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Physics 111 - Class 7C
Force Applications III

Do not draw in/on this box!

October 22, 2021

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Class Outline

- Logistics / Announcements
- Mid-course Feedback Results
- Test 2 Reflection
- Introduction to Chapter 6
- Activity: Worked Problems
- HW6.8 - Two triangle blocks

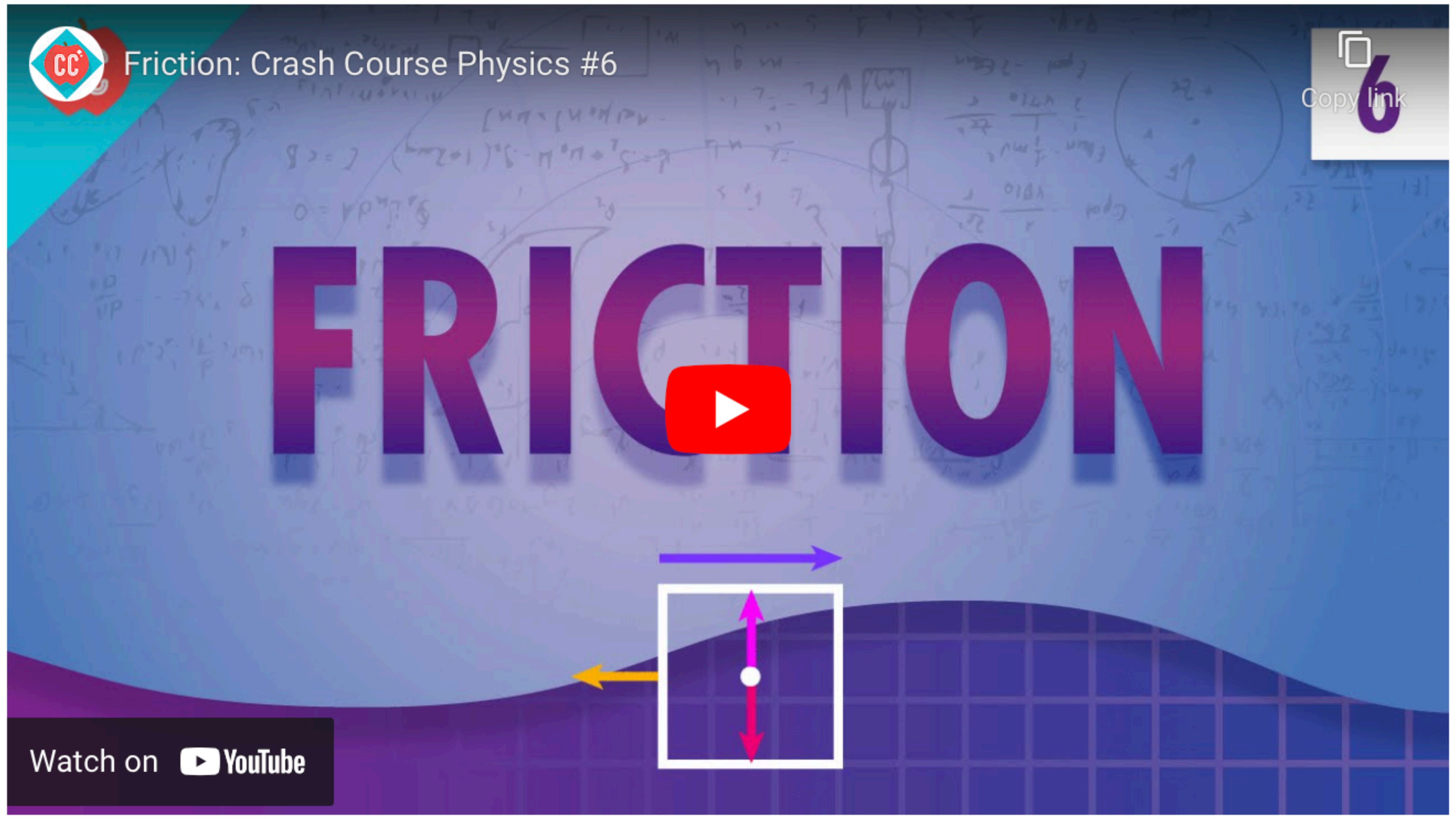
Logistics/Announcements

- 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

Physics 111

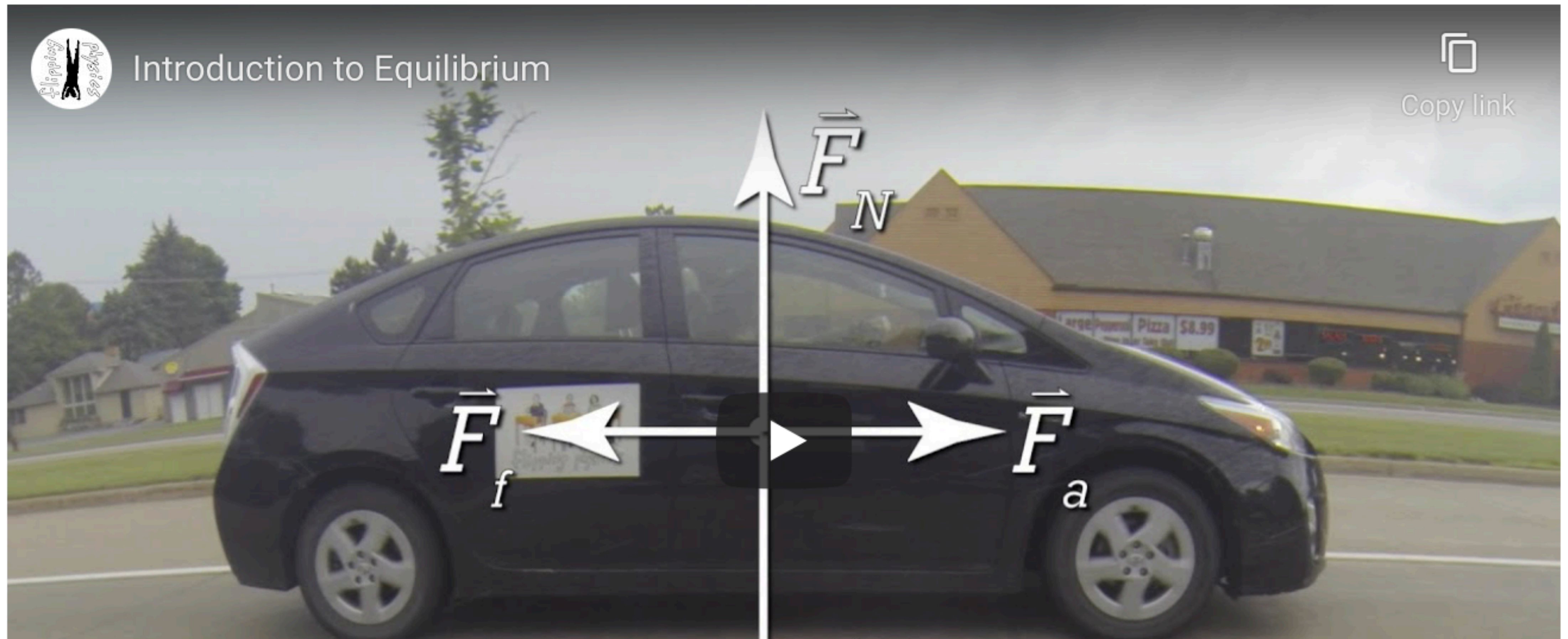
Search this book...

Friction



Required Videos

1. Introduction to Equilibrium



- [ ] Video 2
- [ ] Video 3
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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

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)

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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

Friday’s Class

6.4 Drag force and Terminal Speed

HW 6 Reflection

Most confusing things:

Friction

Centripetal Force

Springs

Drag Force

HW 6.8!!

Spring force

A spring is a special medium with a specific atomic structure that has the ability to restore its shape, if deformed. To restore its shape, a spring exerts a restoring force that is proportional to and in the opposite direction in which it is stretched or compressed. This is the statement of a law known as Hooke's law, which has the mathematical form

$$\vec{\mathbf{F}} = -k\vec{\mathbf{x}}.$$

The constant of proportionality *k* is a measure of the spring's stiffness. The line of action of this force is parallel to the spring axis, and the sense of the force is in the opposite direction of the displacement vector (Figure 5.29). The displacement must be measured from the relaxed position; $x = 0$ when the spring is relaxed.

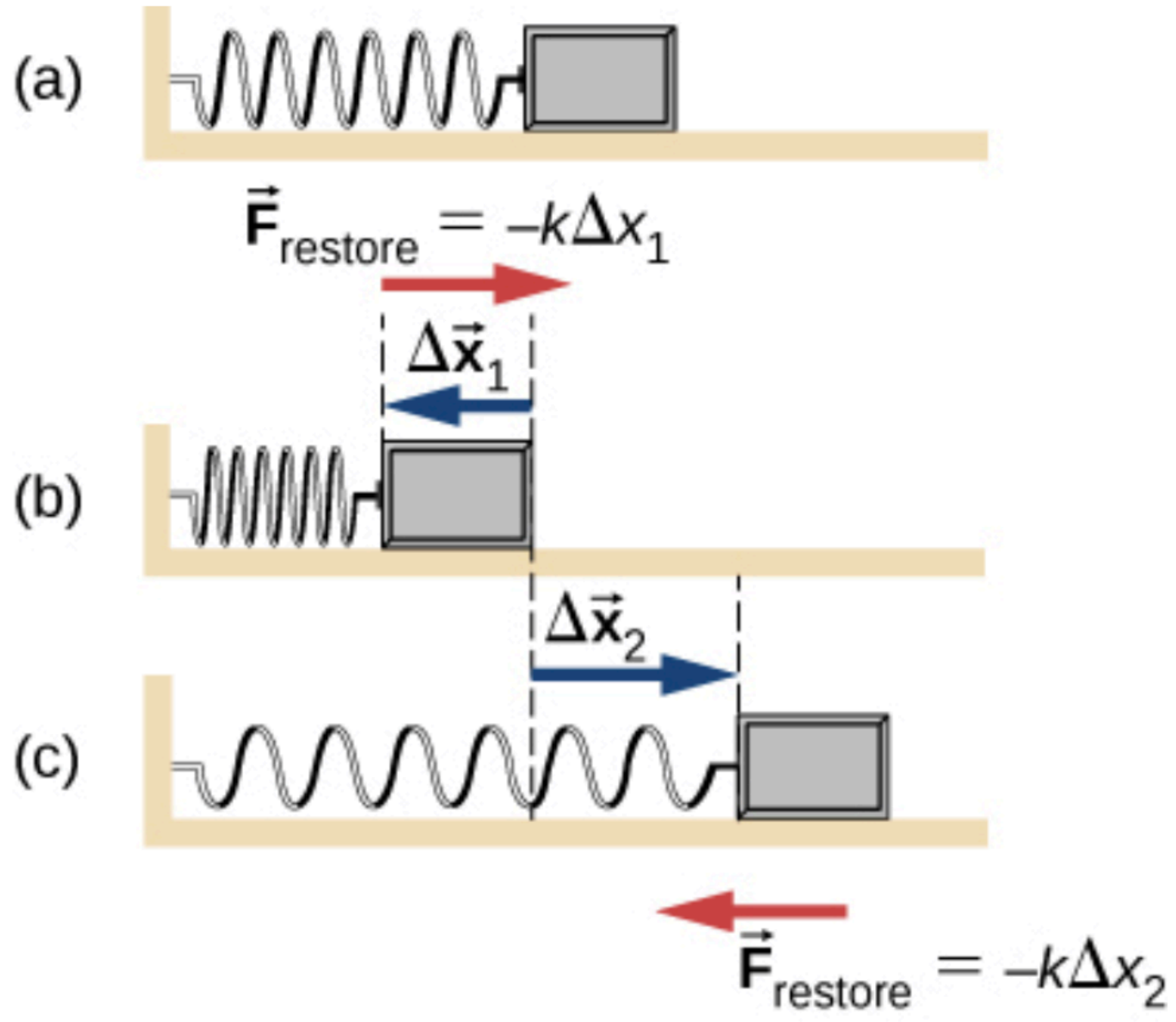

Figure 5.29 A spring exerts its force proportional to a displacement, whether it is compressed or stretched. (a) The spring is in a relaxed position and exerts no force on the block. (b) The spring is compressed by displacement $\Delta\vec{\mathbf{x}}_1$ of the object and exerts restoring force $-k\Delta\vec{\mathbf{x}}_1$. (c) The spring is stretched by displacement $\Delta\vec{\mathbf{x}}_2$ of the object and exerts restoring force $-k\Delta\vec{\mathbf{x}}_2$.

Spring Force

Drag Force

DRAG FORCE

Drag force F_{D} is proportional to the square of the speed of the object. Mathematically,

$$F_{\mathrm{D}} = \frac{1}{2} C \rho A v^2,$$

where C is the drag coefficient, A is the area of the object facing the fluid, and ρ is the density of the fluid.

Drag Force

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Rank the drag force on these specimens from highest (1) to lowest (7)

Terminal Velocity

Terminal Velocity

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	$F_D = \frac{1}{2}C\rho Av^2$
Stokes' law	$F_s = 6\pi r\eta v$

Clicker Questions

CQ.7.9

A 2.20 kg toy plane takes off with an acceleration of 3.30 m/s^2. The engine supplies a force of 8.15 N. Determine the magnitude of drag force acting on the plane as it accelerates.

a) 7.26 N

b) 15.4 N

c) 0.89 N

d) 0.0 N

A

B

C

D

E

CQ.7.9

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✔ c) 0.89 N

d) 0.0 N

Detailed solution: Without any drag force the airplane would accelerate at **3.7 m/s^2**. The drag force opposes a little bit of the force supplied by the motor. If you chose **15.4 N** you may have added a number that should have been subtracted. **7.26 N** is the net force acting on the plane. You'll need this to calculate the drag force.

A B C D E

Activity:
Worked Problems


Terranova
Terranova
VIGORELLI

WP 7.3 - Rotor Ride: Friction & Centripetal Motion

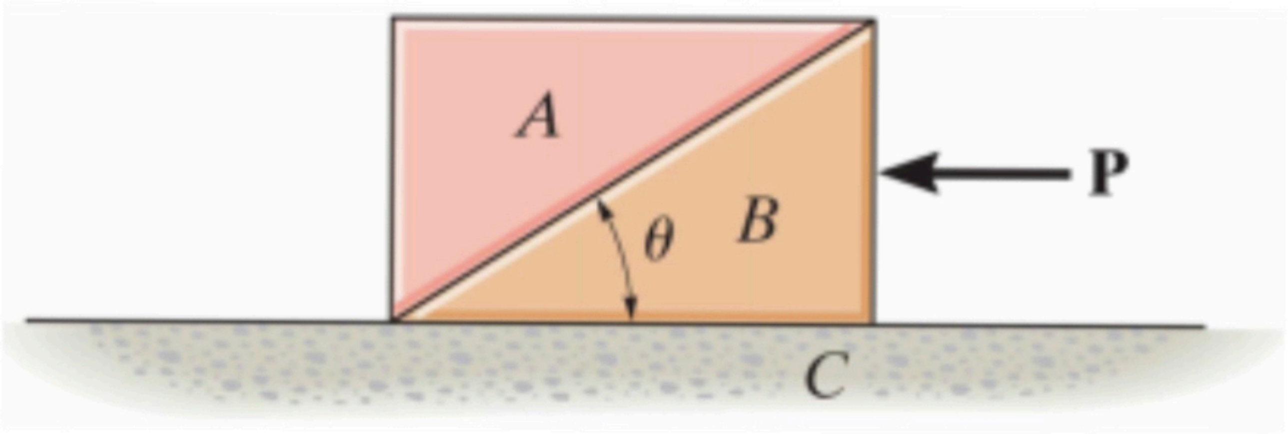
WP 7.3 - Rotor Ride: Friction & Centripetal Motion

Additional Practice: Watch the Organic Chemistry Tutor solve this problem

HW 6.8

HW6.8. Two Blocks Stacked

Blocks A and B each have a mass $m = 10\ kg$. The coefficient of static friction between A and B is $\mu_s = 0.38$. The angle shown is $\theta = 33°$. Neglect any friction between B and C.

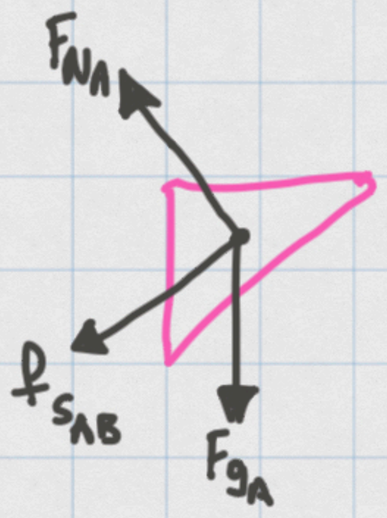


Determine the largest horizontal force $\vec{P}$ that can be applied so that A will not slip on B.

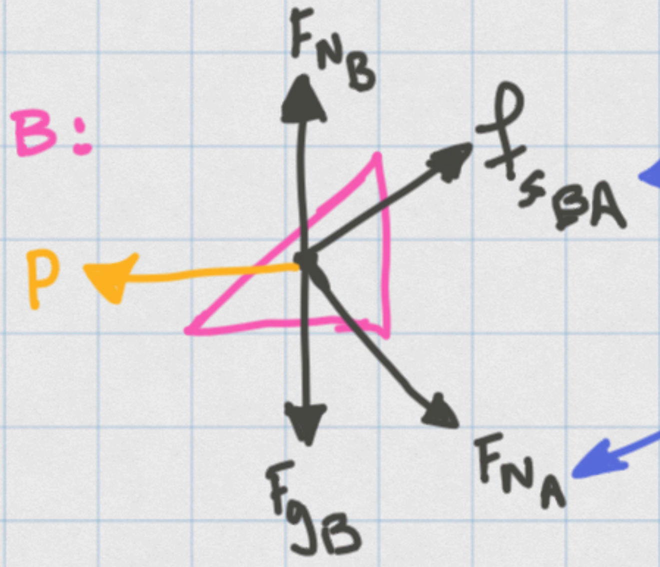
$\vec{P} =$ 37.28 N ✕0%

① Draw separate FBDs for each Block

A:



B:



Where did these forces come from!?

Ans: These are the Newton's 3rd Law Force Pairs

Why is the friction in this direction?

② If Block B is pushed to the left, Block A will slide up the ramp if $\vec{P}$ is large enough!

Remember F_{NA} is the force that changes as P increases (or decreases)

③ Consider the case where forces balance such that $a_A = a_B = a$

HW 6.8

See you next class!

Attribution