Reminders 9-22-10:

-Exam 1 Average 69%

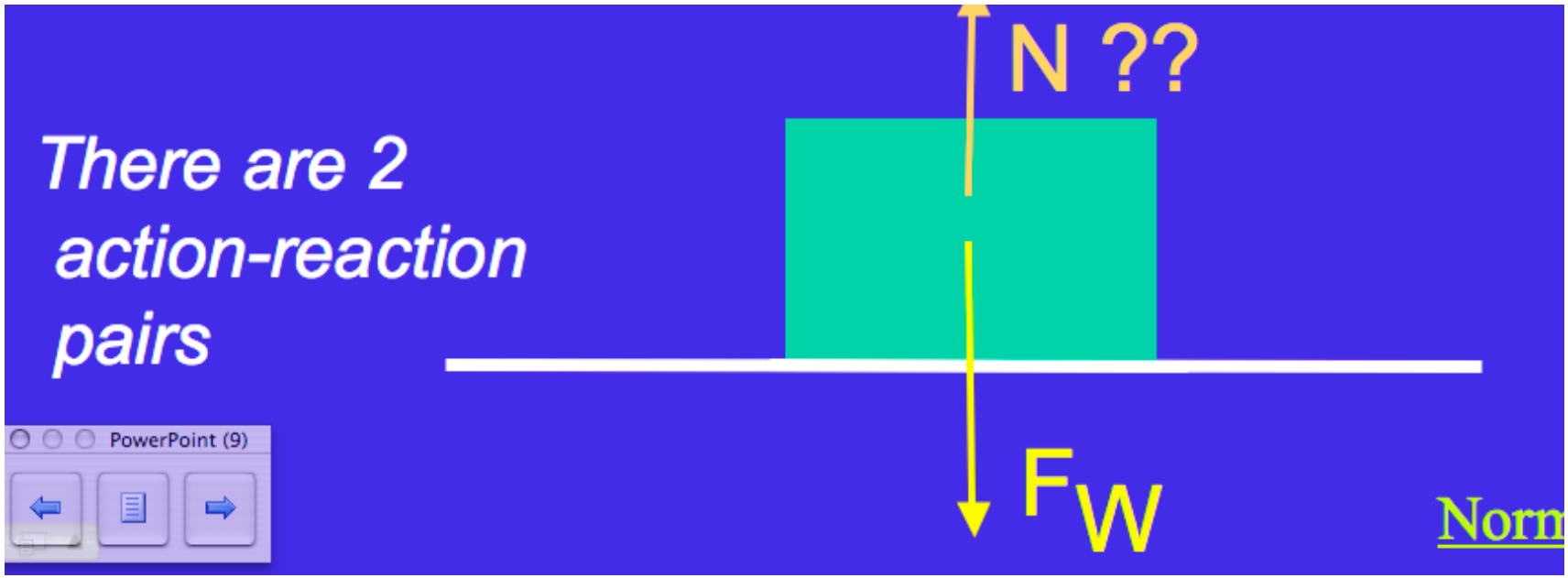
-Quiz Wednesday on Chapter 4

-Next Homework Due September 28

-Update grades will be posted on Blackboard under the "Course Files" tab

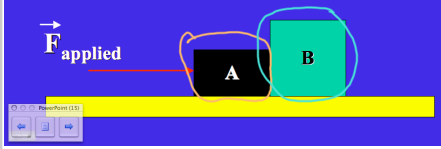
Objectives:

-Newton's 2nd and 3rd Laws + Examples


There are 2
action-reaction
pairs
N ??
F_W
Norm
PowerPoint (9)

Example:

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?



What's touching A?

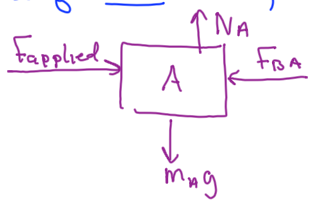
Object B, B exerts force on A, F_{BA}

Table, exerts force on A, N_A

F_{BA} = force of B on A

N_A = Force of table on A

Force of Earth on A, $m_A g$



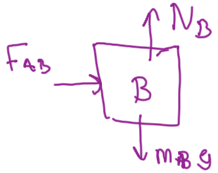
Object B

Table touches B; A touches B

Force of table on B, N_B

Force of A on B, F_{AB}

Force of Earth on B, $m_B g$



$\Sigma F_{A_y} = N_A - m_A g = 0$

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

ds

$F_{applied} \rightarrow \boxed{3K_s}$

$$f_{AB} = (2K_s)(1\ m/s^2) = 2N$$

$$\Delta x = \frac{1}{2}(1\ m/s^2)(2)^2 = 2m$$

$$\sum f_{Ax} = f_{Applied} - f_{BA} = m_A a$$

$$\sum f_{Bx} \qquad f_{AB} = m_B a$$

Add equations $\quad f_{Applied} = (m_A + m_B)\, a$

$$a = \frac{F_{applied}}{m_A + m_B}$$

$$= \frac{3N}{2kg + 1kg} = 1 \frac{m}{s^2}$$

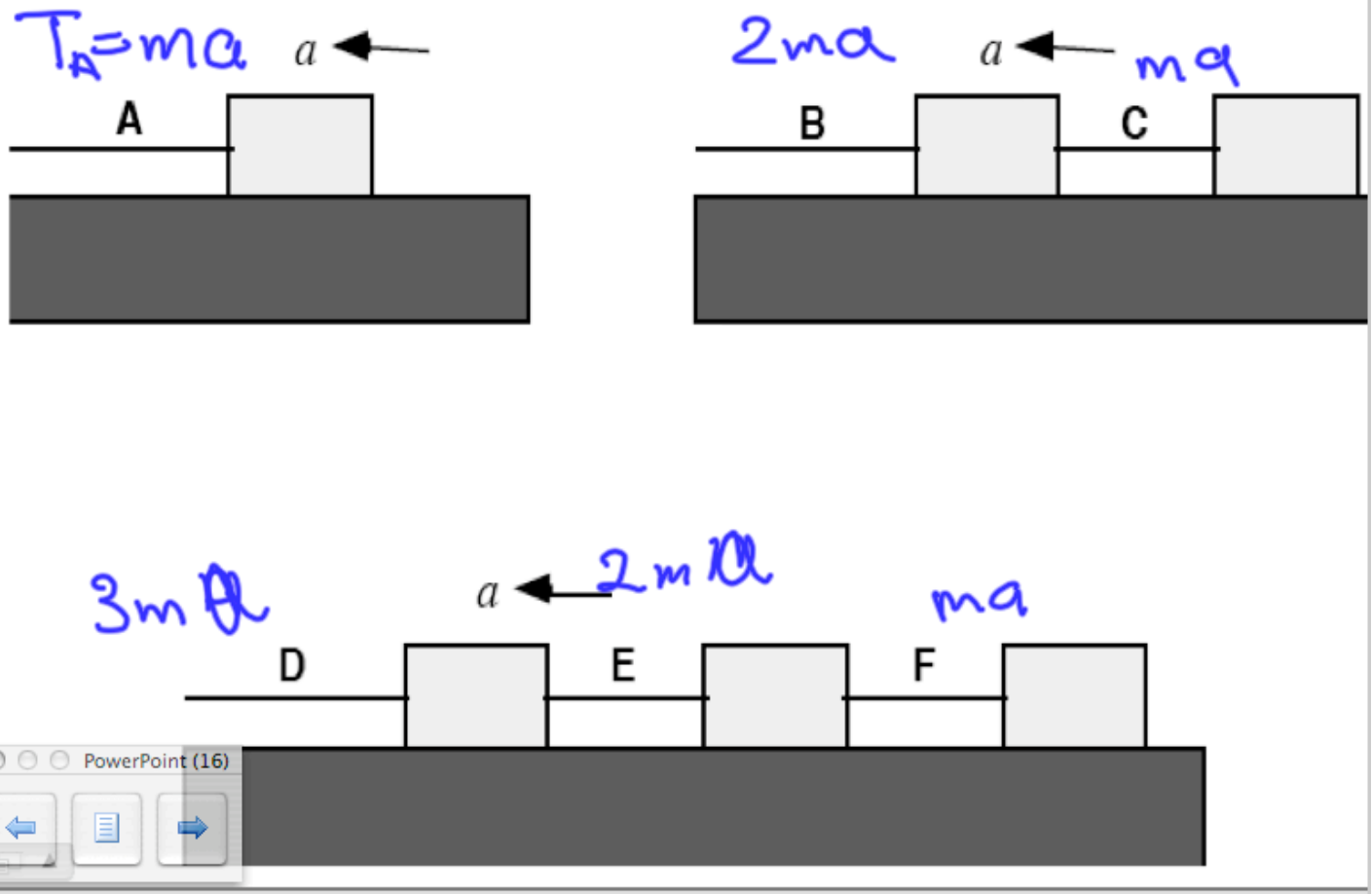
$$f_{AB} = (2kg)(1 m/s^2) = 2N$$

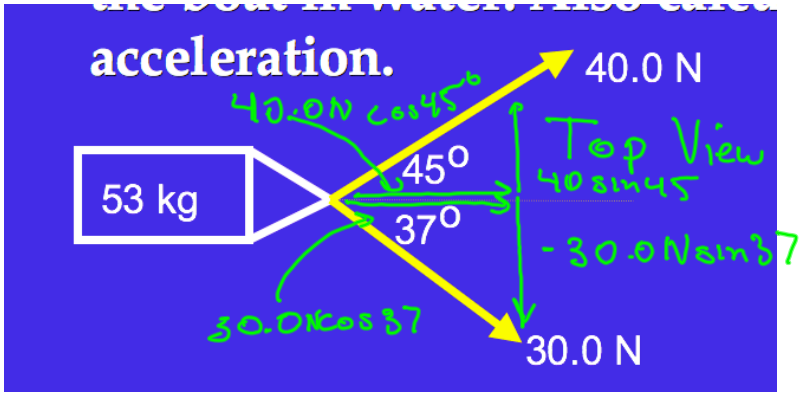
$$f_{BA} = 2N$$

The figures below show boxes that are being pulled by ropes along frictionles toward the left. All of the boxes are identical, and the acceleration is the same in see, some of the boxes are pulled by ropes attached to the box in front of them.

Rank the ropes from greatest to least on the basis of the tension in the rope.

D, BE, ACF





$\sum F_x = 40.0N\cos 45^\circ + 30.0N\cos 37^\circ = ma_x$

$\sum F_y = +40.0N\sin 45 - 30.0N\sin 37 = ma_y$

$52.2N = ma_x \quad a_x = \frac{52.2N}{53kg}$

$10.2N = ma_y \quad a_y = \frac{10.2N}{53kg}$

$a_x = 0.98 m/s^2$

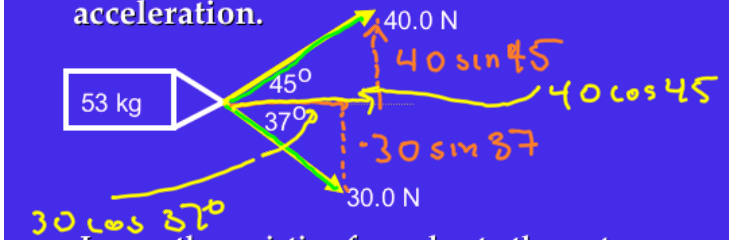
$a_y = 0.19 m/s^2$

$a = \sqrt{.98^2 + .19^2} = 1.0 \frac{m}{s^2}$

$\theta = \tan^{-1}\frac{a_y}{a_x} = \tan^{-1}\frac{.19}{.98}$

$\theta = 11^\circ$ above horizontal

- Calculate the sum of the forces acting on the boat in water. Also calculate its acceleration.



Ignore the resistive force due to the water.

Ans: 53.3 N 11.0° above horizontal; 1.0 m/s² 11.0°

$\sum F_x = 40\cos 45 + 30\cos 37° = 52.3N$ (28.3, 24)

$\sum F_y = 40\sin 45 - 30\sin 37 = 5.3N$ (28.3, 18)

$|\vec{F}_{net}| = \sqrt{(52.3)^2 + (5.3)^2} = 53.3N$

$\theta = \tan^{-1}\left(\frac{5.3N}{52.3N}\right) = 11.0°$ above + X-axis

$F_y = ma_y \quad a_y = \frac{F_y}{m} \quad \theta = \tan \frac{F_y/m}{F_x/m}$

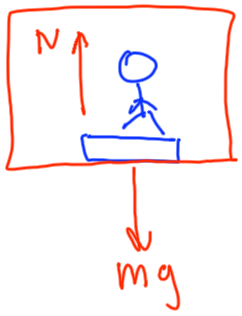
$F_x = ma_x \quad a_x = \frac{F_x}{m}$

$a_y = \frac{5.3N}{53kg} =$

$a_x = \frac{52.3N}{53kg} =$

$\sqrt{\left(\frac{5.3}{53}\right)^2 + \left(\frac{52.3}{53}\right)^2} = 1.0$

A 100.0 kg person is standing on a spring scale (which reads weight in N) in an elevator. The elevator accelerates upward at 1.2m/s². When he looks down at the scale what does it read? What is the acceleration is 1.2m/s² downward?



N is force of scale on person; Scale reads Normal Force

$$N - mg = ma$$

$$N = mg + ma = m(g+a)$$

if $a = 0$ $N = mg$

if $v \neq 0$ but $a = 0$, $N = mg$

$a = 1.2\ m/s^2$ up

$$N = 100\ kg\left(9.80\ \frac{m}{s^2} + 1.2\ \frac{m}{s^2}\right)$$

$$= 1100\ N$$

$a = 1.2\ m/s^2$ down

$$N = 100\ kg\left(9.80\ \frac{m}{s^2} - 1.2\ \frac{m}{s^2}\right)$$

$$= \underline{860\ N}$$