

Labs and Activities

Exploring new ways of
Teaching Online

AAPT - 2021
Winter Meeting
January 9-12



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01 Virtual Labs

02 Group-worthy Online

03 Wrap Up

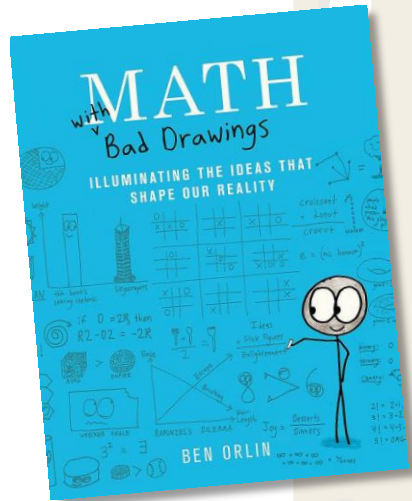
Plan for
this Video

This is Hard.

Many of the labs and activities here were created out of desperation

Online teaching is different and sometimes requires different approaches



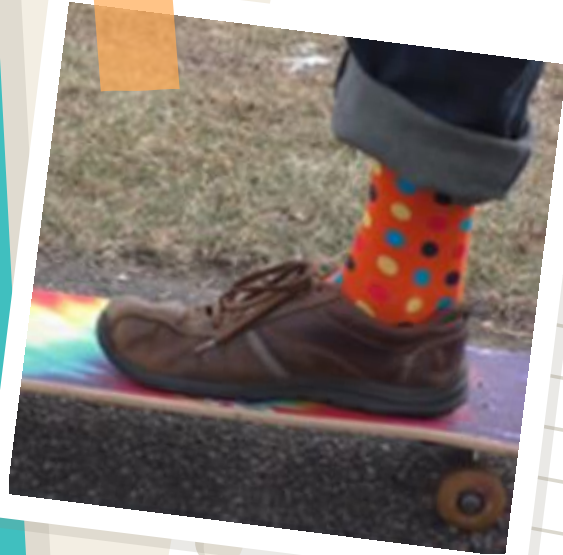


“You can make the case
that *all* creative
endeavors are about
pushing against
constraints”

—Ben Orlin

Virtual Labs

Making things meaningful and
engaging in an online setting



Physics Mini Labs

Challenges where measurements need to be made to solve a problem



Physics of a
Viral Video



Teacher Created
Video Lab



Simulation





How tall is
the cliff?

Physics of a Viral Video



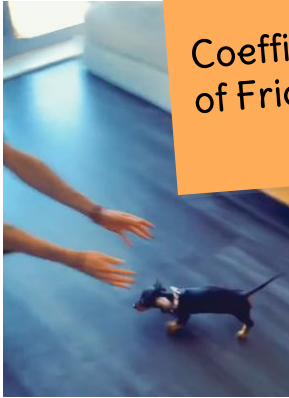


What's his
hang time?

Physics of a Viral Video



Coefficient
of Friction?



Physics of a Viral Video





Useful Tool

The iOS app “**Hudl Technique**” is an easy way to collect precise time data from a video





- Graph the position vs time



How fast did it hit?

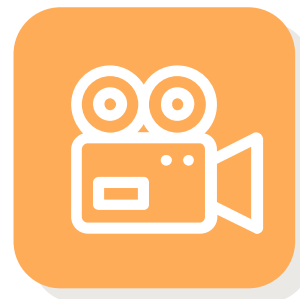
Teacher Created Video Lab

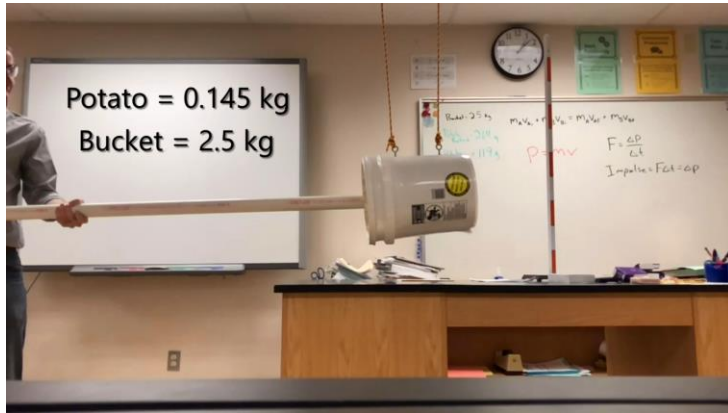


What is the mass of the left ball?



Teacher Created Video Lab



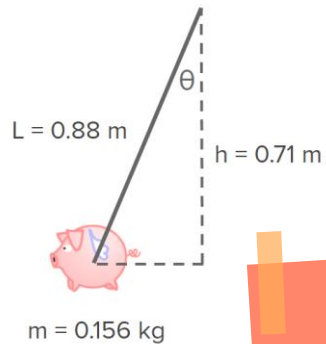


What is the potato cannon's force?

What is the potato's exit velocity?

Teacher Created Video Lab



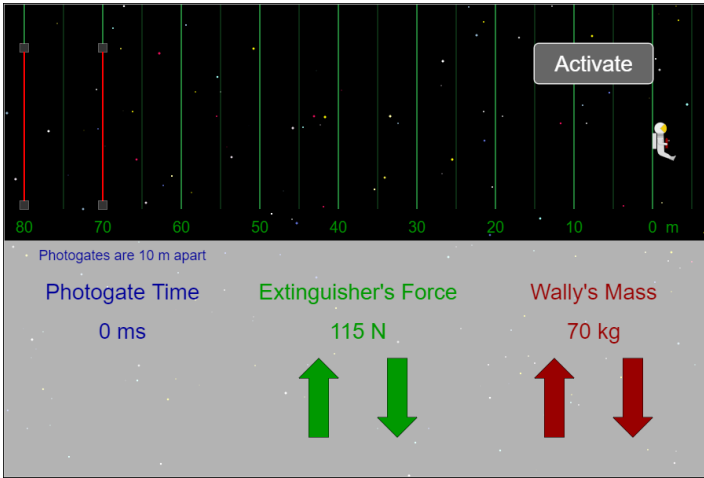


Time for 10 revolutions?



Teacher Created Video Lab



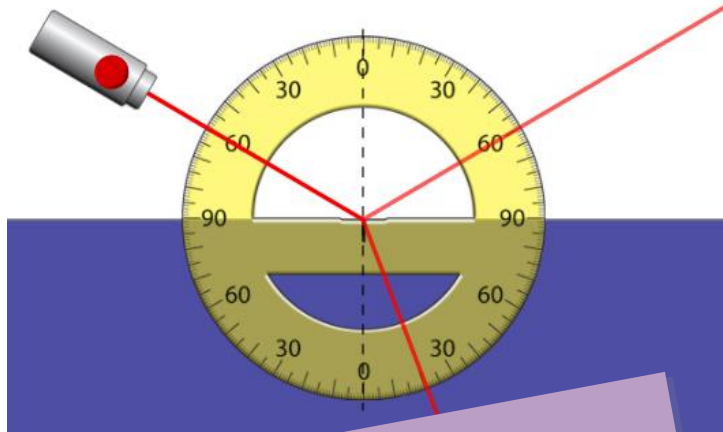


Part 1: Choose values for the Extinguisher's Force, Distance and Wally's Mass. Predict the time to go through the 10-meter photogate.

Part 2: Determine settings to achieve a photogate target time of 750 ms

Simulations





What is the refractive index for Mystery A?

Simulations



Group-worthy Online

Designing an activities that require
all students to be active participants



Mechanics Lab Practical

Your Task:

Calculate as many physics properties as you can that incorporate our topics of Motion, Forces, Energy, and Momentum



Work shown on Jamboard	Missing		Inconsistent		Complete	
	0		1		2	
Units included	Missing		Inconsistent		Complete	
	0		1		2	
Properties Calculated Correctly	9 or less	10-11	12-13	14-15	16-17	18+
	1	2	3	4	5	6

- No list of values provided
- Must collaborate to verify answers

Virtual Escape Room

- Groups of 3-4
- Each student receives a google form with a series of challenges (doors) and data validation
- Many clues interact with information held by teammates

Motion Escape Room | Player 1

* Required

Door #1

Your journey starts small with motion that is steady
Rearrange if needed and calculate when ready

Equations (if you need them)

Constant Velocity	Constant Acceleration
$v = \frac{d}{t}$	$v_f = v_i + at$
$v_f = v_i + at$	$d = \frac{1}{2}(v_f + v_i)t$
$d = vt$	$d = v_i t + \frac{1}{2}at^2$
$v_f^2 = v_i^2 + 2ad$	$v_f^2 = v_i^2 + 2ad$

Know it and Move! Draw on for a clue. Question slides in the...

Motion Escape Room | Player 2

* Required

Door #1

Your journey starts small with motion that is steady
Rearrange if needed and calculate when ready

Equations (if you need them)

Constant Velocity	Constant Acceleration
$v = \frac{d}{t}$	$v_f = v_i + at$
$v_f = v_i + at$	$d = \frac{1}{2}(v_f + v_i)t$
$d = vt$	$d = v_i t + \frac{1}{2}at^2$
$v_f^2 = v_i^2 + 2ad$	$v_f^2 = v_i^2 + 2ad$

This acceleration clue response to be results of about 4 sec

Motion Escape Room | Player 3

* Required

Door #1

Your journey starts small with motion that is steady
Rearrange if needed and calculate when ready

Equations (if you need them)

Constant Velocity	Constant Acceleration
$v = \frac{d}{t}$	$v_f = v_i + at$
$v_f = v_i + at$	$d = \frac{1}{2}(v_f + v_i)t$
$d = vt$	$d = v_i t + \frac{1}{2}at^2$
$v_f^2 = v_i^2 + 2ad$	$v_f^2 = v_i^2 + 2ad$

Motion Escape Room | Player 4

* Required

Door #1

Your journey starts small with motion that is steady
Rearrange if needed and calculate when ready

Equations (if you need them)

Constant Velocity	Constant Acceleration
$v = \frac{d}{t}$	$v_f = v_i + at$
$v_f = v_i + at$	$d = \frac{1}{2}(v_f + v_i)t$
$d = vt$	$d = v_i t + \frac{1}{2}at^2$
$v_f^2 = v_i^2 + 2ad$	$v_f^2 = v_i^2 + 2ad$

Door #1

- Constant Velocity Problem
- Each player has all the information that they need
- Helps players familiarize themselves with the system



This skateboarding dog appears to be moving at about 4 m/s. Assuming a constant velocity the entire time, how far (in meters) will he travel if we let him roll along for a full minute?

Door #2

- Kinematics problem with constant acceleration
- Another player in the group has needed information

Clue on teammate's form

Did you know??

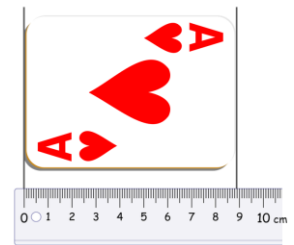
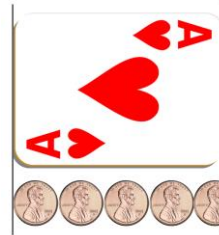
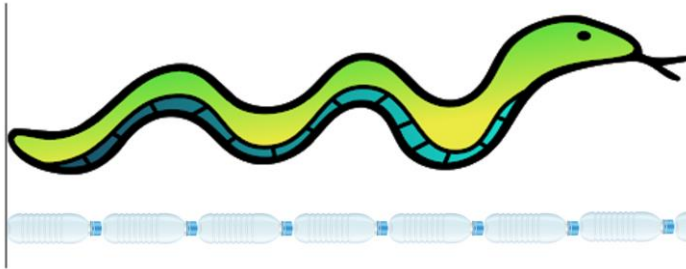
Usain Bolt accelerates out of the blocks with an acceleration of 3 m/s^2



What is the time (in seconds) required for Usain Bolt to accelerate from rest to a final velocity of 9.6 m/s ?

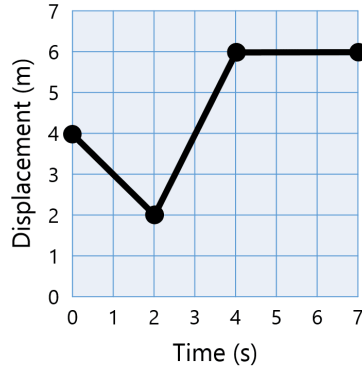
Door #3

- Full team conversion and dimensional analysis challenge
- Each teammate has a conversion to determine the snake's length
- All conversion factors required to solve
- Accepted answer range accounts for reasonable estimation



Door #4

- Calculations from a motion graph
- Each player is given a graph and three questions.
- Two of the questions reference other teammate's graphs



- *What is the average velocity (in m/s) between 0-2 seconds for YOUR graph?*
- *What is the instantaneous acceleration (in m/s^2) at 1 second on PLAYER 2's graph?*
- *What is the total displacement (in meters) during the interval of 2-4 seconds for PLAYER 4's graph*

Door #5

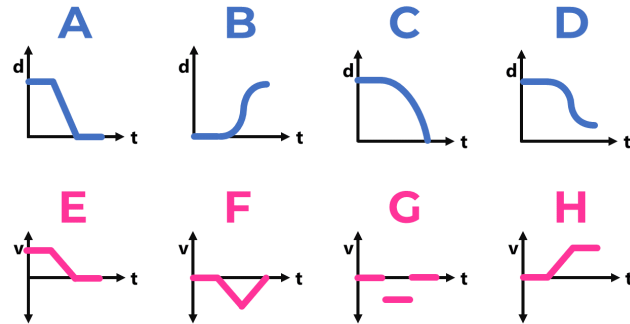
- Piece together a story and describe in motion graphs

First, the bug starts motionless in the on the floor...

...Then, the bug gets faster in the negative direction...

...Finally, the bug slows down to a stop.

Select the correct d vs t and v vs t graphs by writing in the two corresponding letters without a space.



Door #6

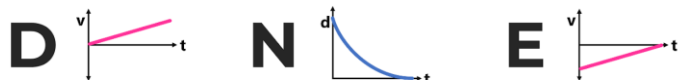
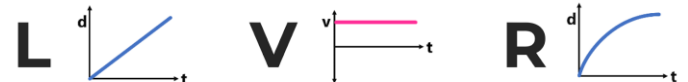
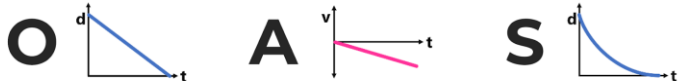
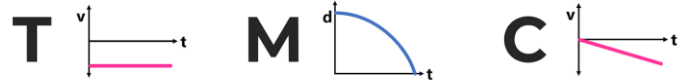
- Free fall calculation problem
- Each player has all the information that they need
- Accepted answers could use $g = 9.8-10 \text{ m/s}^2$



In addition to being insanely adorable, the Klipspringer is known to jump 3.6 meters straight up in the air (that is several times their body height). What is the initial upward velocity required to make this happen?

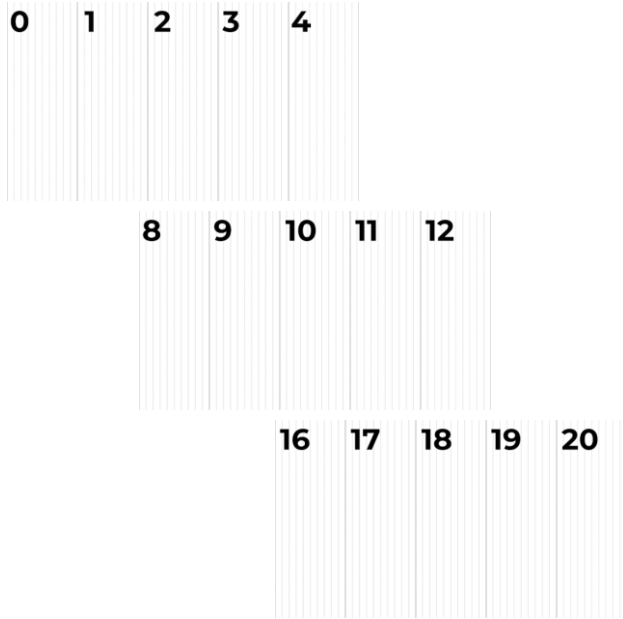
Door #7

- Conceptual motion graph matching from a description
- Students are given three motion graphs and a description
- The descriptions correspond to another teammates graph
- The four correct answers spell a word

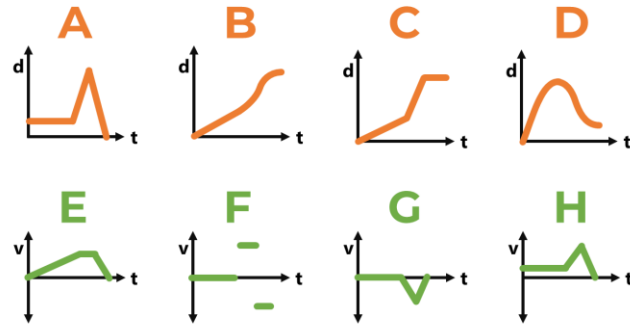


Door #8

- Piece together an animation and describe in motion graphs

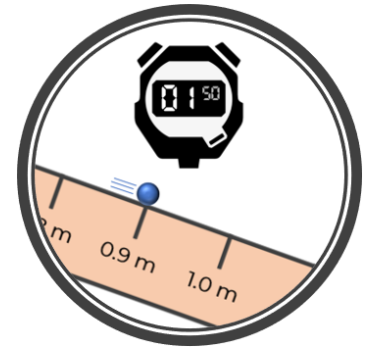
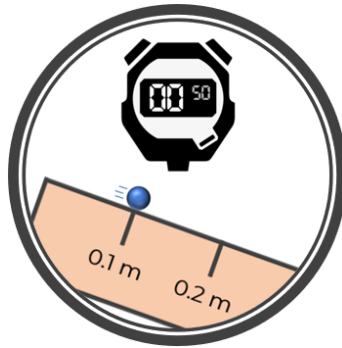
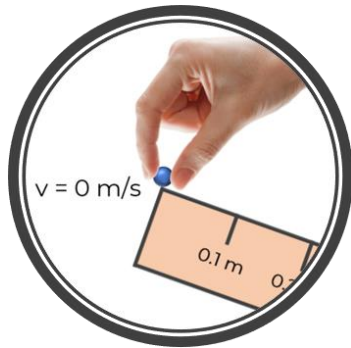


Select the correct d vs t and v vs t graphs by writing in the two corresponding letters without a space.



Door #9 – Final Door

- Teammates need to assembling info about a marble on a ramp
- Calculate the length of the ramp if marble gets to the bottom in 2 s



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In Summary





Thank you!



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