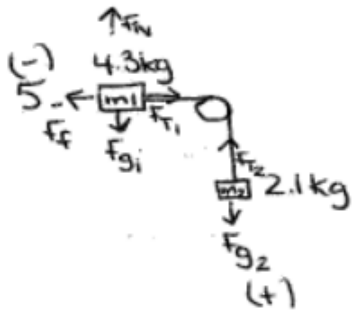
$F_{net} = F_g + F_T$
$406 = -6131.25 + F_T$ (+6131.25)
$6537.25 = F_T$

4. 

$v_0 = -20 m/s$
$v_f = 0 m/s$
$d_0 = 0$
$d_f = -2.45 m$
$m = 33kg$

a) $v_f^2 = v_0^2 + 2a(d_f - d_0)$
$(0)^2 = (-20)^2 + 2(a)(-2.45 - 0)$
$0 = 400 + 2a(-2.45)$
$0 = 400 + -4.9a$
$\frac{-400}{-4.9} = \frac{-4.9a}{-4.9}$
$81.63 m/s^2 = a$
$82 m/s^2 = a$

b) $F_{net} = ma$
$F_{net} = (33)(82)$
$F_{net} = 2706\ N$



$\mu_k = 0.15$

a) $a = ?$ $\quad \Sigma F = \Sigma ma$

$F_f + F_{g_2} = (m_1 + m_2)a$

$\mu F_N + (2.1)(9.81) = (4.3+2.1)a$

$-(0.15)(4.3)(9.81) + 20.60 = 6.4a$

$-6.33 + 20.60 = 6.4a$

$\frac{14.27}{6.4} = \frac{6.4a}{6.4}$

$2.23 \text{ m/s}^2 = a$

b) $F_T = ?$ $\quad \Sigma F = \Sigma ma$

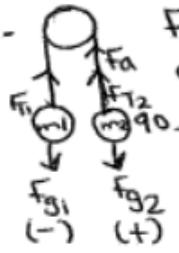
$F_{g_2} + F_{T_2} = m_2 a$

$20.60 + F_{T_2} = (2.1)(2.23)$

$20.60 + F_{T_2} = 4.68 - 20.60$

$F_{T_2} = -15.92 \text{ N}$

6.



$F_a = 275 \text{ N}$

$a = 1.60 \text{ m/s}^2$

a) $\Sigma F = \Sigma ma$

$F_{g_1} + F_{g_2} + F_a = (m_1 + m_2)a$

$-(m)(9.81) + (90)(9.81) + -275 = (m_1 + 90)(-1.6$

$-9.81m_1 + 882.90 - 275 = -1.60m_1 - 144$

$-9.81m_1 + 607.90 = -1.60m_1 - 144 + 144$

$-9.81m_1 + 751.90 = -1.60m_1 + 9.81m_1$

$\frac{751.90}{8.21} = \frac{8.21m_1}{8.21}$

$91.58 \text{ kg} = m_1$

b) $F_T = ?$ $\quad \Sigma F = \Sigma ma$

$F_{g_1} + F_{T_1} = m_1 a$

$-(91.58)(9.81) + F_{T_1} = (91.58)(-1.60)$

$-898.40 + F_{T_1} = -146.53 + 898.40$

$F_{T_1} = 752 \text{ N}$