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Physics 111 - Class 7A
Force Applications I

October 18, 2021

Do not draw in/on this box!

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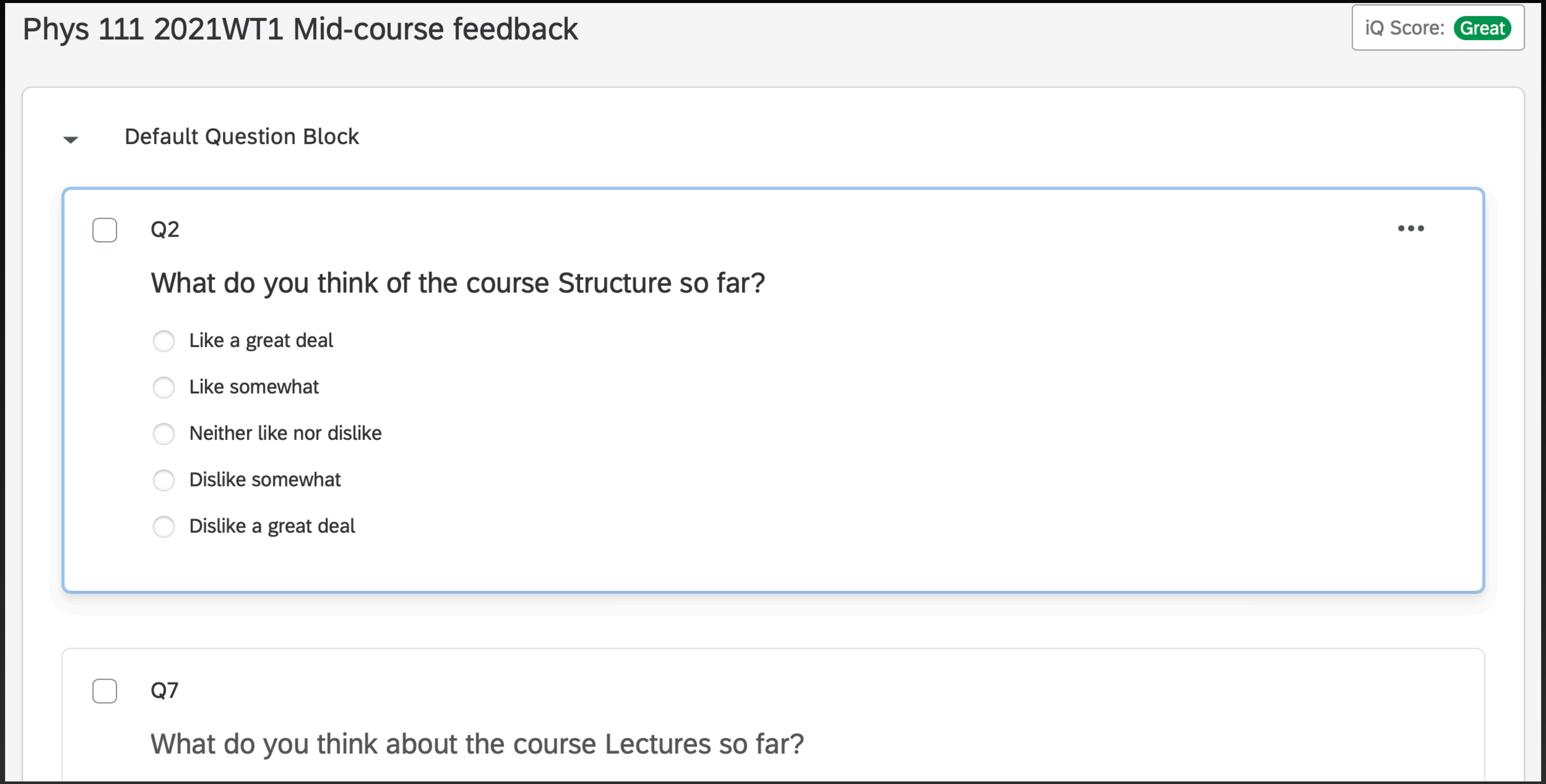
Class Outline

- Logistics / Announcements
- Mid-course Feedback Results
- Test 2 Reflection
- Introduction to Chapter 6
- Clicker Questions
- Activity: Worked Problems

Logistics/Announcements

- Lab this week: Lab 4
- HW6 due this week on Thursday at 6 PM
- Learning Log 6 due on Saturday at 6 PM
- HW and LL deadlines have a 48 hour grace period
- Test/Bonus Test: Bonus Test 2 available this week (Chapters 3 & 4)
    - Test Window: Friday 6 PM - Sunday 6 PM

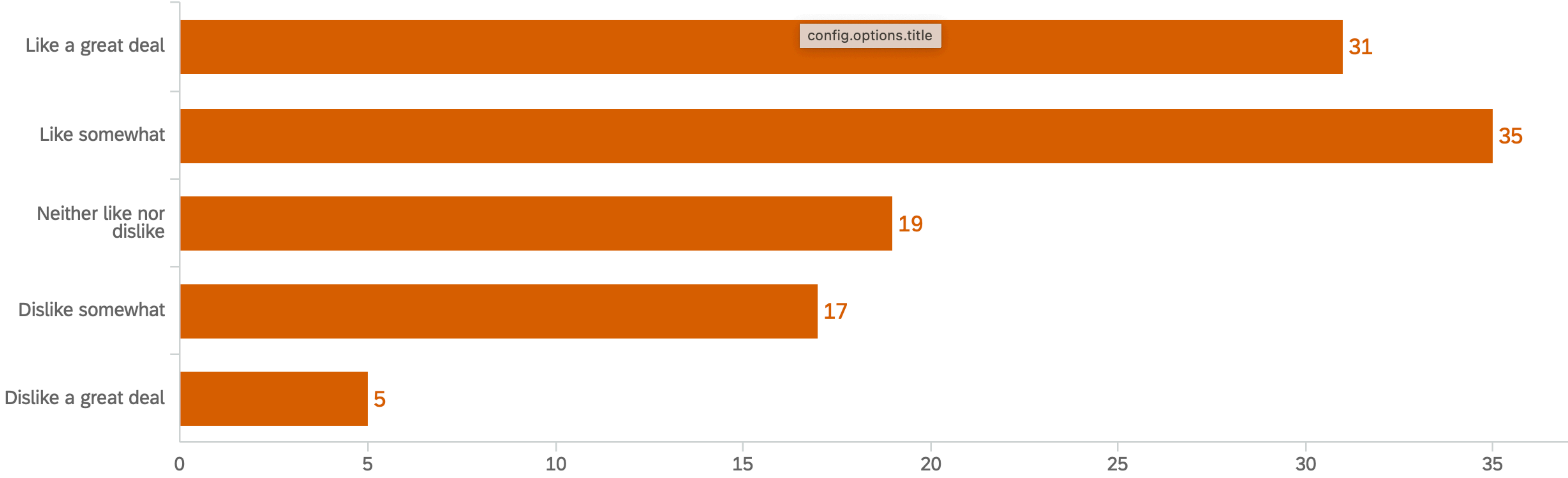
Mid-course Feedback Results



- 107 respondents (class of 304)
  - Thank you for taking the time to submit the feedback!

Mid-course Feedback Results

What do you think of the course Structure so far?



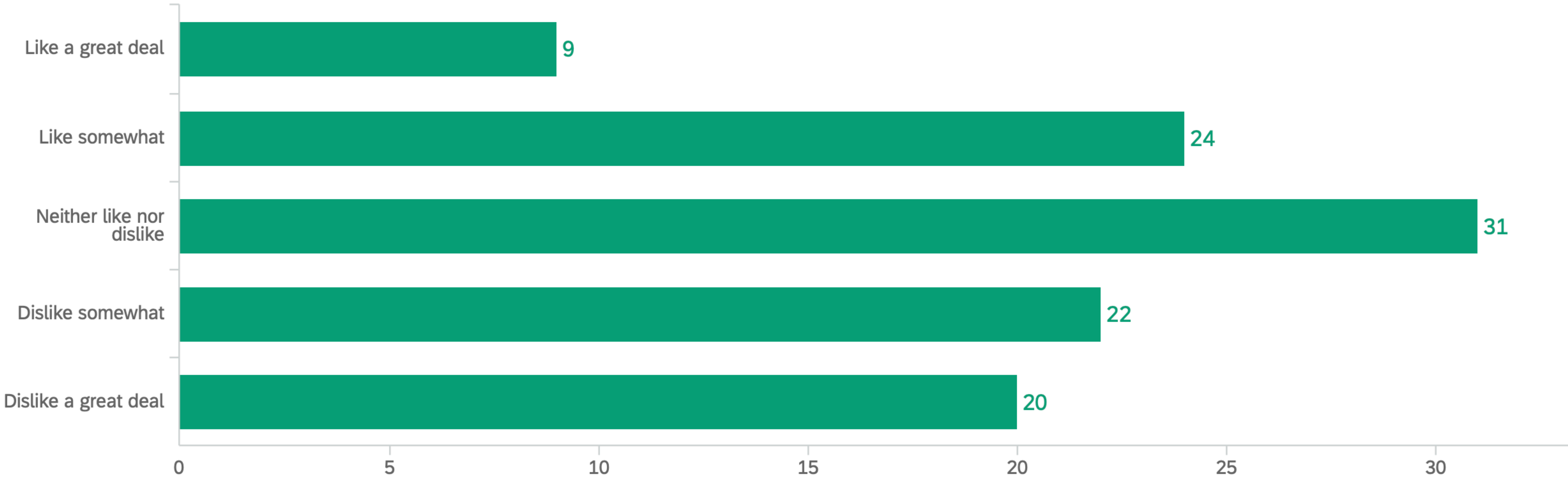
Mid-course Feedback Results

Mid-course Feedback Results

How difficult are you finding the content we cover in lecture?

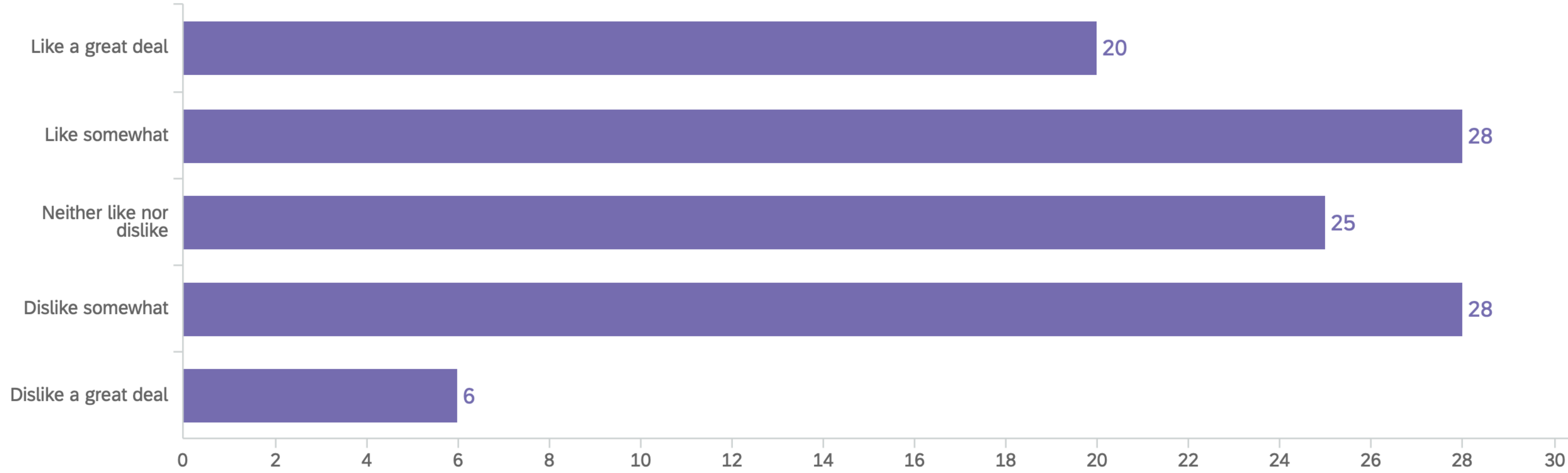
Mid-course Feedback Results

What do you think about the course Labs so far?



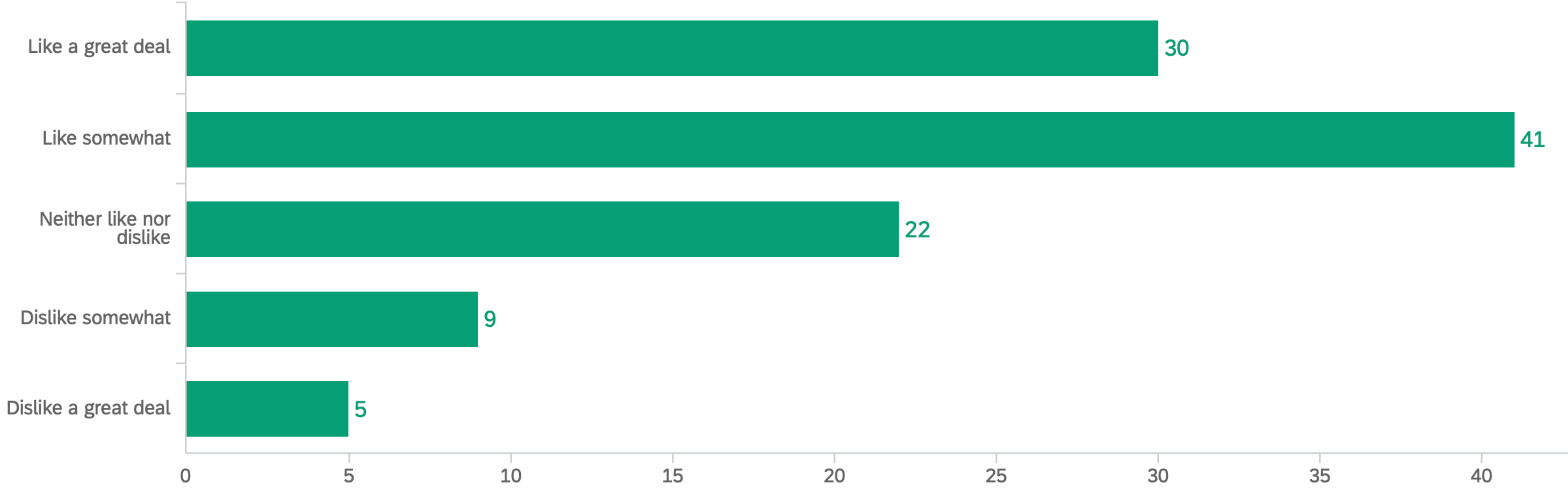
Mid-course Feedback Results

What do you think of the course Homework so far?



Mid-course Feedback Results

What do you think of the course Learning Logs so far?



Mid-course Feedback Results

Do you feel that you are getting sufficient feedback in the course so far?

Mid-course Feedback Results

Overall, How do you think the course is going so far ?

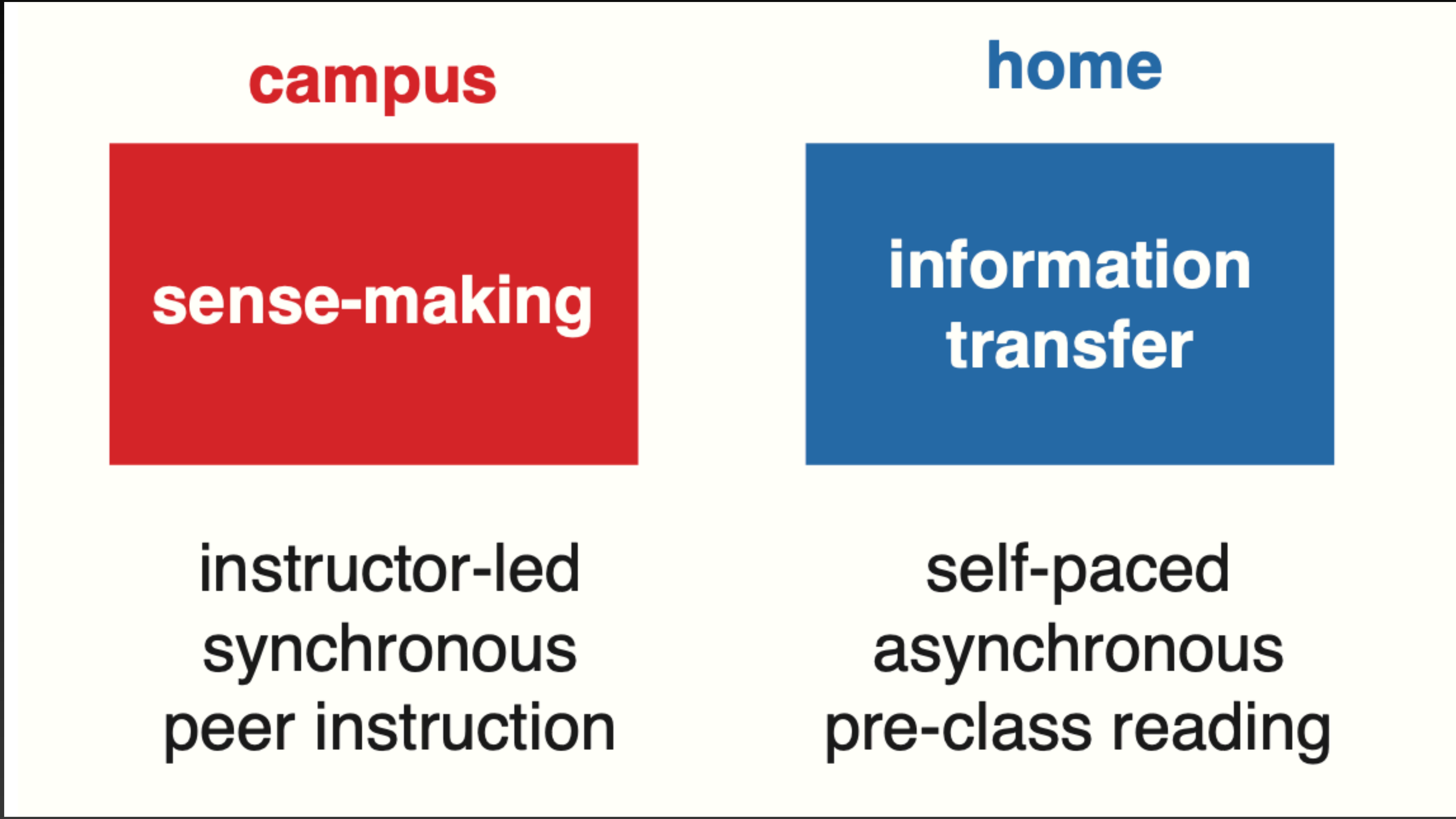
Mid-course Feedback Results

Start	My response
Doing more examples in class	*I'll try, but the classes are pretty jam-packed already and many students are asking to complete the full examples, rather than leave it in algebra…*
Teaching the introductory concepts we need for the HW (lecturing)	*Unfortunately, this cannot happen ; this is a flipped classroom and I already feel like I'm lecturing "a bit too much". You should teach yourself the concepts outside of class and come to class to practice them.*
Review HW problems in class	*Ok. I think I can probably do this during my Student Hours after class on Monday and Wednesdays.*
Provide practice problems for weekly HW	*Done! In the readings each week, we will provide some practice Qs.*
Doing harder problems in class	*This is controversial…*
Doing easier problems in class	*This is controversial…*
Adding more time for breakout rooms	*This is controversial…*

Mid-course Feedback Results

Stop	My response
Using breakout rooms, they're not helpful because nobody talks :-(	Okay - no more breakout rooms... This is the one downside of online teaching, people are less willing to talk behind a screen than in person!
Making the Learning Log deadline so late in the week	It has to come at the end of the week, if I set it any earlier, people just complete it to "get it out of the way". Maybe you do that anyway, but to me it "feels better" having it at the end of the week. You are more than welcome to use the grace period if you want to do it on Monday instead!
Making the tests so long (and hard)!	Sorry! Test 2, admittedly, was longer than I wanted it to be!
Making us teach ourselves the course material	See next slide...

Twilight of the Lecture: Peer Instruction for Active Learning
- Dr. Eric Mazur



Reference: Twilight of the Lecture

Mid-course Feedback Results

Continue	My response
using intuitive easy-to-use platforms like Ed Discussion, PrairieLearn, Course Website.	*Glad you like them, I love them!!*
building and encouraging the excellent community on Ed Discussion, it's very helpful	*I am so proud of all of you helping each other on Ed Discussion! This is what learning is all about :-)*
asking students for feedback and acting on it.	*Thanks for recognizing this! This is my M.O.*
using learning logs to reflect on the week's content.	*I love learning Logs too, and reading your responses weekly.*
assigning the Flipping Physics videos, they are great!	*Agreed! Every year I use Mr. P's videos, I make a personal donation on behalf of the class - this year I sent $150.*
the grace periods, it is awesome.	*Glad you like it! It's the least I can do...*

Test 2 Reflection

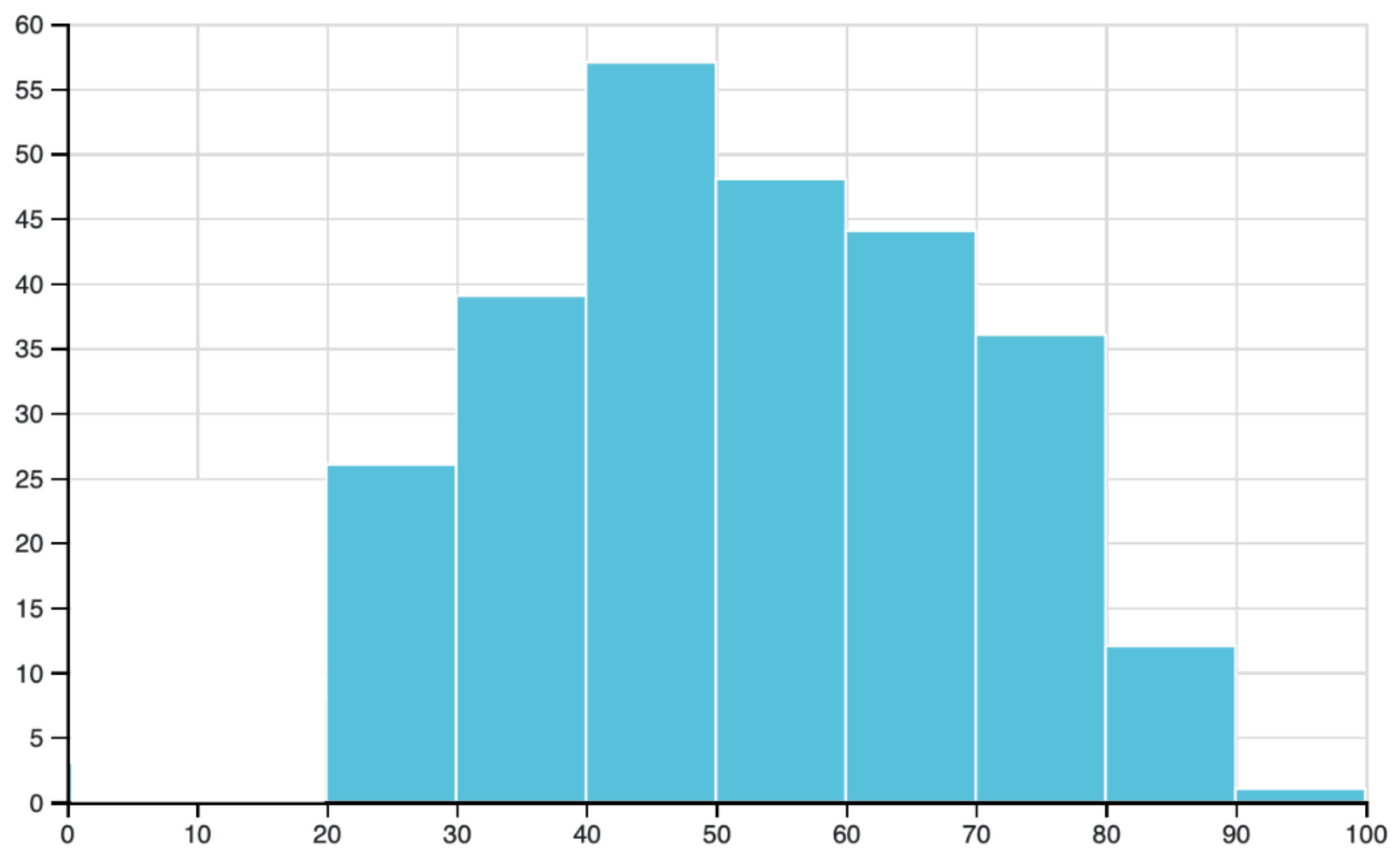
DrMoosvi (Firas) INSTRUCTOR
6 days ago in Test and Bonus Test – Test2

PINNED STAR WATCHING 341 VIEWS

Test 2 Details

Hi all, here are the stats for Test 2:

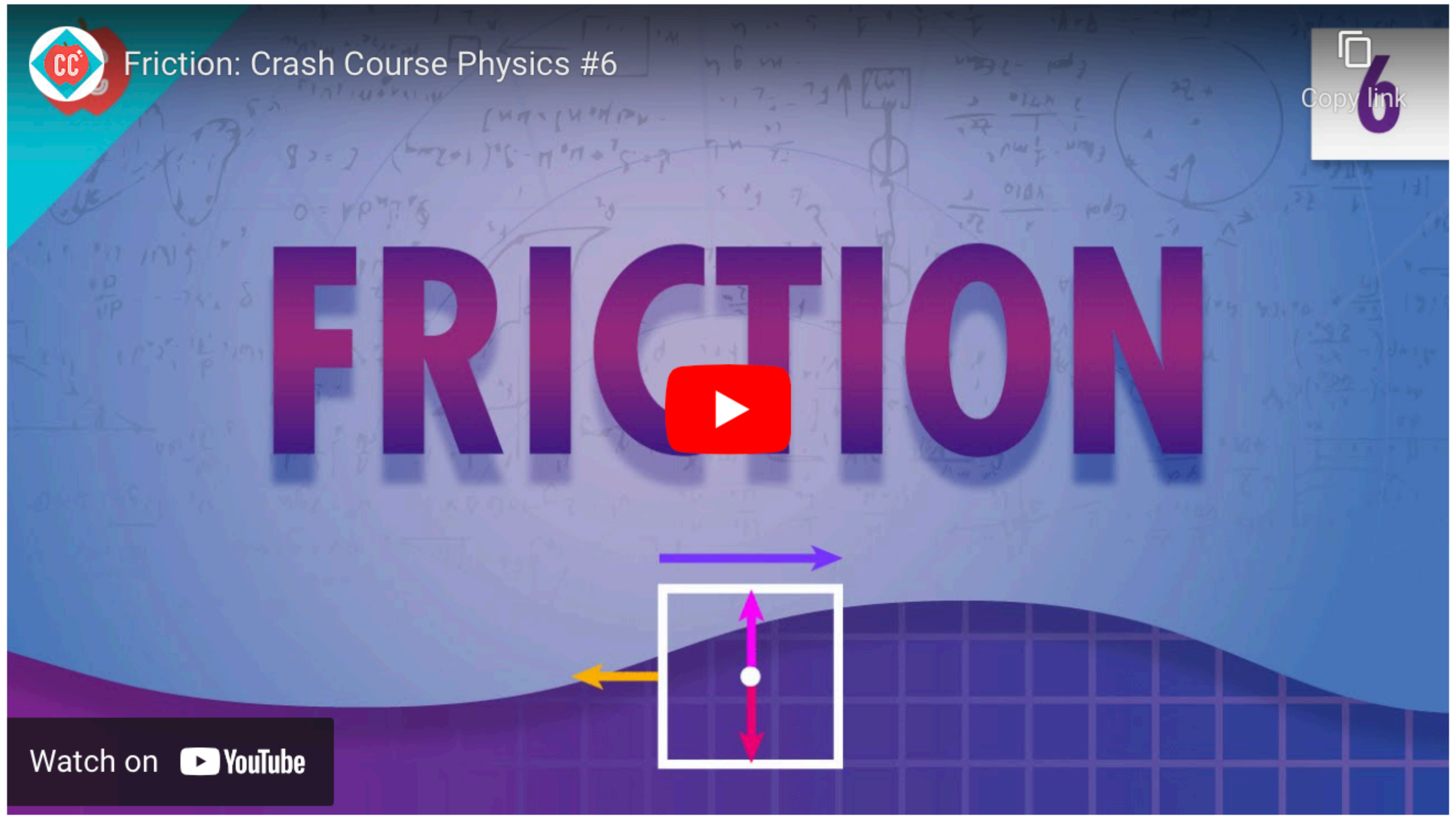
Tests and Bonus Tests 2: Score statistics (before scaling)



Number of students	274
Mean score	~~51%~~ 72%

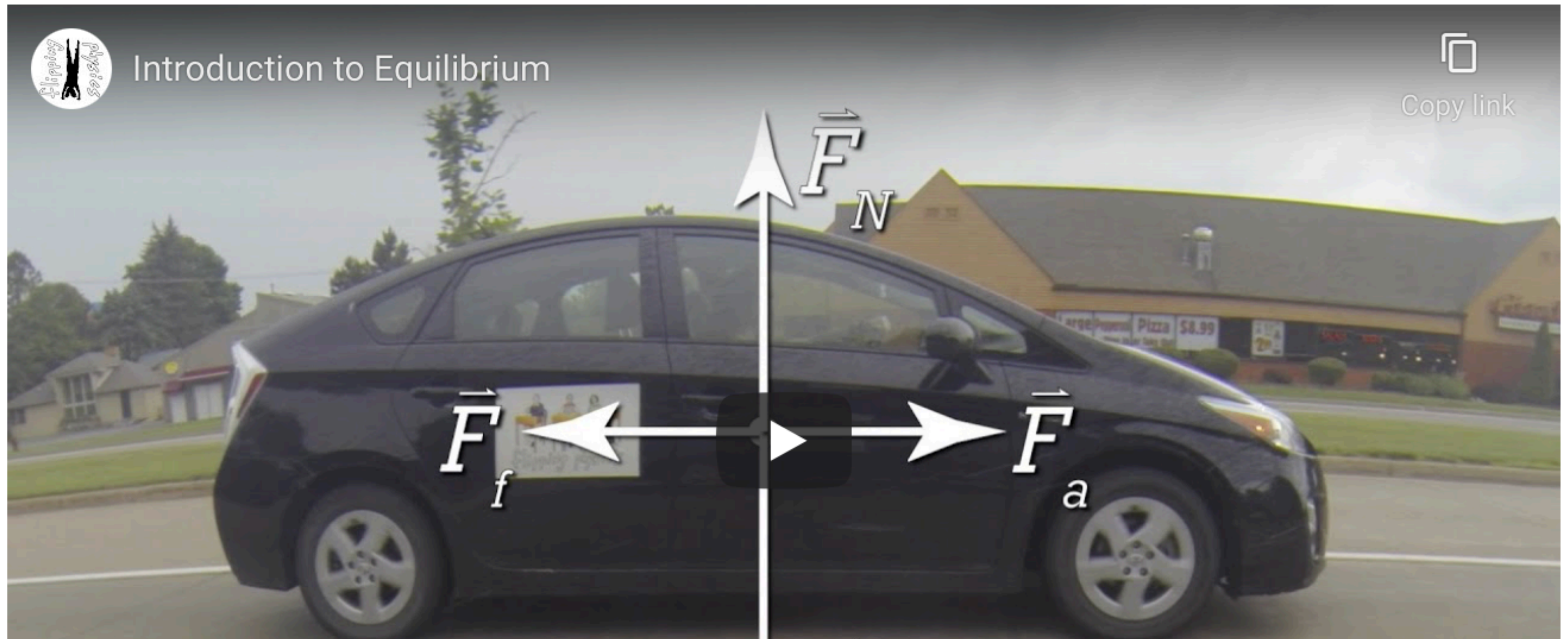
Reference: Link to Ed Discussion Post

Friction



Required Videos

1. Introduction to Equilibrium



Video 2
Video 3
Video 4
Video 5
Video 6
Video 7
Video 8
Video 9
Video 10
Video 11
Video 12

Figure 6.1 Stock cars racing in the Grand National Divisional race at Iowa Speedway in May, 2015. Cars often reach speeds of 200 mph (320 km/h). (credit: modification of work by Erik Schneider/U.S. Navy)

Chapter Outline

Car racing has grown in popularity in recent years. As each car moves in a curved path around the turn, its wheels also spin rapidly. The wheels complete many revolutions while the car makes only part of one (a circular arc). How

Table of contents

Search this book

My highlights

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Chapter Outline

Car racing has grown in popularity in recent years. As each car moves in a curved path around the turn, its wheels also spin rapidly. The wheels complete many revolutions while the car makes only part of one (a circular arc). How

Applications of Newton’s Laws

- Before the break, we discussed Newton’s Three Laws, the concept of a “Free Body Diagram”, and splitting forces into its vector components.
- This week, we will look at solving some physics problems with those concepts!
- It’s important to note that there is no “new physics” this week! All of the problems we solve will just be applying Newton’s Laws in different contexts

Monday's Class

6.1 Solving problems with Newton's Laws

Components of Forces

$$\sum F_{net,x} = ma_x$$

$$\sum F_{net,y} = ma_y$$

No matter how complex the problem seems, this always holds true!

Textbook Examples

EXAMPLE 6.1

Different Tensions at Different Angles

EXAMPLE 6.2

Drag Force on a Barge

EXAMPLE 6.3

What Does the Bathroom Scale Read in an Elevator?

EXAMPLE 6.4

Two Attached Blocks

EXAMPLE 6.5

Atwood Machine

EXAMPLE 6.6

What Force Must a Soccer Player Exert to Reach Top Speed?

EXAMPLE 6.7

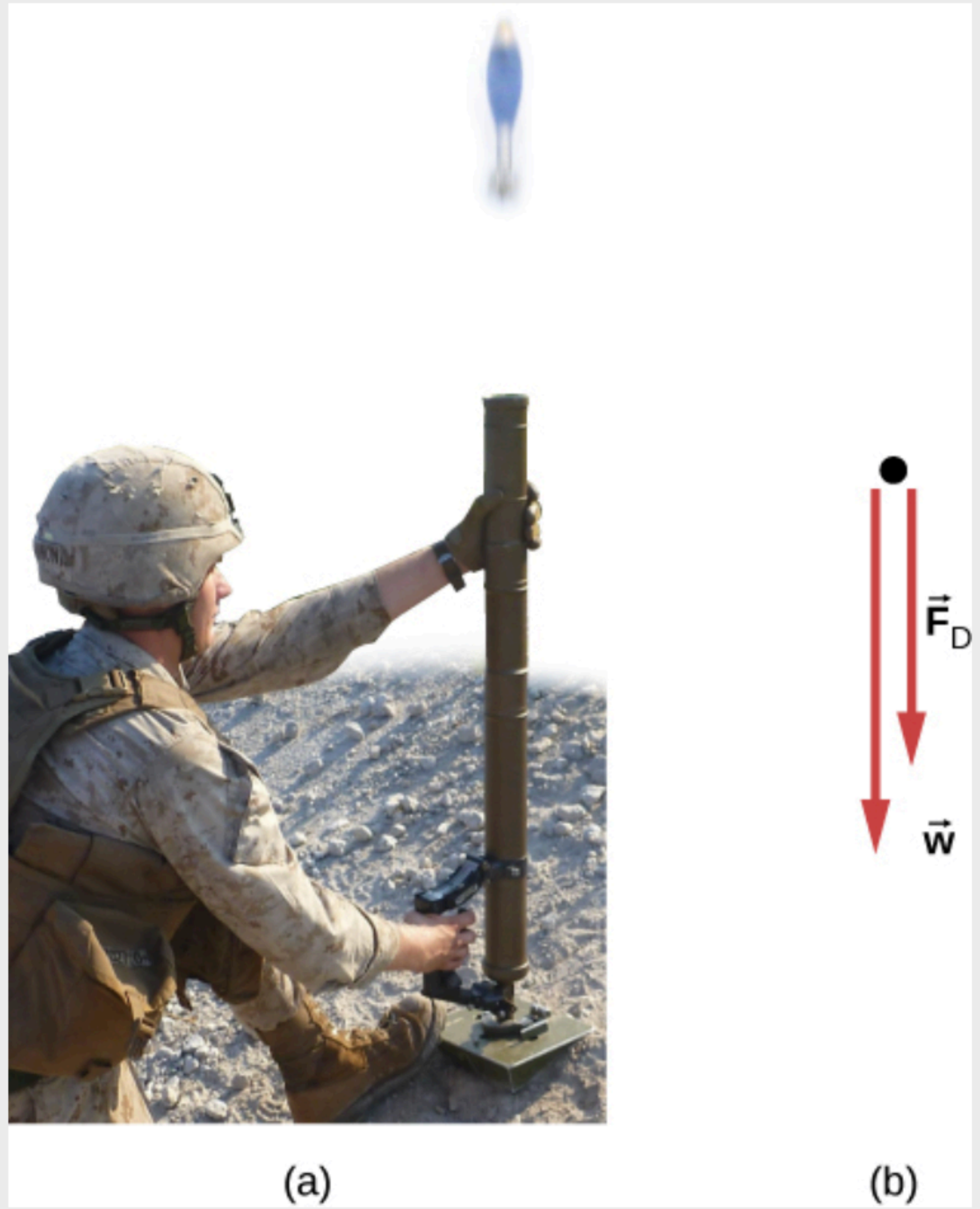
What Force Acts on a Model Helicopter?

Textbook Examples (requires Integration)

EXAMPLE 6.9

Motion of a Projectile Fired Vertically

A 10.0-kg mortar shell is fired vertically upward from the ground, with an initial velocity of 50.0 m/s (see Figure 6.9). Determine the maximum height it will travel if atmospheric resistance is measured as $F_D = (0.0100v^2)$ N, where *v* is the speed at any instant.



EXAMPLE 6.8

Baggage Tractor

Figure 6.8(a) shows a baggage tractor pulling luggage carts from an airplane. The tractor has mass 650.0 kg, while cart A has mass 250.0 kg and cart B has mass 150.0 kg. The driving force acting for a brief period of time accelerates the system from rest and acts for 3.00 s. (a) If this driving force is given by $F = (820.0t)$ N, find the speed after 3.00 seconds. (b) What is the horizontal force acting on the connecting cable between the tractor and cart A at this instant?

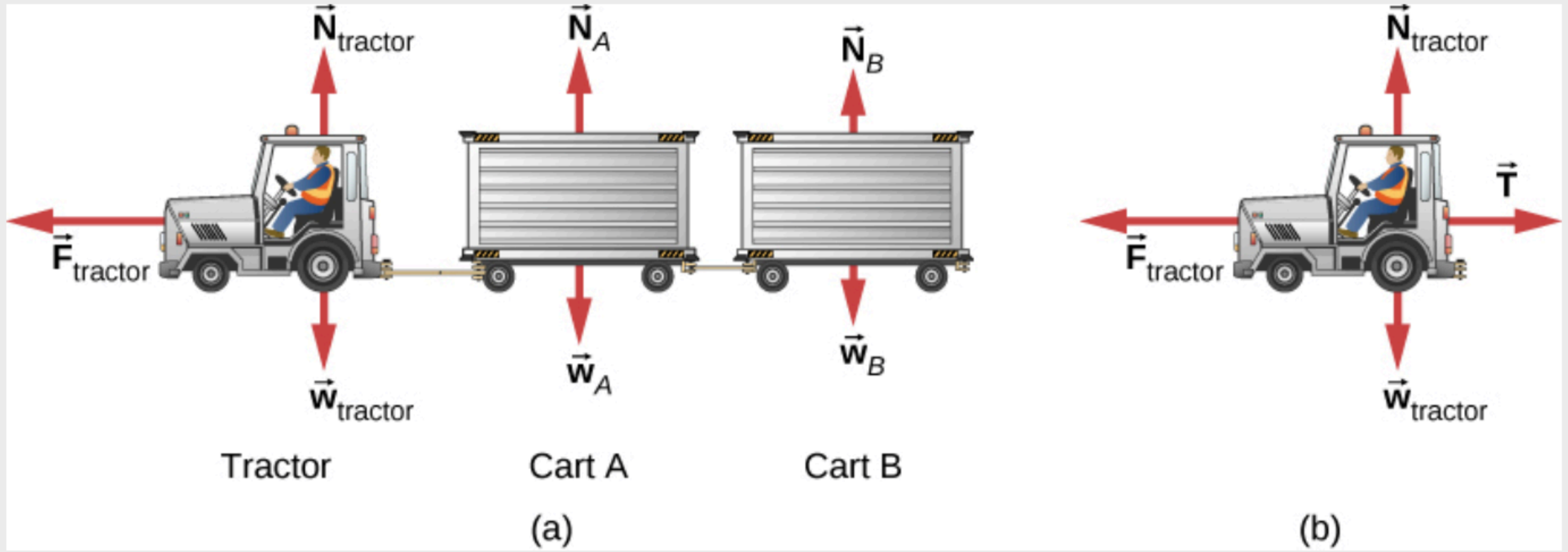


Figure 6.8 (a) A free-body diagram is shown, which indicates all the external forces on the system consisting of the tractor and baggage carts for carrying airline luggage. (b) A free-body diagram of the tractor only is shown isolated in order to calculate the tension in the cable to the carts.

Elevator at rest

$$\vec{a} = 0$$
$$\vec{v} = 0$$

A person is standing in an elevator on top of a weighing scale. The person has a mass of 60kg.

What is the reading on the scale?

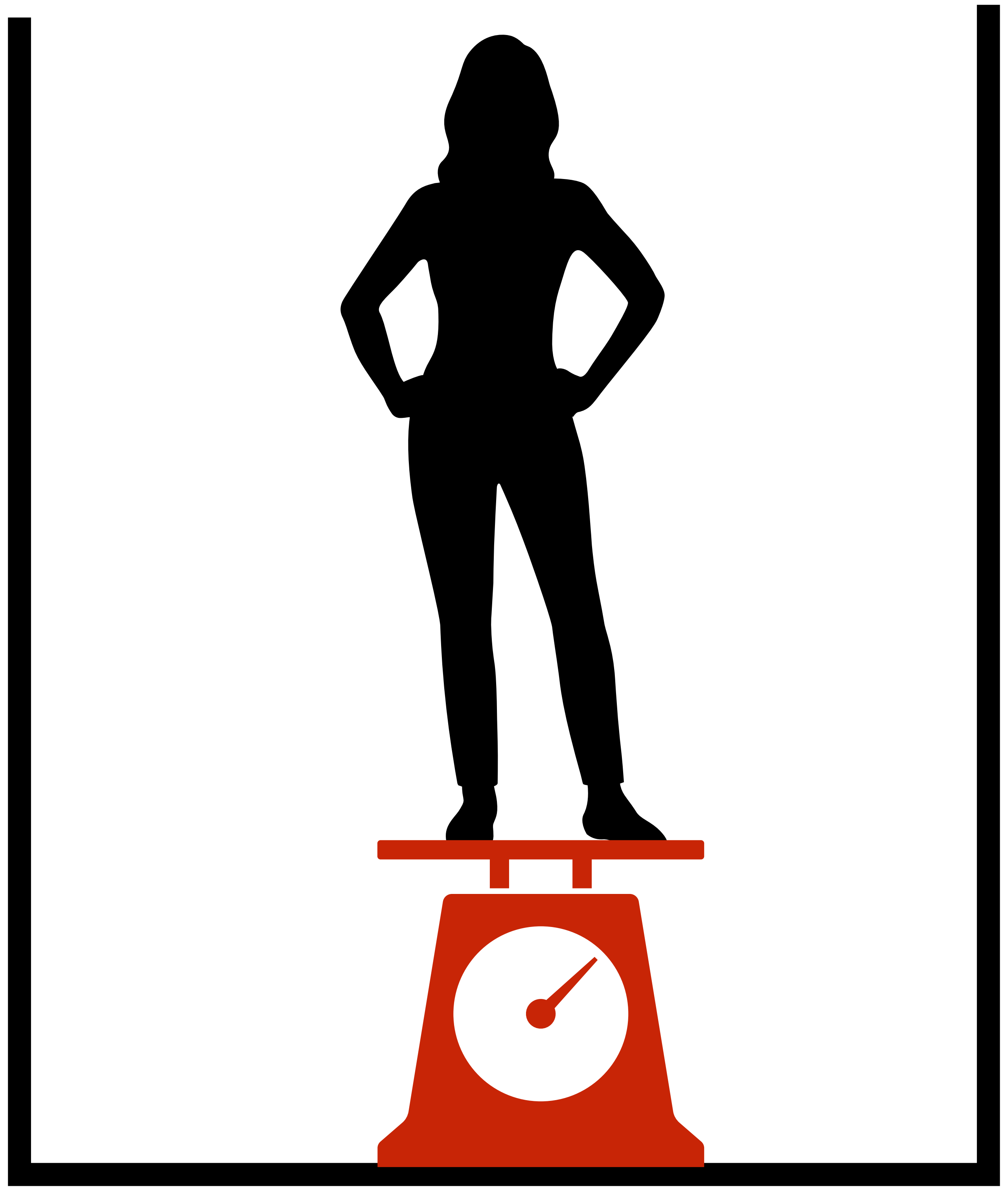
A) 710 N

B) 590 N

C) 470 N

D) 440 N

E) 0 N or I don't know



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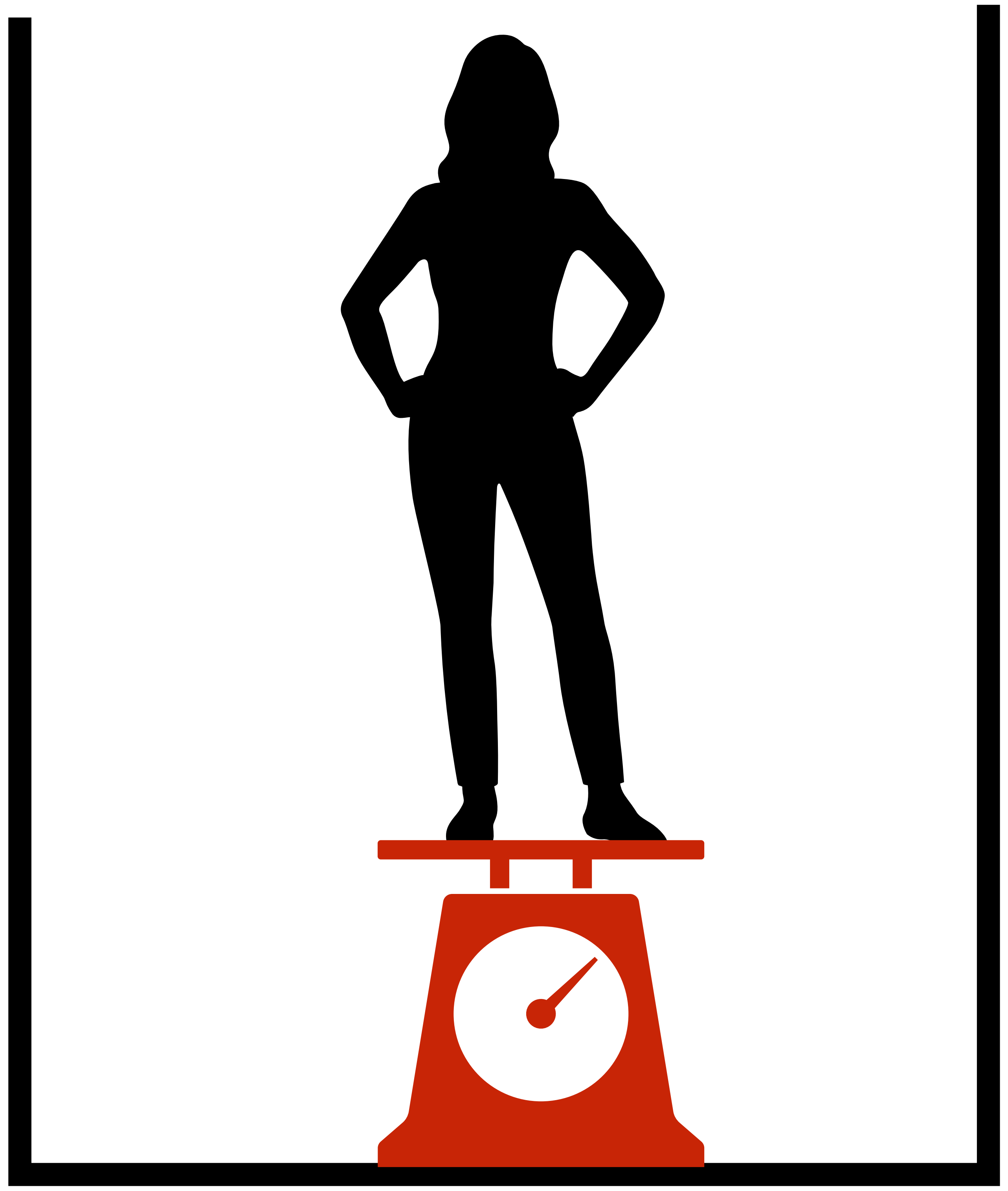


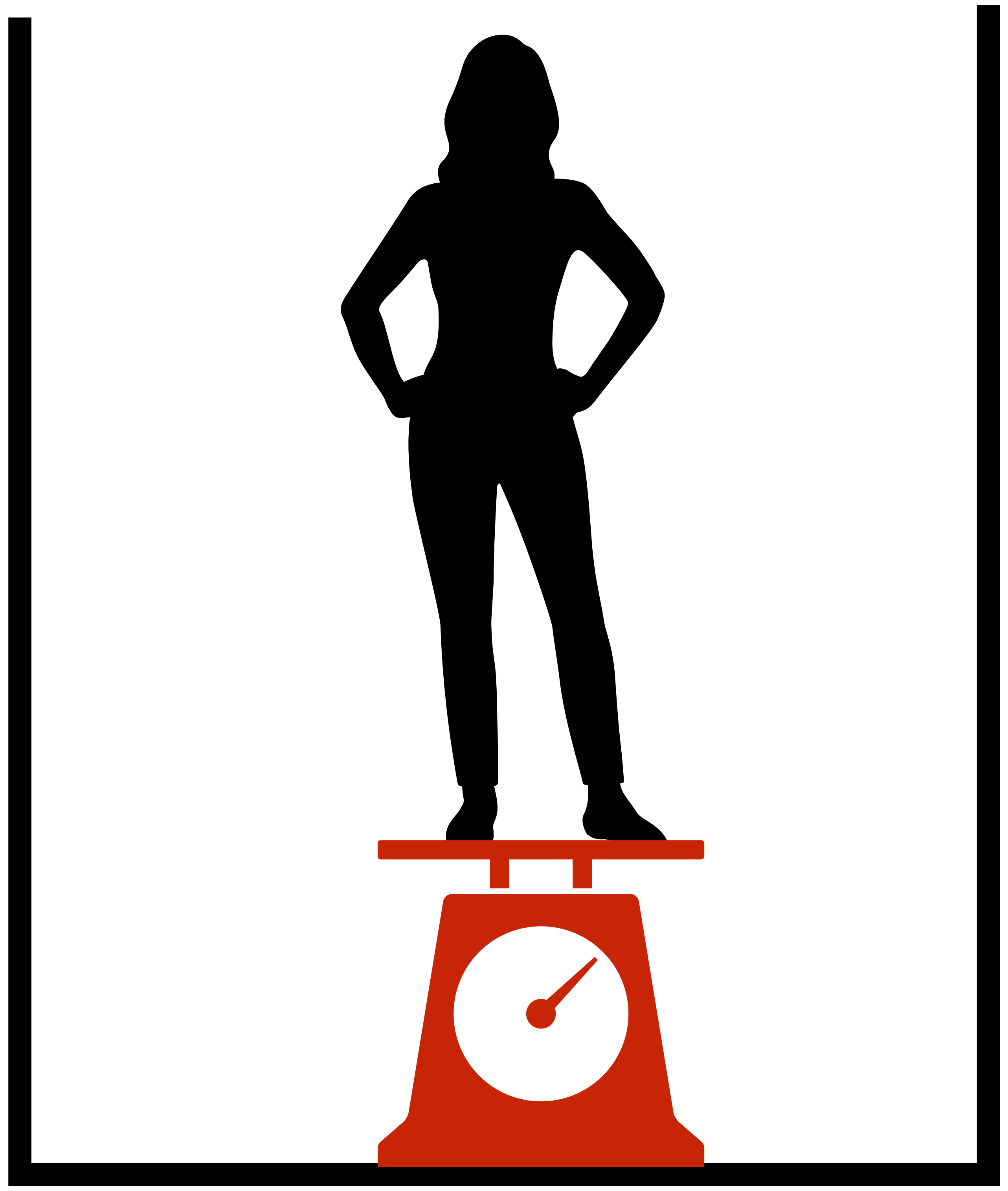
A person is standing in an elevator on top of a weighing scale. The person has a mass of 60kg.

Elevator moving up

$$\vec{a} = 0$$

$$\vec{v} = +3m/s$$

What is the reading on the scale?



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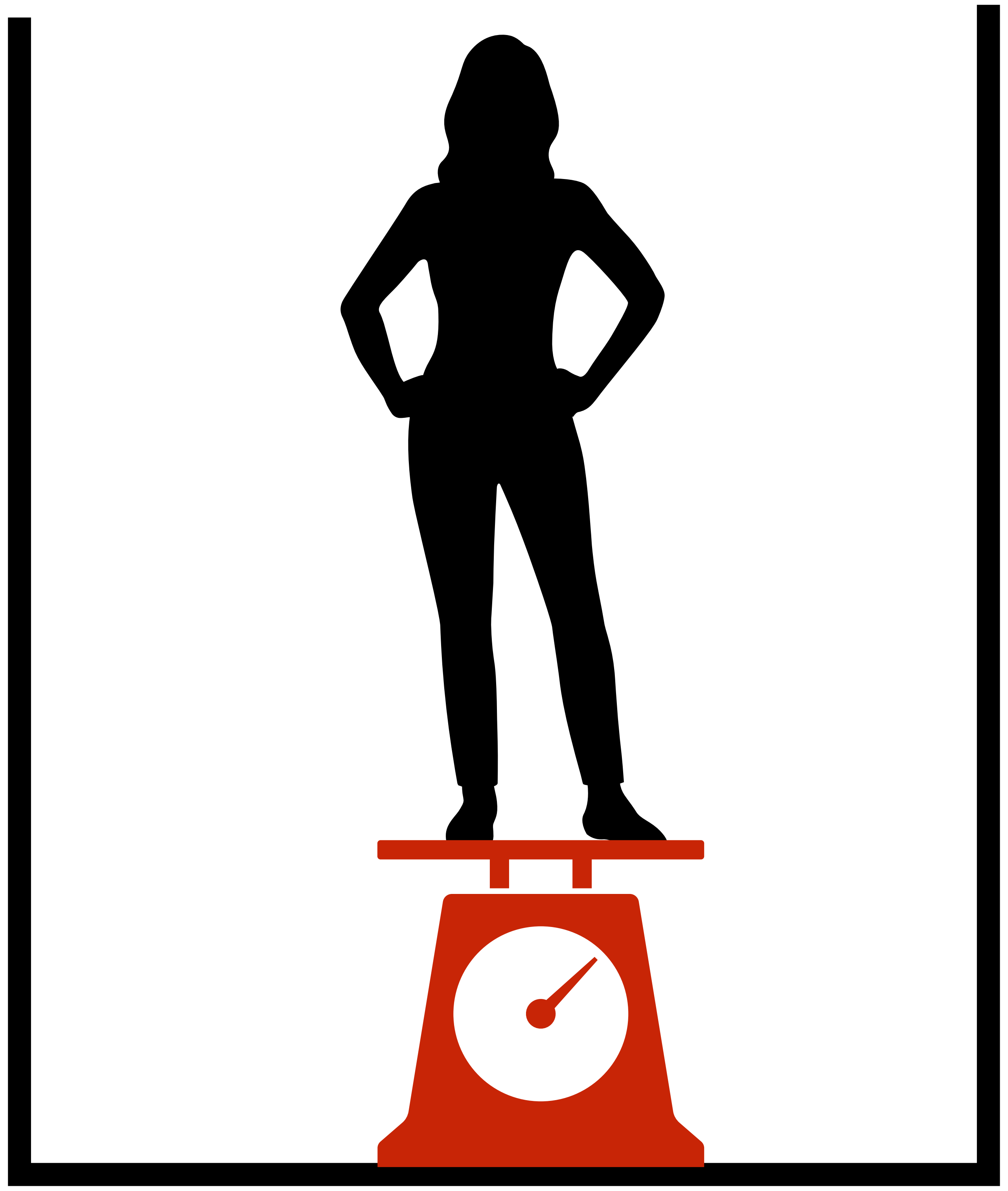

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

What is the reading on the scale (in N)?

Classic Elevator Problems

Elevator accelerating UP

$$\vec{a} = 2m/s^2$$

$$\vec{v} = \text{variable}$$

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B) 590 N

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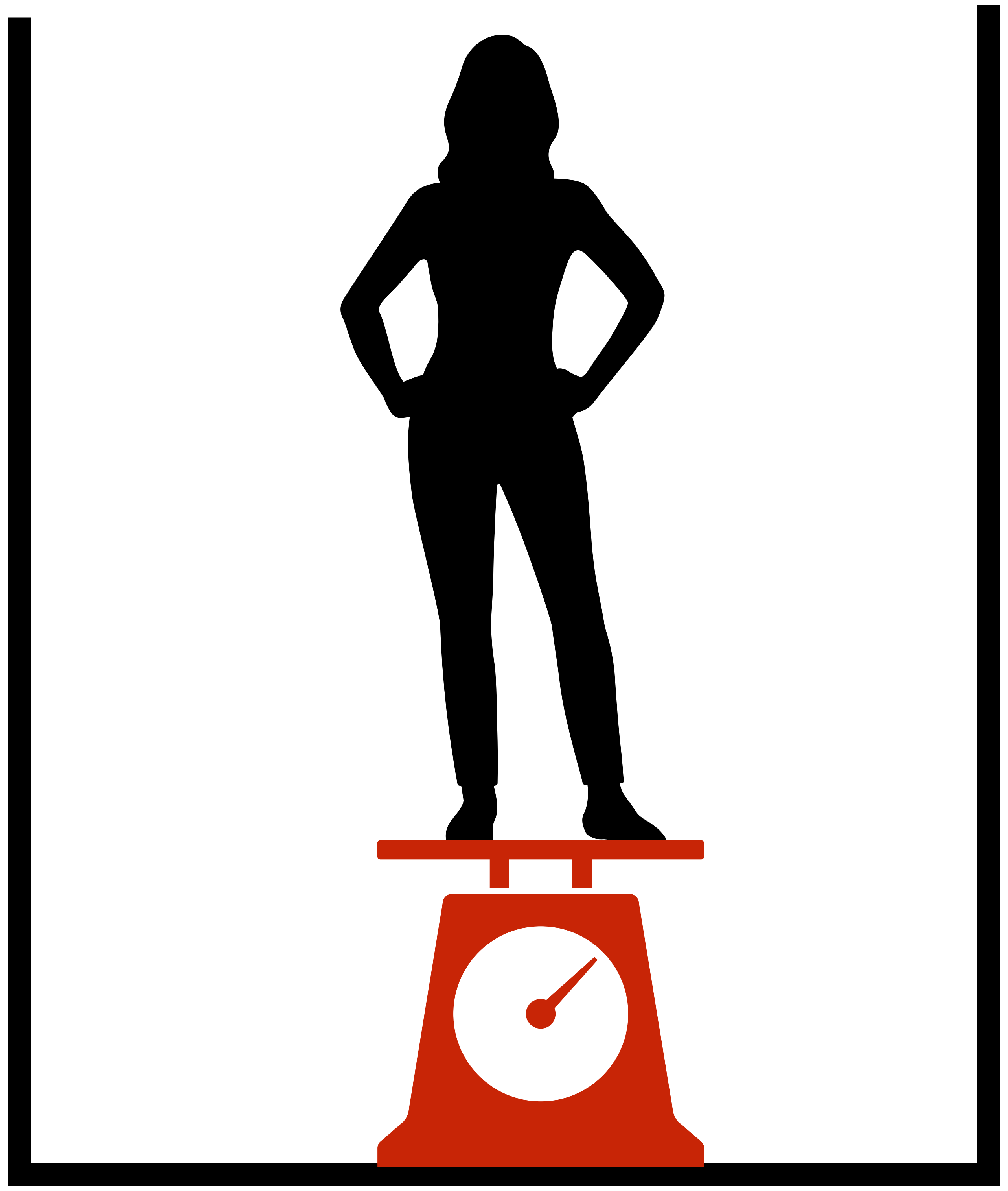

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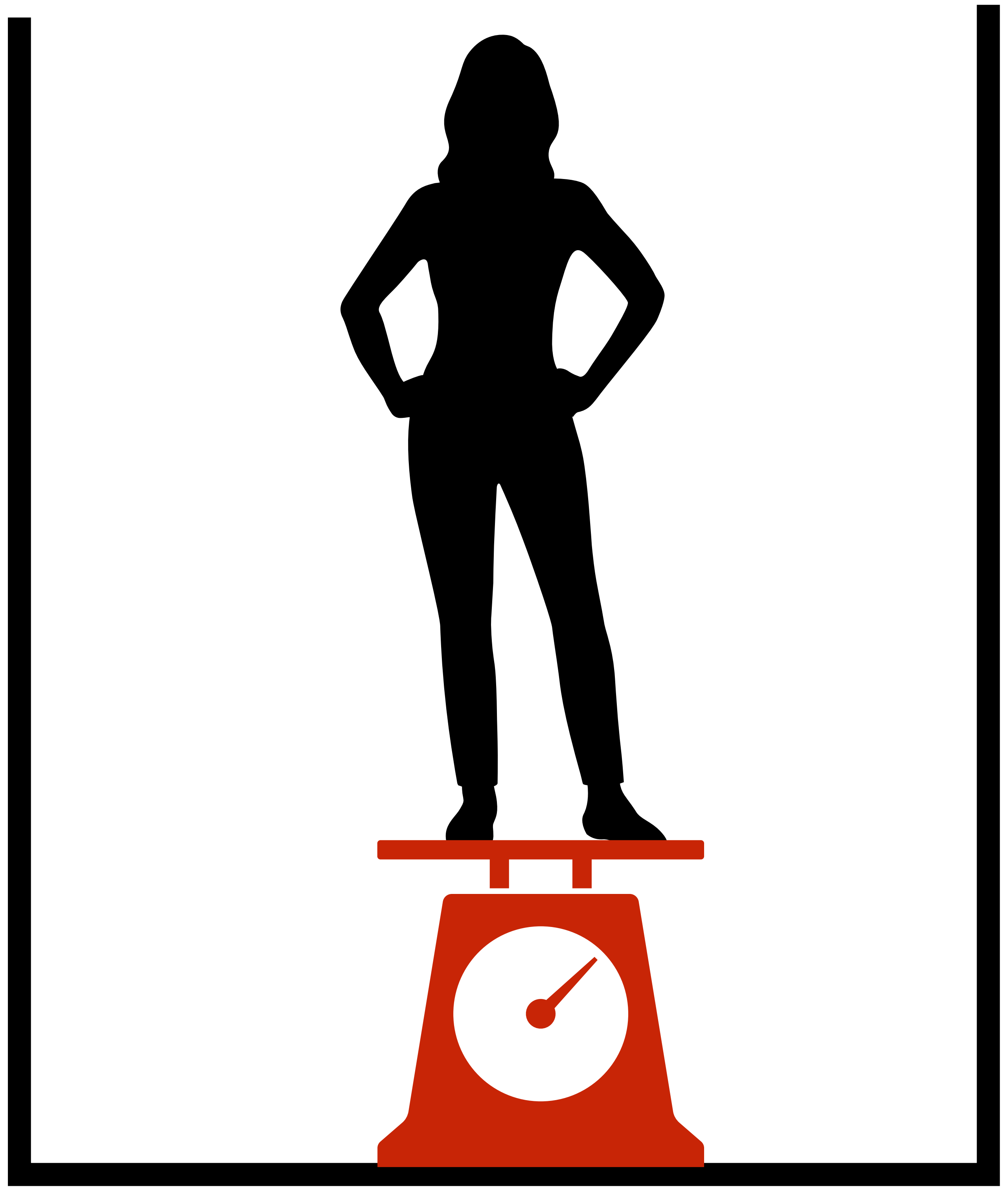

Classic Elevator Problems

Elevator accelerating down

$$\vec{a} = -2m/s^2$$

$$\vec{v} = \text{variable}$$

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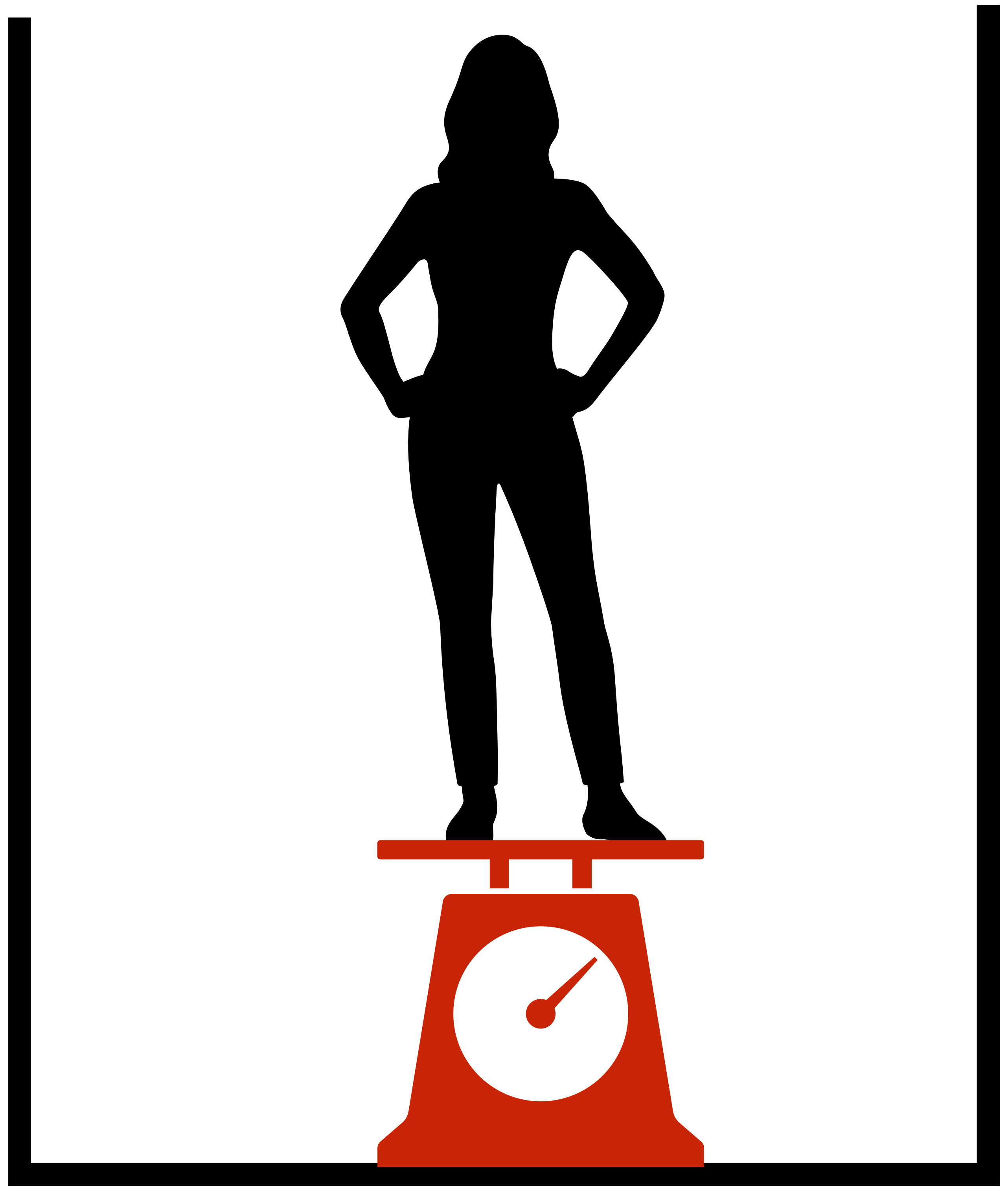

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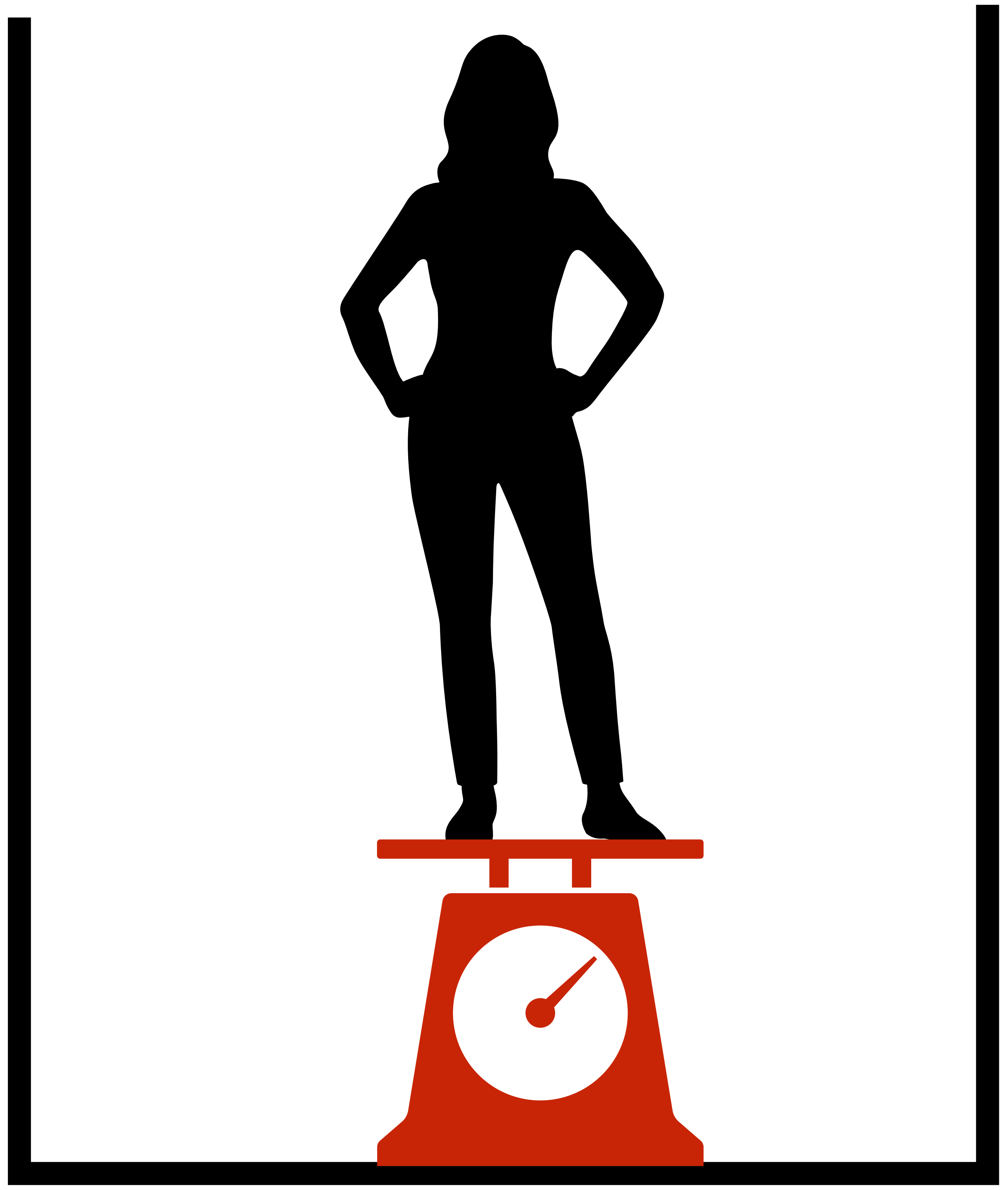

Classic Elevator Problems

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

Elevator cable is cut!

$\vec{a}$ = pain

$\vec{v}$ = fast

What is the reading on the scale (in N)?

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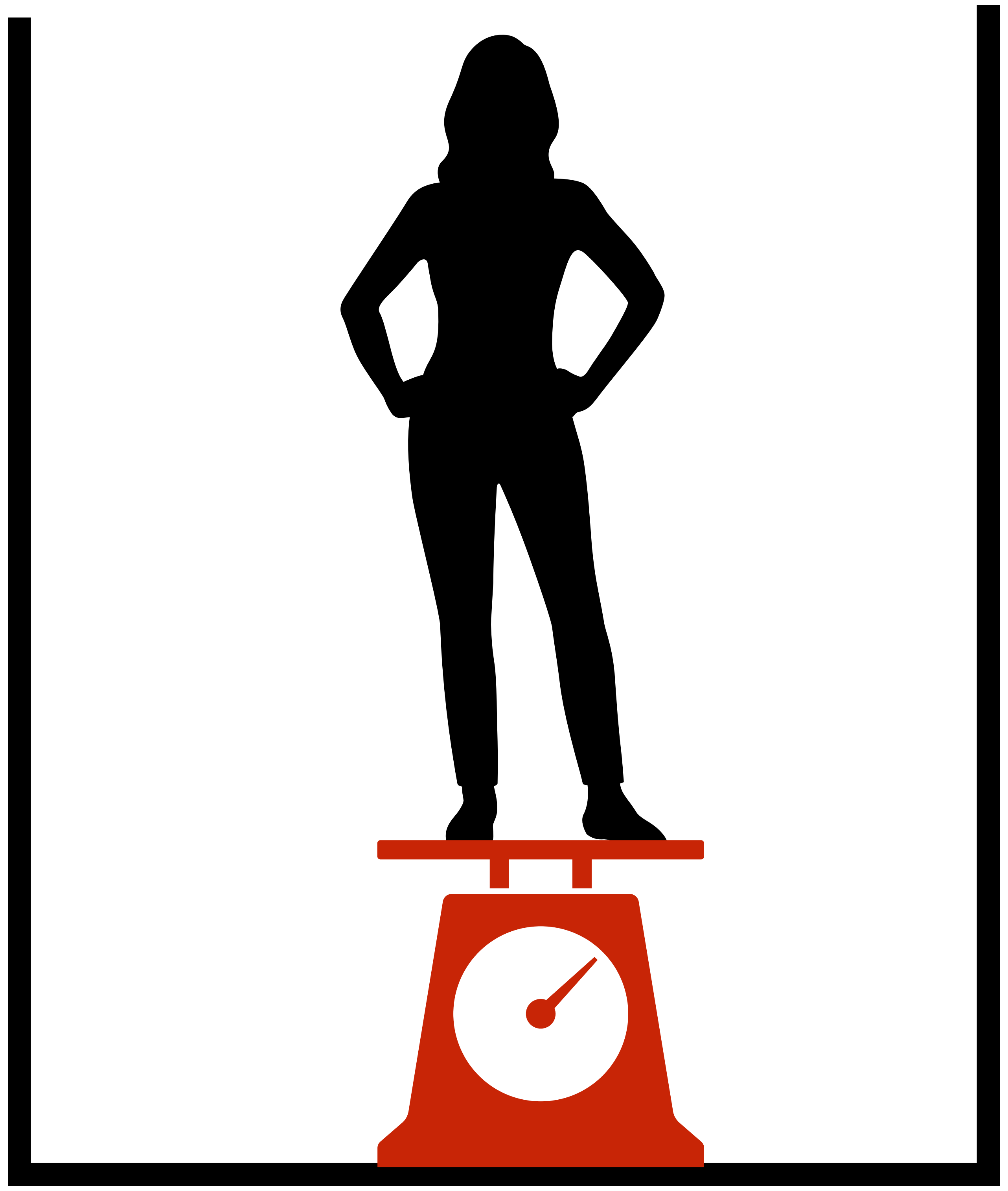

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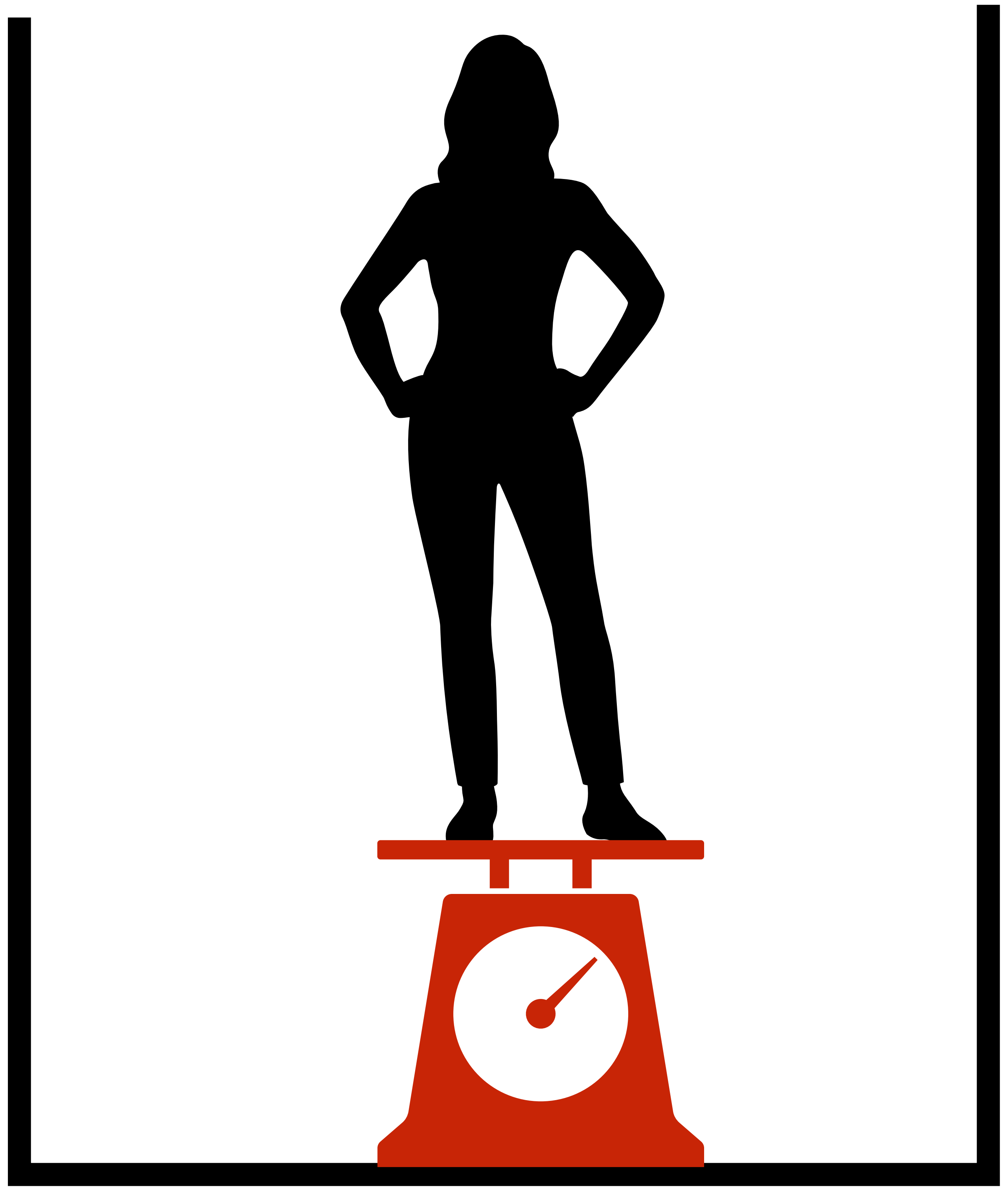

Key Equations

Magnitude of static friction	$f_s \leq \mu_s N$
Magnitude of kinetic friction	$f_k = \mu_k N$
Centripetal force	$F_c = m\frac{v^2}{r}$ or $F_c = mr\omega^2$
Ideal angle of a banked curve	$\tan\theta = \frac{v^2}{rg}$
Drag force	$F_D = \frac{1}{2}C\rho A v^2$
Stokes' law	$F_s = 6\pi r\eta v$

Clicker Questions

CQ.7.1

A 1100-kg car pulls a boat on a trailer.

What total frictional force resists the motion of the car, boat, and trailer, if the car exerts a 1900-N force on the road and produces an acceleration of $0.550\ \mathrm{m/s^2}$ **? The mass of the boat plus trailer is** $700 kg$**.**

a) 1300 N

b) 1900 N

c) 1520 N

d) 910 N

A B C D E

CQ.7.1

A 1100-kg car pulls a boat on a trailer.

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a) 1300 N

b) 1900 N

c) 1520 N

✓ d) 910 N

A B C D E

CQ.7.2

A flea jumps by exerting a force of 1.20×10^{-5} N straight down on the ground. A breeze blowing on the flea parallel to the ground exerts a force of 0.500×10^{-6} N on the flea. Find the direction and magnitude of the acceleration of the flea if its mass is 6.00×10^{-7} kg. Do not neglect the gravitational force.

a) $20.0\ \mathrm{m/s^2}$, 2.39° from vertical

b) $10.2\ \mathrm{m/s^2}$, 2.39° above horizontal

c) $10.2\ \mathrm{m/s^2}$, 4.67° from vertical

d) $20.0\ \mathrm{m/s^2}$, 4.67° from vertical

A B C D E

CQ.7.2

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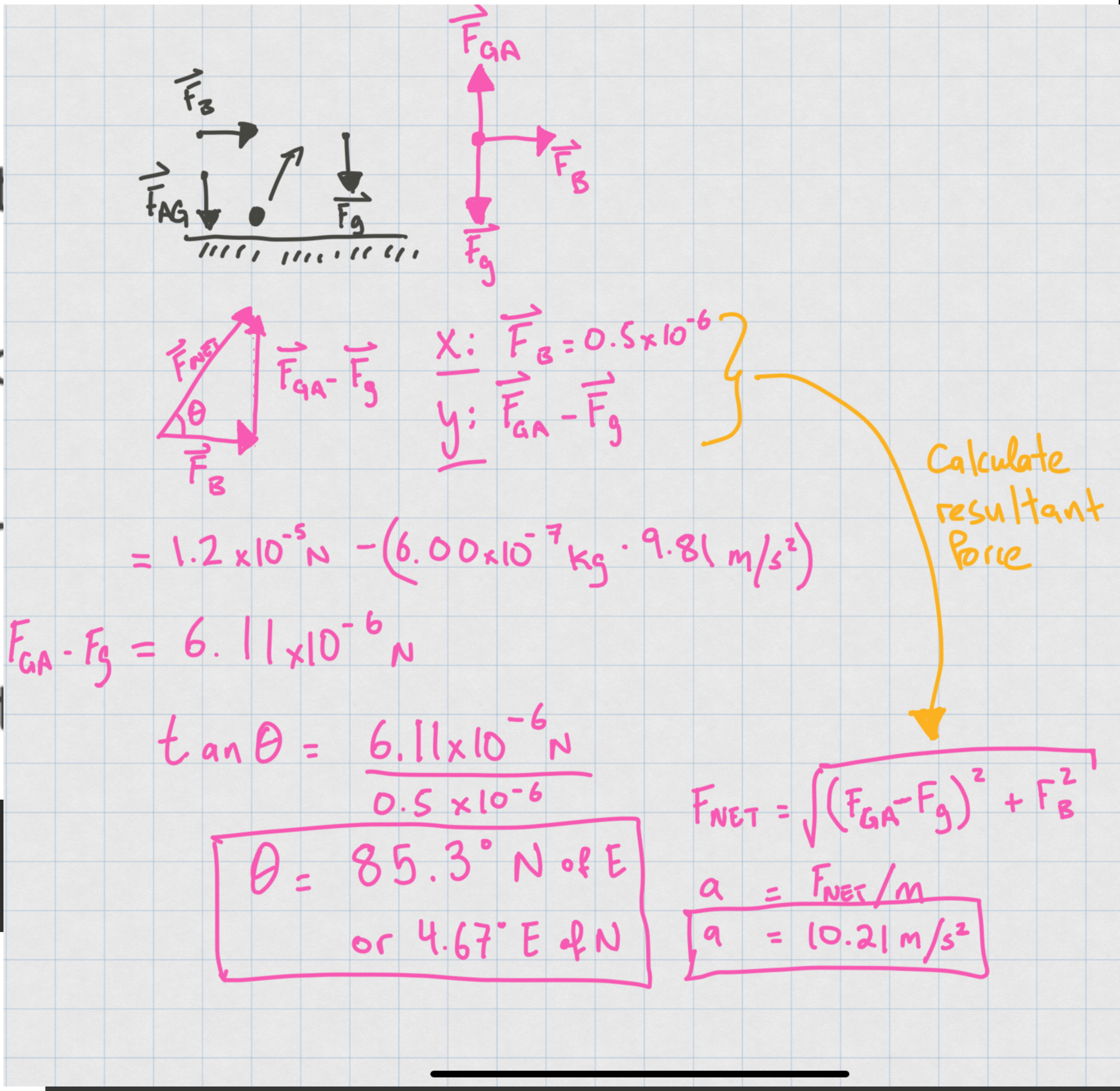
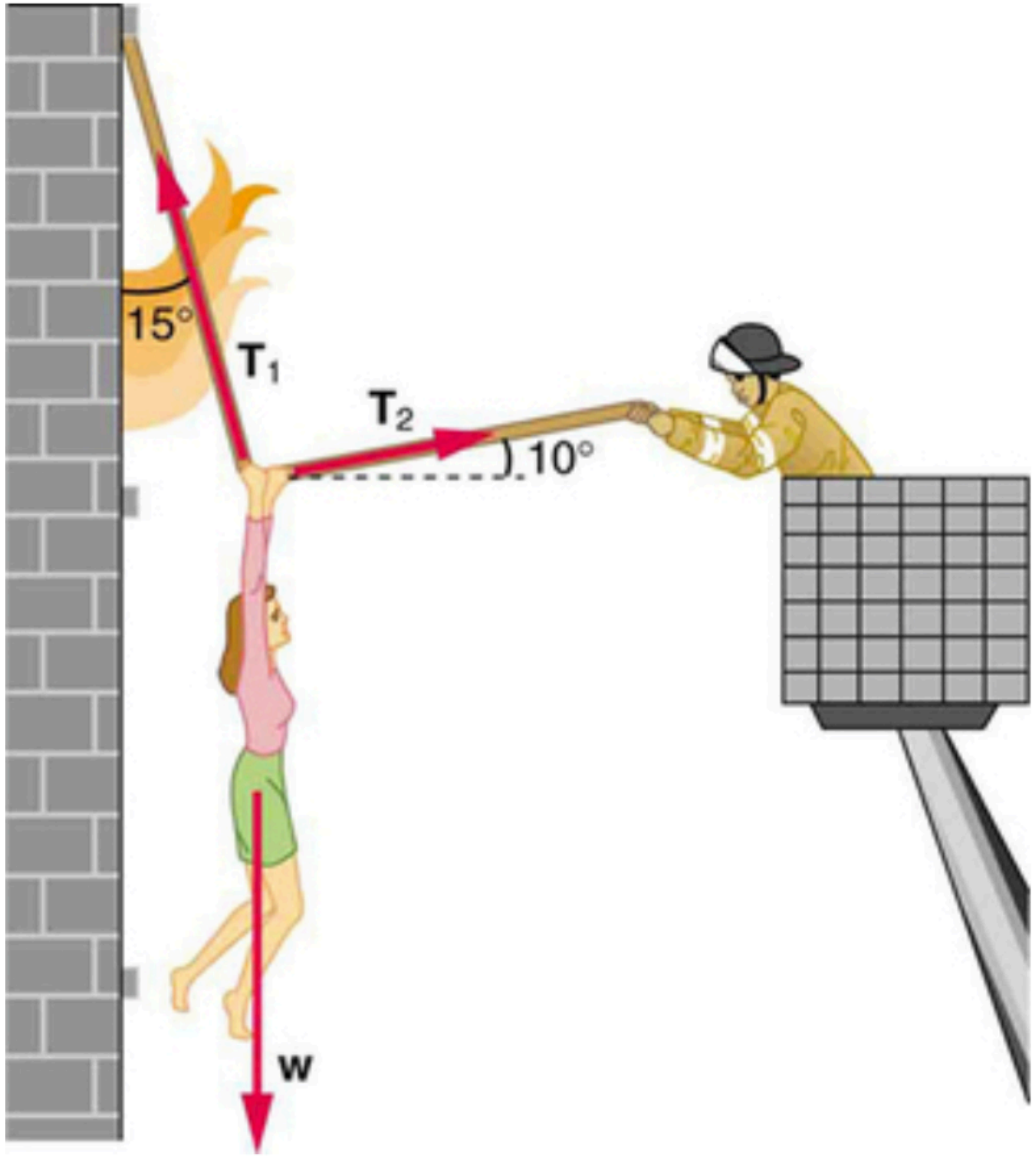


A B C D E

Activity:
Worked Problems

WP 7.1

A 76.0-kg person is being pulled away from a burning building as shown in the figure. Calculate the tension in the two ropes if the person is momentarily motionless. Include a free-body diagram in your solution.



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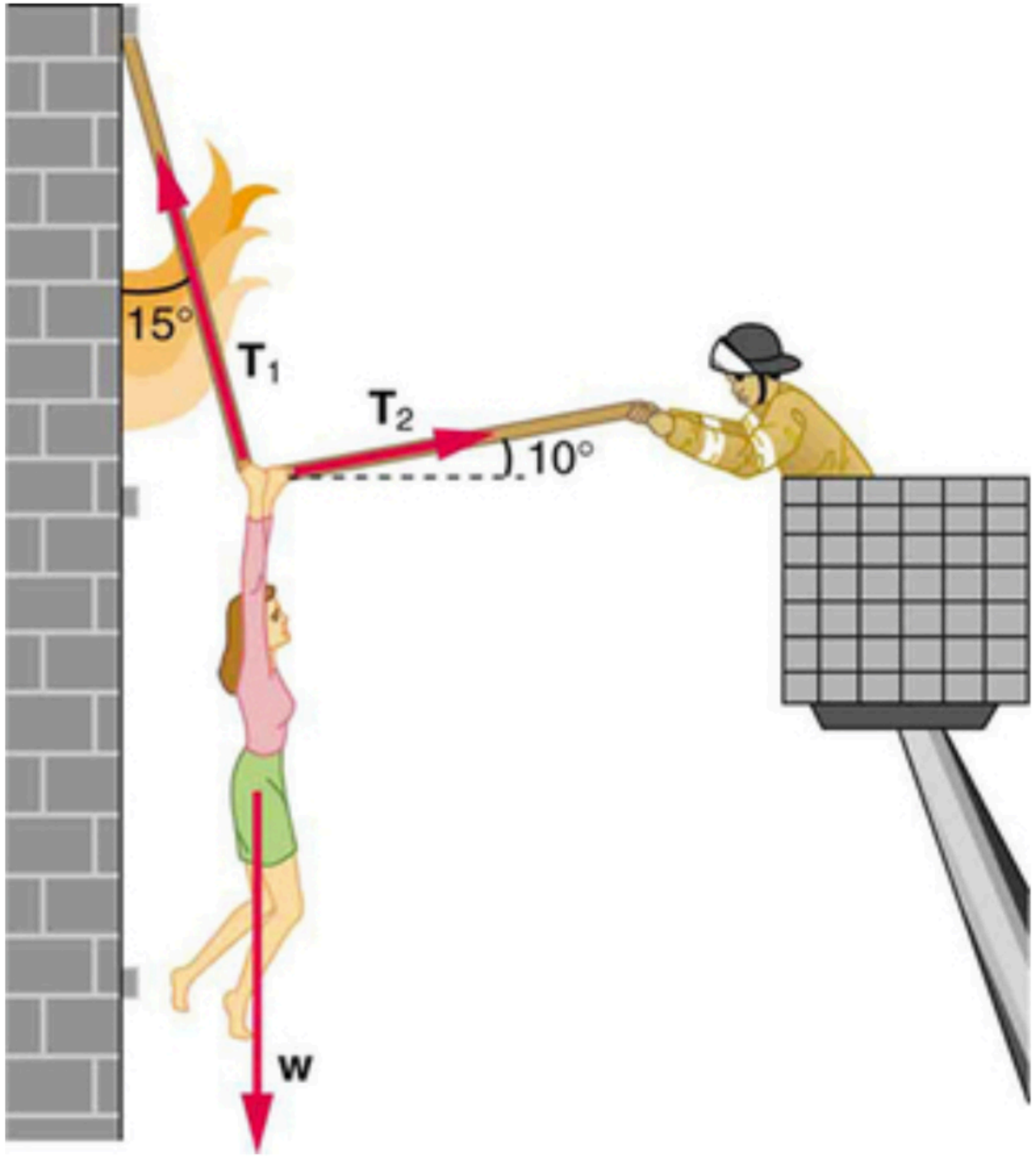

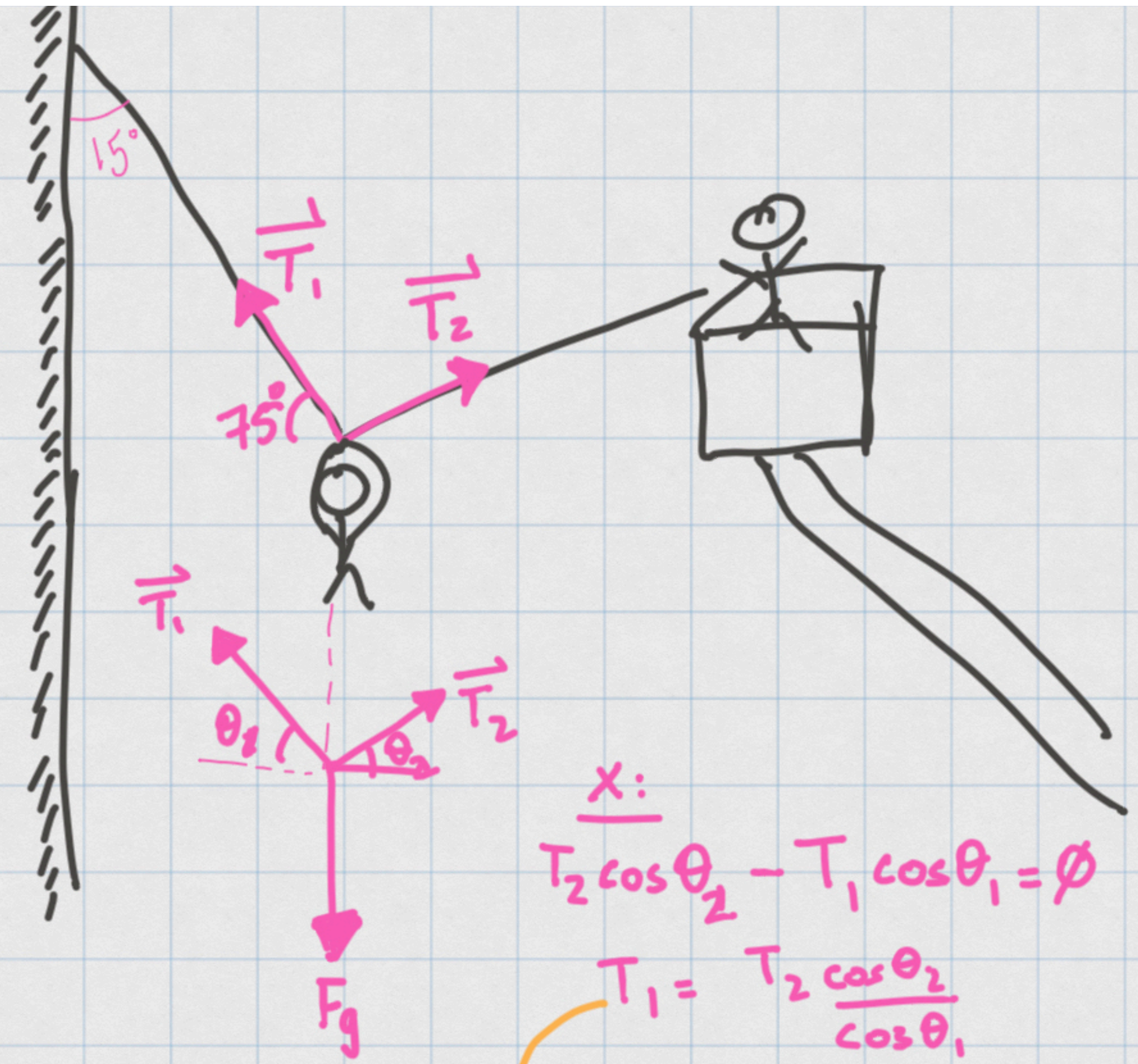

x:

$$T_2\cos\theta_2 - T_1\cos\theta_1 = 0$$

$$T_1 = \frac{T_2\cos\theta_2}{\cos\theta_1}$$

y:

$$T_1\sin\theta_1 + T_2\sin\theta_2 - F_g = 0$$

$$\left(\frac{T_2\cos\theta_2}{\cos\theta_1}\right)\sin\theta_1 + T_2\sin\theta_2 - mg = 0$$

$$T_2\cos\theta_2\tan\theta_1 + T_2\sin\theta_2 = mg$$

$$T_2\left[\cos\theta_2\tan\theta_1 + \sin\theta_2\right] = mg$$

$$T_2 = \frac{mg}{\cos\theta_2\tan\theta_1 + \sin\theta_2}$$

$$T_2 = 654\ \text{N}$$

$$T_1 = 2489\ \text{N}$$

See you next class!

Attribution