Reminders 02-11-10:

-3rd POW due Tuesday by 5PM

-Quiz 4 in lecture Thursday.

-Homework 5 Due Wednesday the 17th.

Objectives:

-Newton's Laws of Motion

-Free-Body Analysis

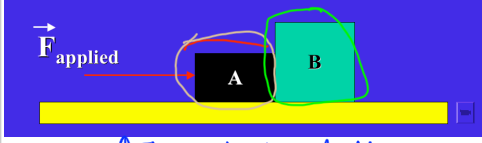
-Examples, Examples, Examples

Misconceptions of force concept (please acknowledge and avoid these):

1. Forces are caused by animate objects.
2. If F=0, object must stop moving.
3. Motion requires force.
4. Net force is proportional to velocity.
5. Object at rest means no force acting on it.
6. Tension is the sum of forces acting on a string.
7. The forces that an object exerts on its surrounds affect its own motion.
8. A horizontal force can cancel a vertical force.
9. The motion of an object is only in the direction of the net force.
10. Friction always hinders motion.
11. Large objects always exert greater forces than small objects

Two blocks are resting on a frictionless table. Block A has mass of 1 kg and block B has mass 2 kg. A 3 N force is applied to block A as shown.

- What are the forces that are acting?
- What is the acceleration of the system?
- What's the displacement after 2 s?
- What is the force of A on B?



Force of table on A, N_A

Applied force — A — Force of B on A, F_{BA}

Force of Earth on A, $m_A g$

N_A

F_{APP} — A — F_{BA} — +

$m_A g$

Apply Newton's 2nd Law

$\Sigma F_x = F_{APP} - F_{BA} = m_A a$

$\Sigma F_y = N_A - m_A g = 0$

$N_A = m_A g$

Force of A on B, F_{AB}

Force of table on B, N_B

Force of Earth on B, $m_B g$

N_B

F_{AB} — B

$m_B g$

$\Sigma F_{x_B} = F_{AB} = m_B a = 2(1) = 2N$

$\Sigma F_{y_B} = N_B - m_B g = 0 \quad N_B = m_B g$

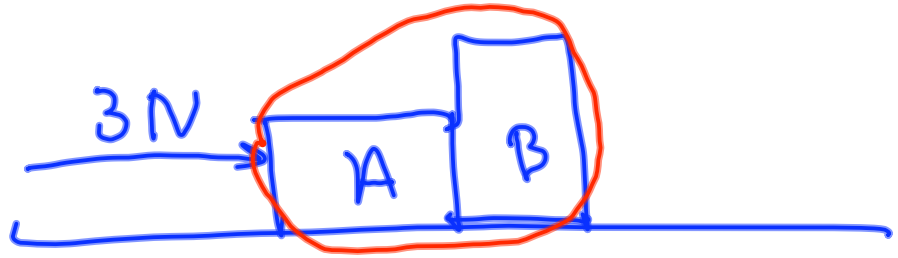
$F_{APP} - F_{BA} = m_A a$

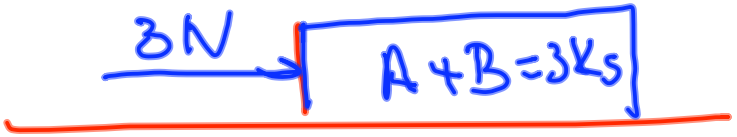
$F_{AB} = m_B a$

$F_{AB} = 2N \quad F_{BA} = 2N$

$F_{APP} = (m_A + m_B) a$

$a = \frac{F_{APP}}{m_A + m_B} = \frac{3N}{3kg} = 1 \frac{m}{s^2}$



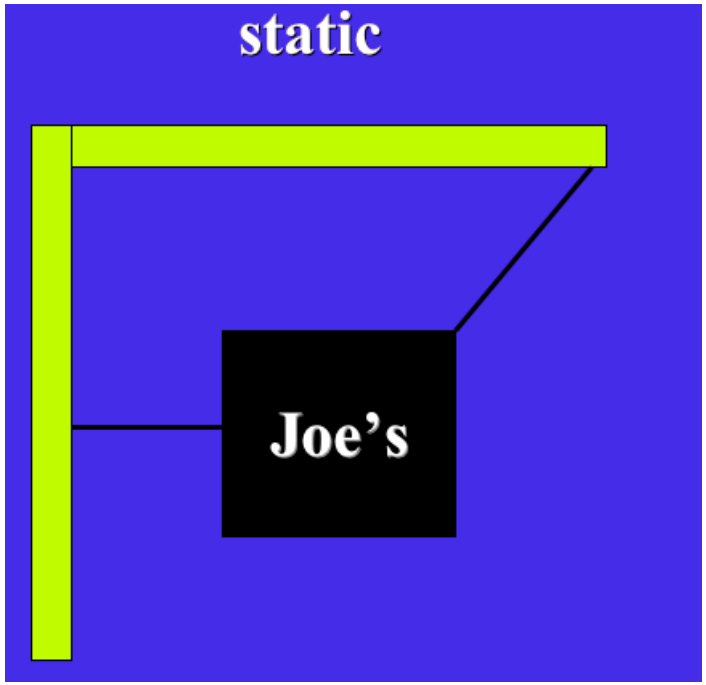


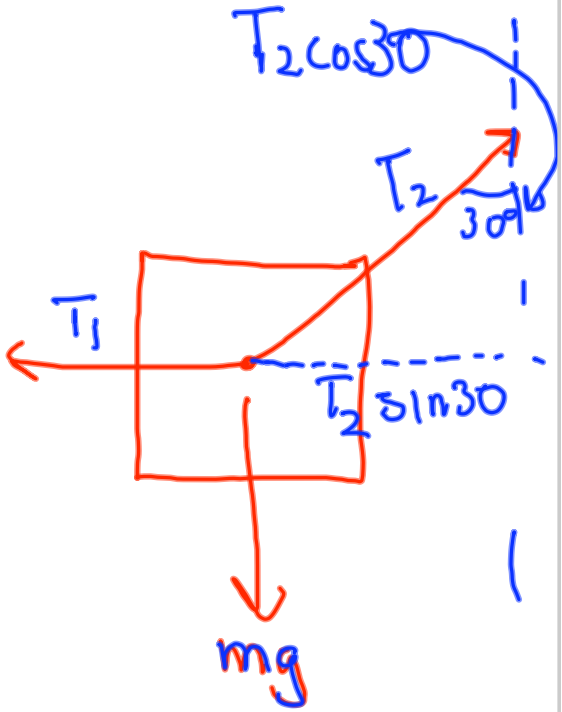
Want displacement after 2 s.

$$\Delta x = \frac{1}{2} a t^2 = \frac{1}{2}\left(1\frac{m}{s^2}\right)(2s)^2$$

$$= 2m$$

$V_f = 2 m/s$ because $V = at$





$$\sum F_x = -T_1 + T_2 \sin 30 = 0$$

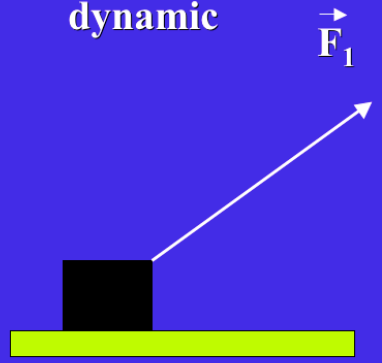
$$\sum F_y = -mg + T_2 \cos 30 = 0$$

$$T_2 = \frac{mg}{\cos 30} = \frac{(100\,kg)(9.8\,m/s^2)}{\cos 30}$$

$$T_2 = 1130\,N$$

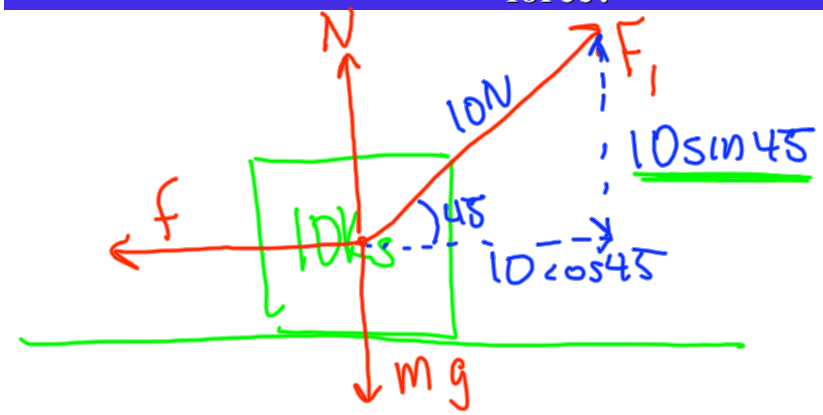
$$T_1 = T_2 \sin 30 = 1130 \sin 30 = 565\,N$$

dynamic



V = constant

A 10 kg mass is at rest on a table. When a 10 N force is applied at an angle of 45° the mass moves at a constant 1 m/s. What is the frictional force and the normal force exerted by the table? If F_y>98N, what is the normal force?



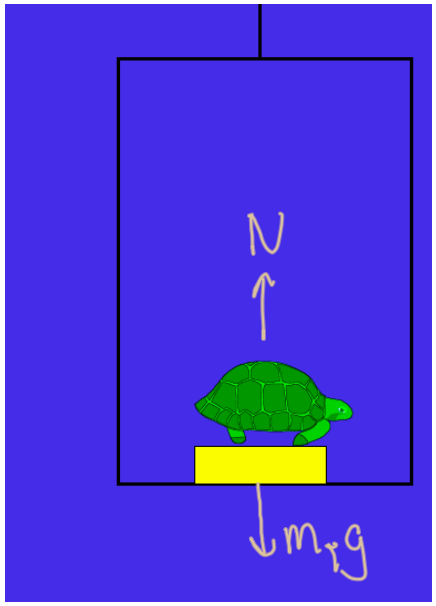
$\Sigma F_x = 10\cos 45 - f = 0$

$f = 10N\cos 45 = 7.1N$

$\Sigma F_y = N - mg + 10\sin 45 = 0$

$N = mg - 10\sin 45 = 0$

$= 98N - 7.1N = \underline{90.1N}$



$N - mg = ma$

$N = mg + ma$

$= m(g + a)$

a) $a = 0$

$N = mg = 50(9.8)$

$= 490N$

b) $a = 4\ m/s^2$

$N = 50(9.8+1) = 50(10.8)$

$= 540N$

c) $a = 0 \quad N = 490N$

d) $a = -1\ m/s^2$

$N = 50(9.8-1) = 50(8.8)$

$= 440\ N$

Forces on Elevator