



Virtual Learning

Physics

Force and Free Body Diagrams

April 10, 2020



Physics

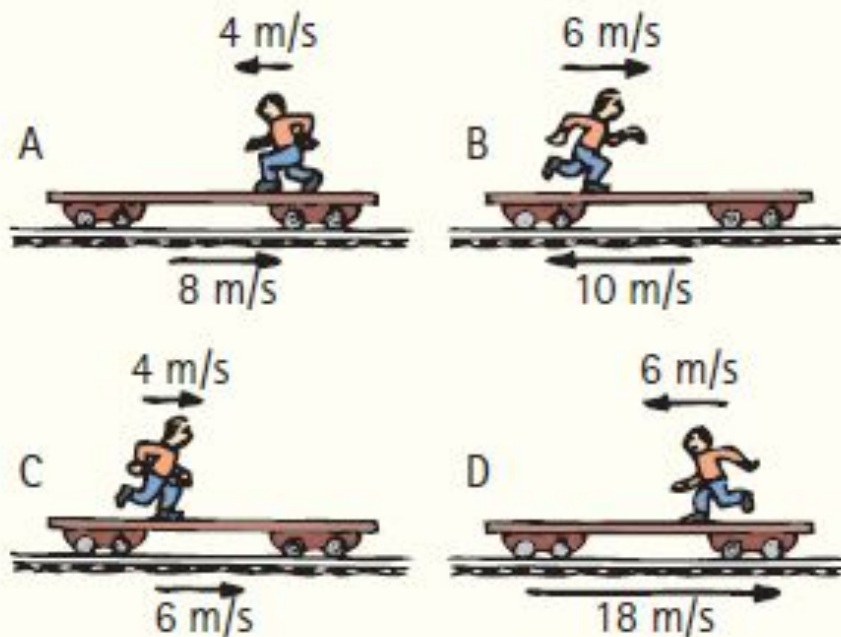
Force and Free Body Diagrams: April 10, 2020

Objective/Learning Target:

Students will learn how to draw free body force diagrams, and use them to help in determining net force.

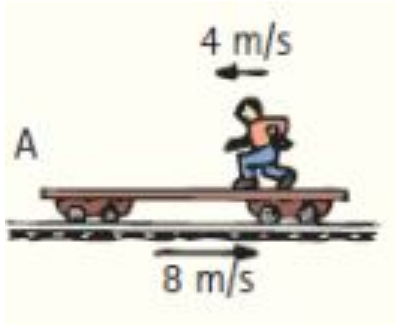
Quick Review 1

- 1) Running Ray jogs along a train flatcar that moves at the velocities shown in positions A-D. Determine Ray's velocities relative to a stationary observer on the ground and rank them from greatest to least. (The direction to the right is positive.)



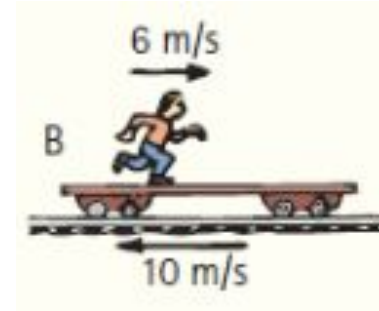
Quick Review 1 Answer

1)



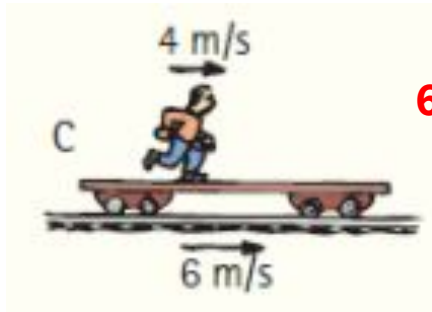
$$8 \text{ m/s} - 4 \text{ m/s} = 4 \text{ m/s}$$

-----> 4 m/s



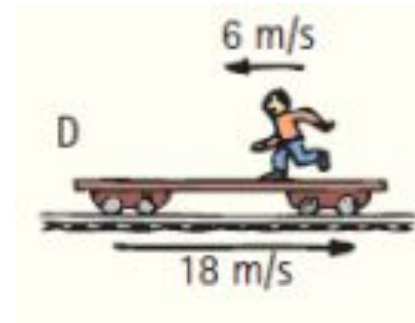
$$6 \text{ m/s} - 10 \text{ m/s} = -4 \text{ m/s}$$

←---- -4 m/s



$$6 \text{ m/s} + 4 \text{ m/s} = 10 \text{ m/s}$$

-----> 10 m/s



$$18 \text{ m/s} - 6 \text{ m/s} = 12 \text{ m/s}$$

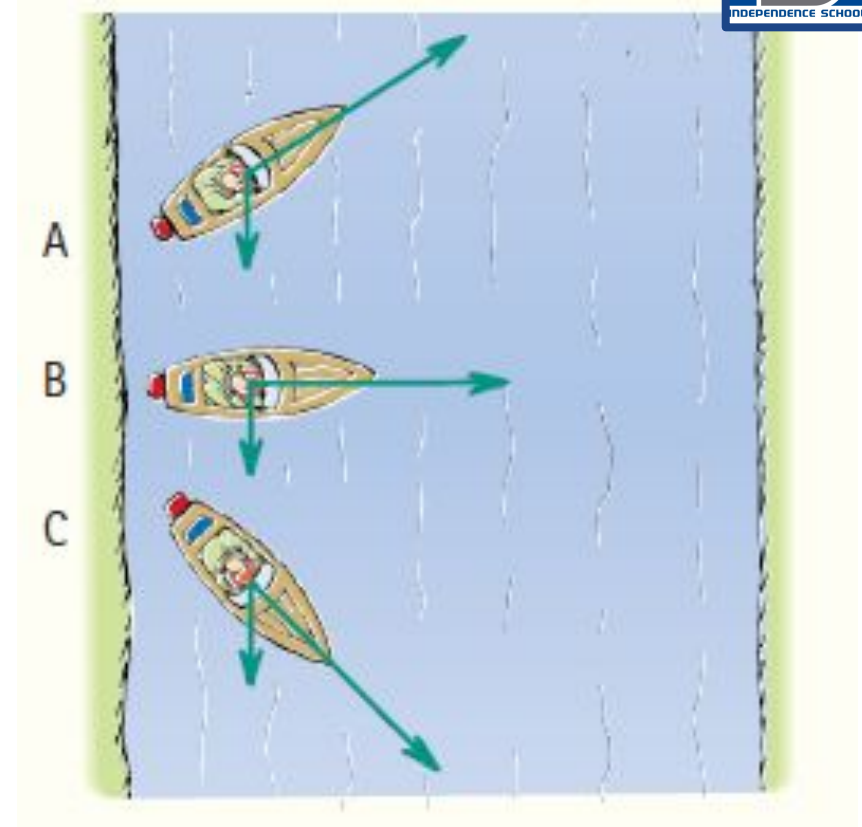
-----> 12 m/s

From Greatest To Least: D, C, A, B

Quick Review 2

Here we see top views of three motorboats crossing a river. All have the same speed relative to the water, and all experience the same river flow. Construct resultant vectors showing the speed and direction of each boat. Rank the boats from most to least for

- The time to reach the opposite shore.
- The fastest ride.



Quick Review 2 Answer

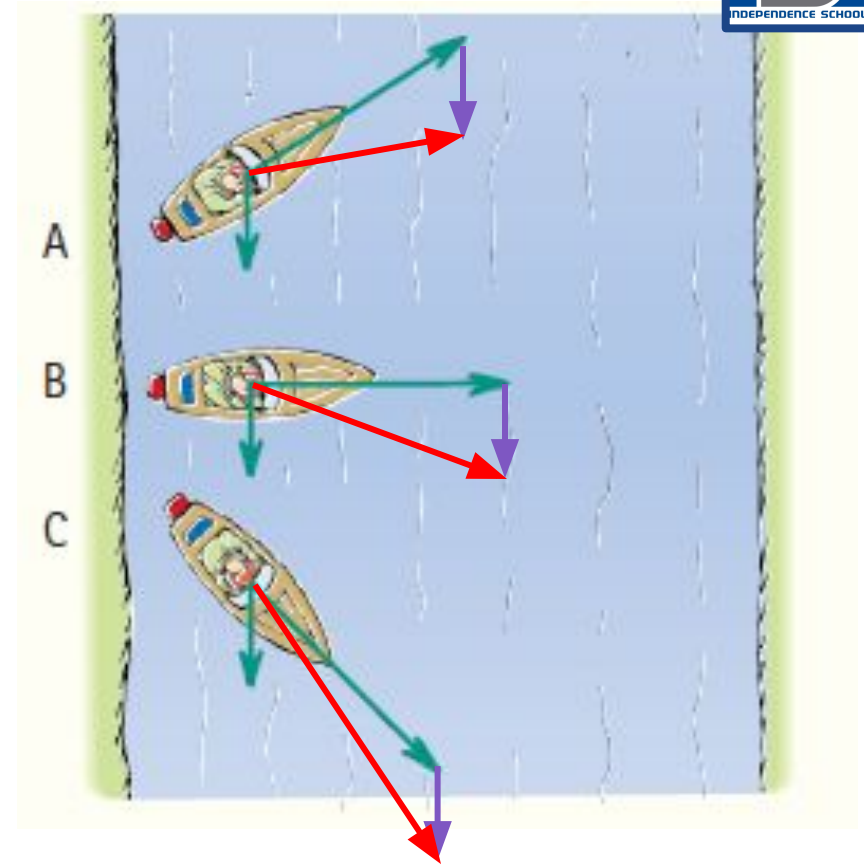
The red arrows represent the resultant velocity.

a) Time to reach the opposite shore, most to least:

C---A---B

b) The Fastest Ride, most to least:

C---B---A



Force & Newton's Second Law of Motion

Link: [Development of Force](#)

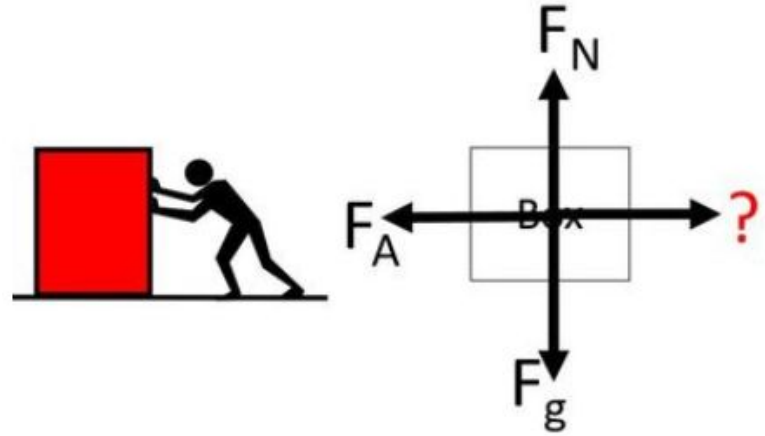
Directions:

- Read through the section on Development of Force
- Work through any examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slides.
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.



Free Body Diagrams

Watch the following Bozeman Science Video on Free Body Diagrams. Work along with the video by pausing on the examples, then un-pausing to check your answers.

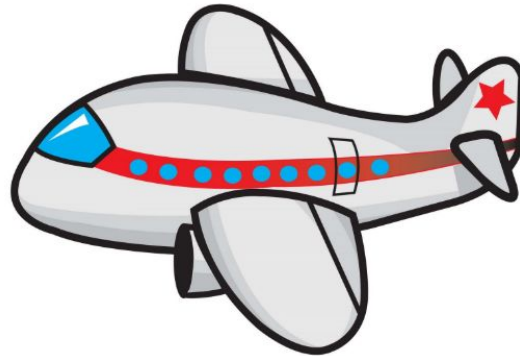


[Free Body Diagrams Video Explanation](#)

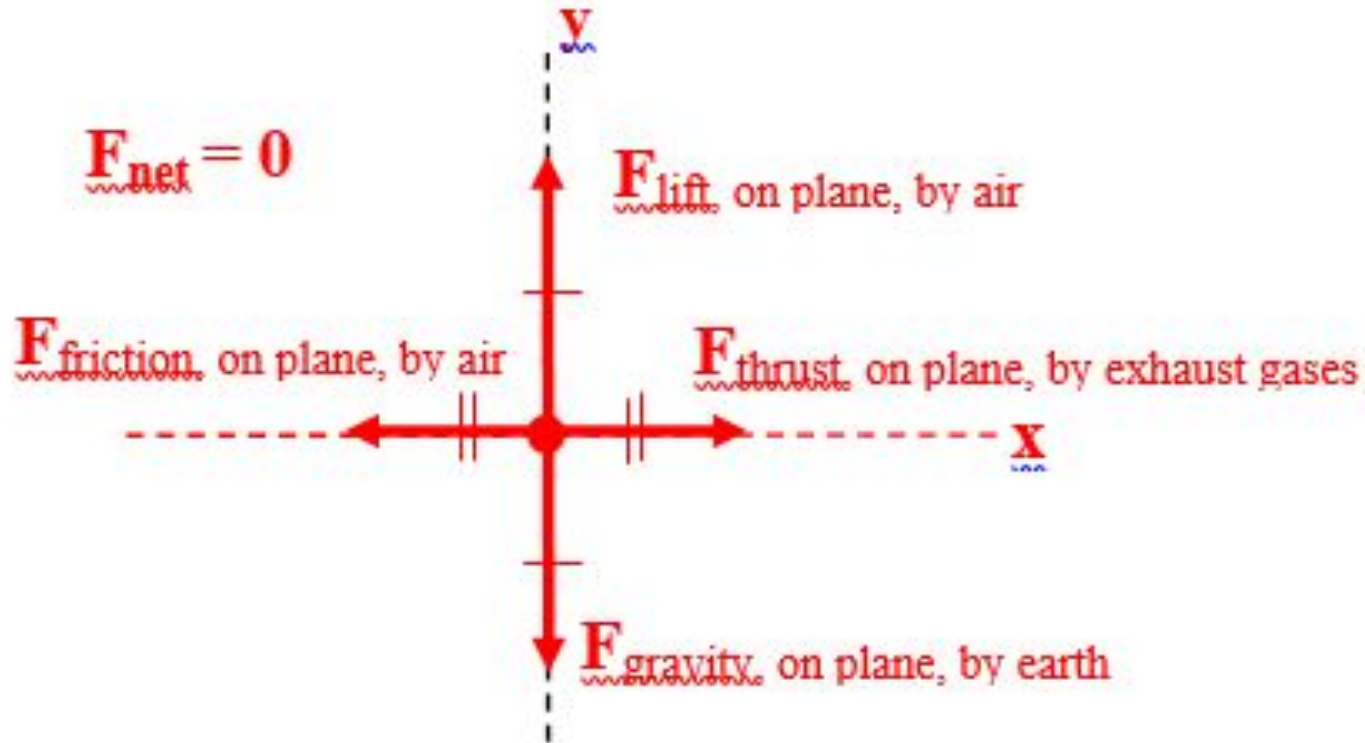
Then complete the practice problems on the following slides.

Practice Problems

1. Draw a force diagram for an airplane in straight and level flight. Label the forces and use equality marks on the force vectors to show what forces are balancing out.

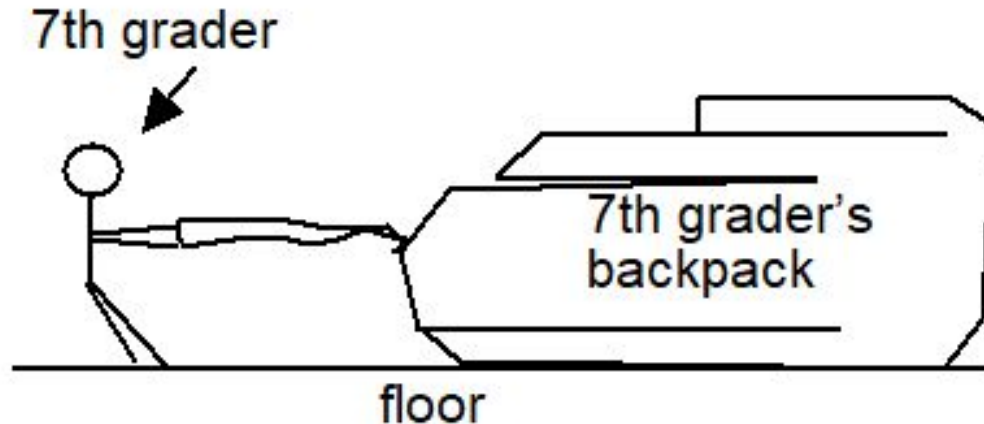


Practice Problem 1 Answer



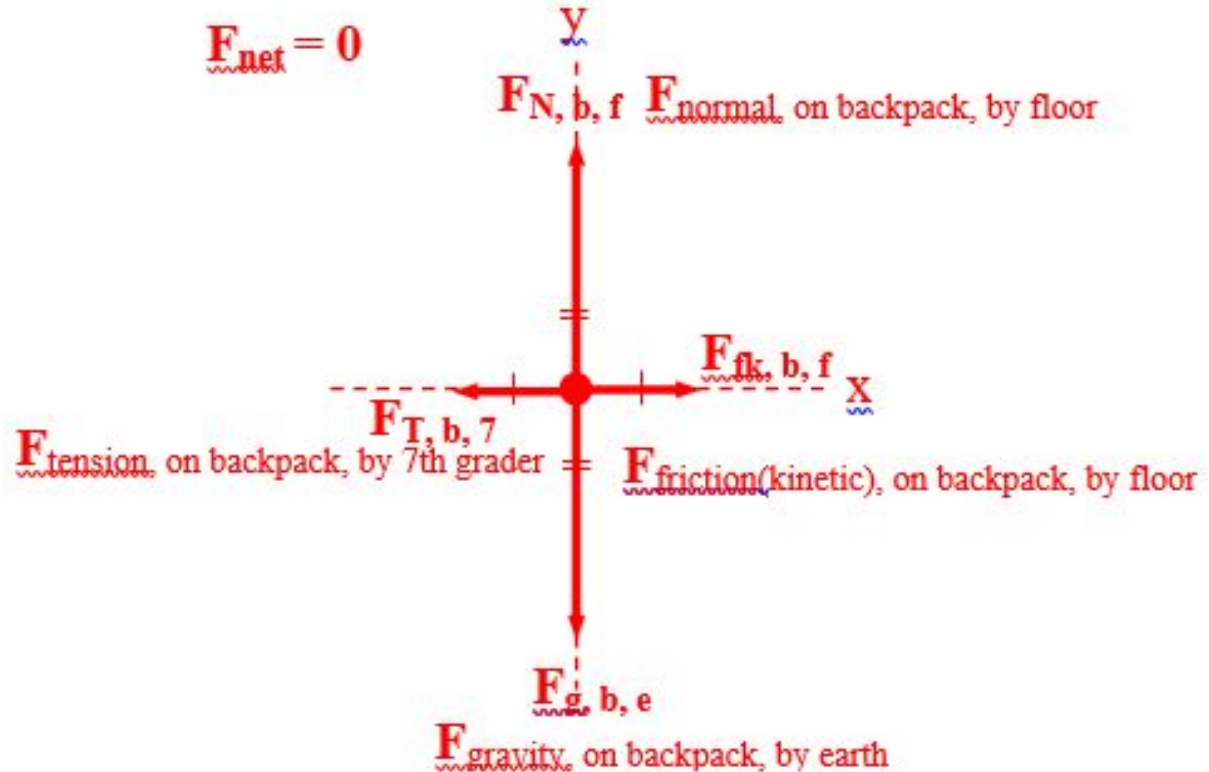
Practice Problems

2. Make a free body force diagram for the backpack being dragged at a constant velocity.



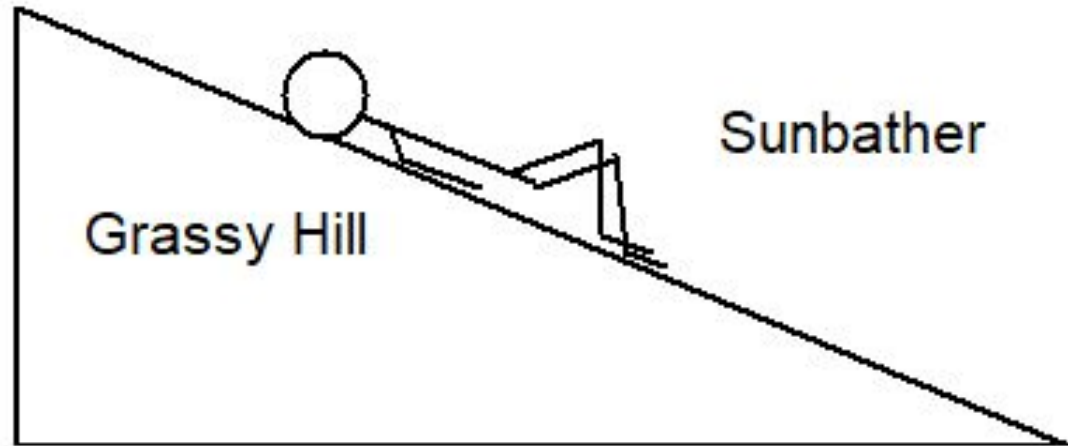
Practice Problem 2 Answer

Note: Both complete and shorthand labels for force vectors were provided in this key.



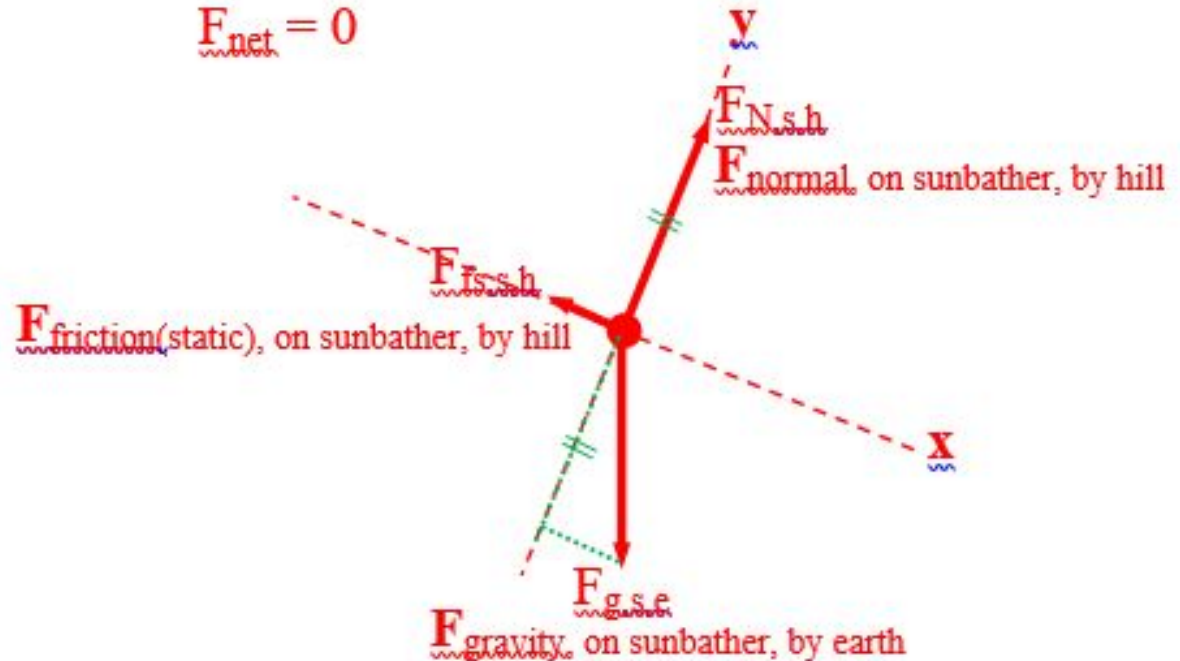
Practice Problems

- 3) Make a free body force diagram for the sunbather at rest.



Practice Problem 3 Answer

Note: Both complete and shorthand labels for force vectors were provided in this key.



Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.