

Name: _____

Phet Forces and Free Body Diagrams Lab

Directions: Go to the Phet Link: <https://phet.colorado.edu/en/simulation/forces-and-motion-basics>

- Click play button
- When the APP opens select “Net Force”
- Choose the “Sum Forces” and “Sound” off

Net Force Section

1. Think back to the discussion for solving for F_{net} . How do you solve for a Net Force?
2. Select one blue 50N person and a 50N red person. Move them up to the rope. Draw a Free Body Diagram with vector arrows, labels and a box below.
3. What is the sum of the forces and direction for problem #2? Explain.
4. Select one blue 150N person, 100N blue person, two 50N red people. Move them up to the rope. Draw a Free Body Diagram with vector arrows, labels and a box below.
5. What is the sum of the forces and direction for problem #4? Explain.
6. Select 5 people red or blue. Move them up to the rope. Draw a Free Body Diagram with vector arrows, labels and a box below.

7. What is the sum of the forces and direction for problem #6? Explain.

8. Explain how a Free Body Diagram allows you to solve force problems.

Motion

At the bottom of the APP change the window to MOTION.

- **Check the boxes for Forces, Values, Masses and Speed**

9. Under the “Applied Forces” arrow to 50 N. Watch and observe the person. Describe in detail what occurs with forces and what happens to the speed?

10. Select the reset button. Add the girl on top of the box. There is a mass of 90kg. Under the “Applied Forces” arrow to 50 N. Watch and observe the person. Describe in detail what occurs with forces and what happens to the speed?

11. Now add in additional 100N of “Applied Forces.” Describe what happens with forces and what happens to the speed?

12. Select a combination of 3 objects and an “Applied Force” of your choosing. Describe what happens with forces and what happens to the speed?

Friction

At the bottom of the APP change the window to Friction.

- Check the boxes for Forces, Values, Masses and Speed

13. Under the “Applied Forces” arrow to 50 N. Watch and observe the person. Describe in detail what occurs with forces and what happens to the speed?

14. Now add in additional 100N of “Applied Forces” for a total of 150N.

a. Describe what happens with forces and what happens to the speed?

b. What is the friction force?

c. What is the sum of the forces?

d. Describe the speed.

15. Change the friction to the maximum amount.

a. What is the friction force?

b. What is the sum of the forces?

c. Describe the speed.

16. Now you select. Choose the following:

a. Friction force= _____

b. Applied force= _____

c. Sum of the forces= _____

d. Acceleration= _____

e. Describe what happens with forces and what happens to the speed?

f. What is the friction force?

g. What is the sum of the forces?

- h. Describe the speed and acceleration.

Reset the simulation

- **Check the boxes for Forces, Values, Masses, and Speed**

17. Set the applied force to 94N

- a. What is the friction force?
- b. What is the applied force?
- c. Is the box moving?

18. Now increase the applied force by 1 newton at a time until you get to 125N

- a. What is the friction force?
- b. What is the applied force?
- c. Is the box moving?
- d. Is there a net force?
- e. Draw a free body diagram

19. Now increase the applied force to 126N

- a. What happens to the box
- b. What is the friction force?
- c. Is the box moving?
- d. Is the box accelerating?

20. Now decrease the applied force until the box stops accelerating

- a. What is the force?
- b. What is the friction force?
- c. What is happening to the box?
- d. Is the box accelerating (remember we can have negative acceleration) Explain.
- e. Draw a free body diagram of the situation

21. Now decrease the applied force until the box stops accelerating and add more weight (you choose)

- a. What is the friction force?
- b. What is happening to the box?
- c. Is the box accelerating (remember we can have negative acceleration) Explain.
- d. Draw a free body diagram of the box

Reset the simulation

- **Check the boxes for Forces, Values, Masses, and Speed**

22. Put whatever mass you want and set friction to 0, apply a force until the object is moving, now decrease the force to 0

- a. What happens to the person pushing the object?
- b. What happens to the object

Acceleration

At the bottom of the APP change the window to Acceleration.

Play with different friction levels, Mass, force. Click all the boxes to show the values of Forces, Sum of forces, Values, Speed, Acceleration.

Add more mass, less mass, change force, change friction

23. Describe what you did and what you learned about force, mass, friction, and acceleration

Conclusion

24. How does friction, acceleration, speed and net force relate to each other? Explain.

25. Describe an example of friction, speed and net force in your life.

26. Draw a Free Body Diagram of your example and explain how the forces interact with each other.

27. Describe an example where you want to solve for a balanced $F_{\text{net}} = 0\text{N}$. Be specific and detailed.

28. Describe an example where you want unbalanced F_{net} . Be specific and detailed.