NEWTON'S THREE LAWS OF GRADUATION

Though famous for his seminal work in Mechanics, Isaac Newton's theories on the prediction of a doctoral graduation formulated while still a grad student at Cambridge remain his most important contribution to academia.

FIRST LAW

"A grad student in procrastination tends to stay in procrastination unless an external force is applied to it"

This postulate is known as the "*Law of Inertia*" and was originally discovered experimentally by Galileo four years before Newton was born when he threatened to cut his grad student's funding. This resulted in a quickening of the student's research progress.

Galileo's observations were later perfected by Descartes through the application of "Weekly Meetings."

Before Galileo's time, it was wrongfully thought that grad students would rest only as long as no work was required of them and that in the absence of external forces, they would graduate by themselves.

(From Encyclopaedia Britannica)

PHD.STANFORD.EDU

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mon/wed/fri, 12:50-2:05pm, 370-370

e14 - applied mechanics: statics

day	date		topic	chapter
	w01		force week	ch 1-2
mon	mar	28	what's statics?	1.1-1.5
wed	mar	30	what's a force?	2.1-2.4
fri	apr	01	what's a force resultant?	2.5-2.9
	w02		particle week	ch 3
mon	apr	04	what's a free body diagram at a point?	3.1-3.2
wed	apr	06	what's force equilibrium at a point?	3.3-3.4
fri	apr	08	problem session 1	
	w03		moment week	ch 4
mon	apr	11	what's a moment?	4.1-4.4
wed	apr	13	what's a couple? what's distributed loading?	4.5-4.7
fri	apr	15	problem session 2	
	w04		practice week	ch 1-4
mon	apr	18	problems, problem, problems ...	
wed	apr	20	midterm 1, in class, closed book, 1 cheat sheet	
fri	apr	22	recover-from-midterm friday / no problem session	
	w05		2d equilibrium week	ch 5
mon	apr	25	what's a free body diagram of a 2d system?	5.1-5.2
wed	apr	27	what force and moment equilibrium in 2d?	5.3-5.4
fri	apr	29	problem session 3	

first homework due

syllabus

e14 - applied mechanics: statics

Homework I - Chapters 1 and 2

due Friday, 08/04/11, 12:50pm, 370-370

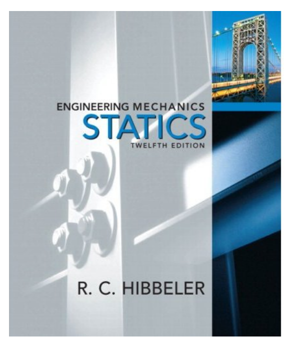
For late homework, you are responsible to arrange drop off with our grader Kaushik Mani, kmani@stanford.edu. Once you have used up your three late days, you will no longer receive points for your homework. Here are our office hours and emails.

when	when	where	who	email
Tuesdays	06:00 - 07:30pm	Durand 247	Charbel	ceid@stanford.edu
Wednesdays	02:30 - 04:00pm	Durand 217	Ellen	ekuhl@stanford.edu
Wednesdays	05:00 - 06:30pm	Durand 393	Chris	cploch@stanford.edu
Thursdays	10:00 - 11:30am	Durand 203	Joules	jmgould@stanford.edu
Thursdays	01:00 - 02:30pm	Durand 393	Estevan	estevanm@stanford.edu

For this homework, you need to be familiar with chapters 1 and 2 of your book! You may skip pages 22-31.

homework #01

e14 - applied mechanics: statics

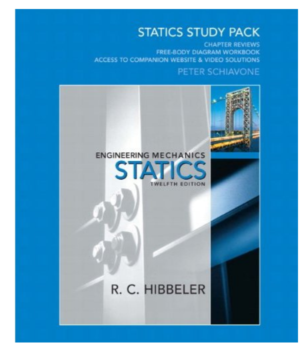


textbook.

russell c. hibbeler
prentice hall, 12th edition

engineering mechanics statics

read chapters 1 and 2 for homework #1



homework #01

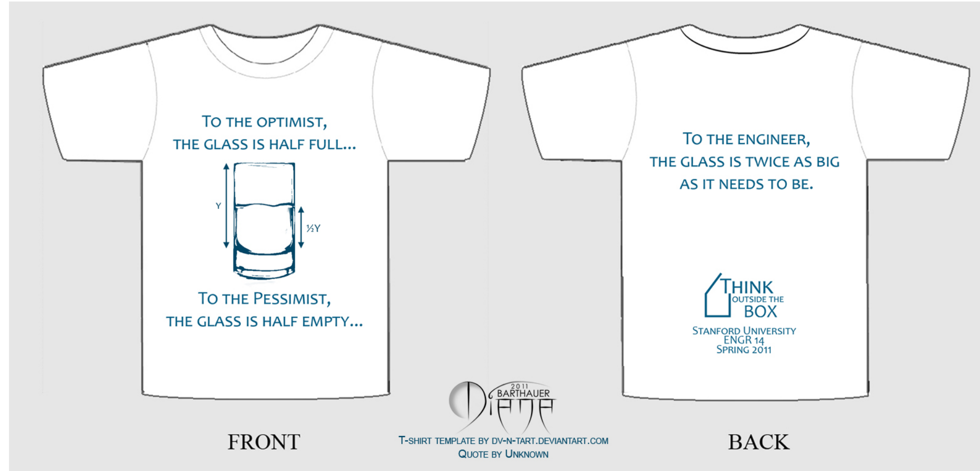
e14 - applied mechanics: statics

design your own E14 statics t-shirt!

- designs can only be single color.
- designs can cover both front and back, but could also be single sided
- everybody who uploads one or more designs into the drop box will receive 5 extra bonus points for this homework
- the top three designs will receive another 5 extra bonus points
- the best design will be elected as our E14 shirt
- everybody in class will receive a free shirt

upload your design into the drop box on coursework!

design your own e14 t-shirt!



©diana barthauer

design your own e14 t-shirt!

©brandon skerda

design your own e14 t-shirt!

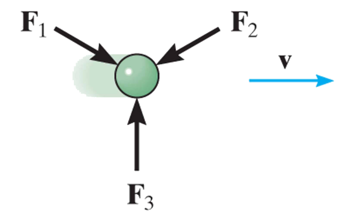
@brandon skerda

today's objectives

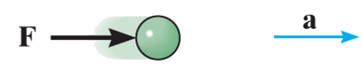
- to introduce the concept of the free-body diagram for a particle
- to show how to solve particle equilibrium problems using the equations of equilibrium
- when cables are used for hoisting loads, the must be selected so that they do not fail. today, we will show how to calculate cable forces for such cases

newton's three laws of motion

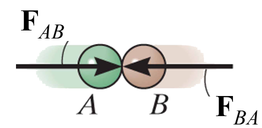
- first law
  equilibrium
  if $\sum \boldsymbol{F} = \boldsymbol{0}$ then $\boldsymbol{v} = \text{const.}$



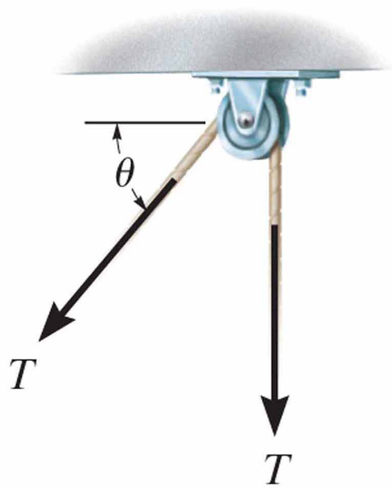
- second law
  accelerated motion
  $\boldsymbol{F} = \boldsymbol{m} \cdot \boldsymbol{a}$ $= \boldsymbol{0}$



- third law
  actio = reactio
  $\boldsymbol{F}_{AB} = - \boldsymbol{F}_{BA}$

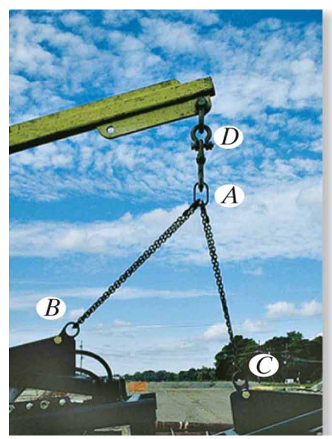


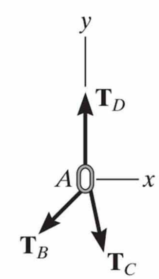
assumptions - cables and pulleys



- **cables.** unless otherwise stated, we will assume that all cables have a **negligible weight** and **cannot stretch**. they can only support **tension** along their axis.
- **pulleys.** for now, we assume that pulleys are **frictionless**, i.e., the tension force of a cable that passes over a pulley may change its direction but not its magnitude.

procedure for drawing a FBD





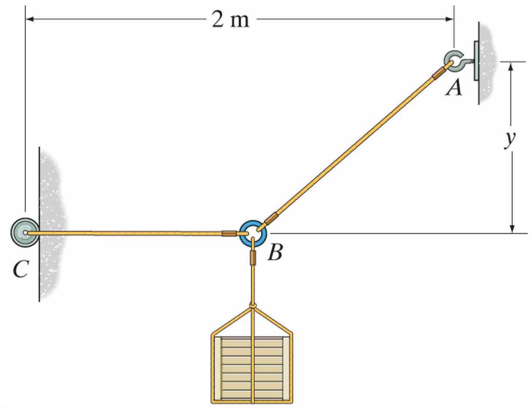
I. isolate the particle of interest - easy ;-)
here shown for particle A

II. show all forces - tricky!
3 cables, 3 tension forces
assume directions

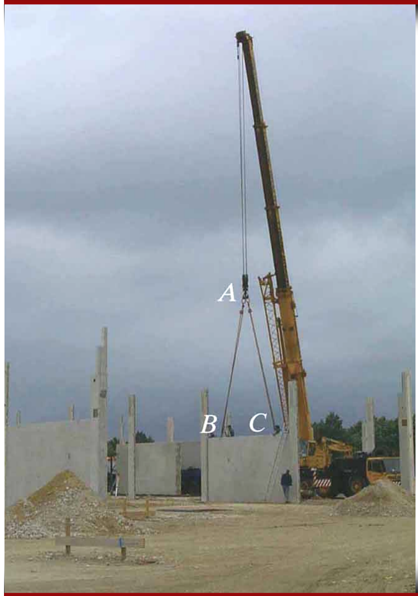
III. label each force - easy ;-)

problem 3-1

determine the force in each cord for equilibrium of the 200kg crate. cord BC remains horizontal due to the roller at C, and AB has a length of 1.5m. set y = 0.75m.

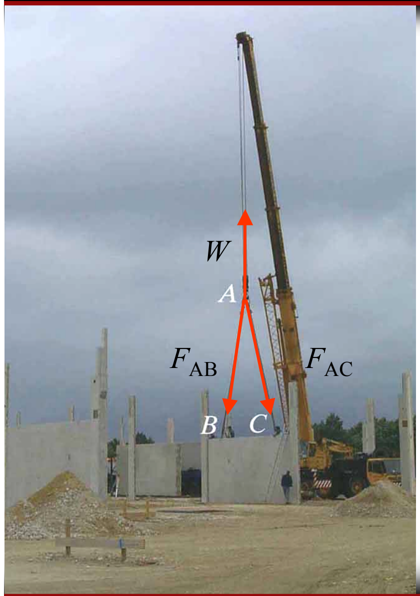


conceptual problem 3-1



the concrete wall panel is held in position using the two cables AB and AC of equal length. establish appropriate dimensions and use an equilibrium analysis to show that the longer the cables, the less the forces in each cable.

conceptual problem 3-1



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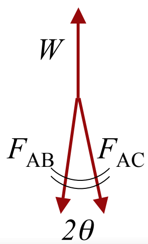
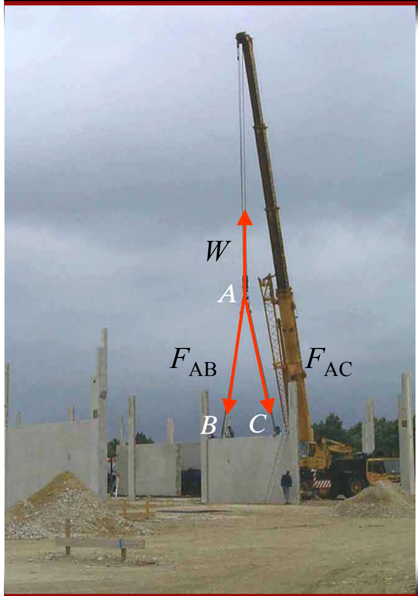
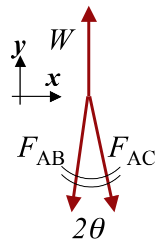


conceptual problem 3-1



show that the longer the cables, the less the forces in each cable.

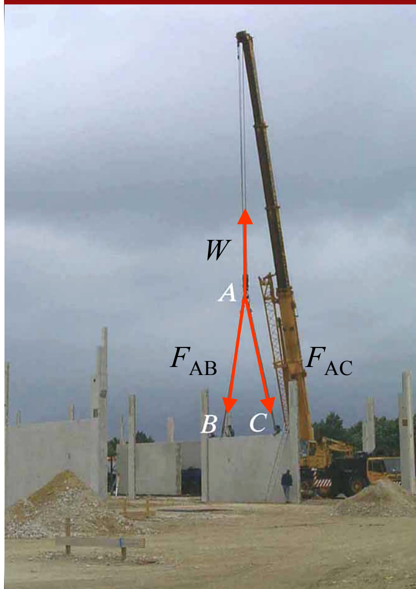


$$\Sigma F_x = 0$$
$$F_{AB}\sin\theta - F_{AC}\sin\theta = 0$$
$$F_{AB} = F_{AC}$$

$$\Sigma F_y = 0$$
$$W - F_{AB}\cos\theta - F_{AC}\cos\theta = 0$$
$$F_{AB} = F_{AC} = W/(2\cos\theta)$$

for longer cables, the angle θ becomes smaller, $\cos\theta$ becomes bigger, and F_{AB} and F_{AC} become smaller.

conceptual problem 3-1



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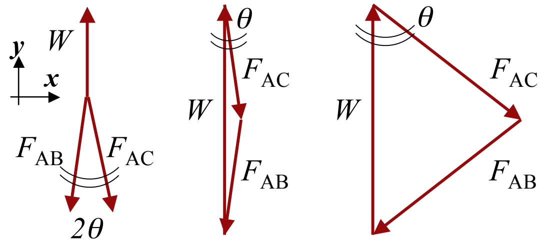
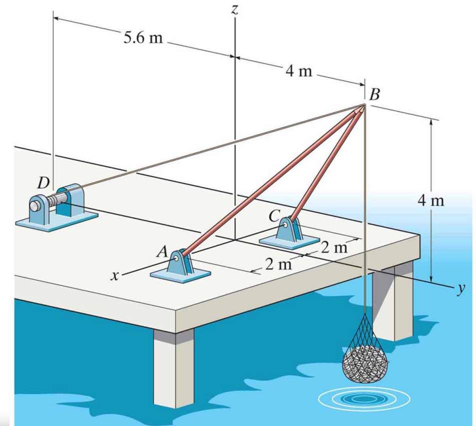


for longer cables, the angle θ becomes smaller, $\cos\theta$ becomes bigger, and F_{AB} and F_{AC} become smaller.

problem 3-47

the shear leg derrick is used to haul the 200kg net of fish onto the dock. determine the compressive force along each of the legs *BA* and *BC* and the tension in the winch *BD*.



problem 3-47

the shear leg derrick is used to haul the 200kg net of fish onto the dock. what would happen if we moved points *A*, *B*, and *D* closer together?