

## Free Body Diagrams

## Mastery Assignment

This assignment needs to be completed turned in and check using answers in the blue notebook before taking the mastery test. Some answers can be found online at [www.mrwaynesclass.com/freebodies](http://www.mrwaynesclass.com/freebodies).

Answer these questions on a separate sheet of paper.

1. List the six principles of friction
2. Which kind of friction offers more resistance, static or kinetic?
3. A ball is rolling around a loop-de-loop on a toy track. Assuming friction and no acceleration along this part of the track. Draw a free body diagram of the forces acting on the ball.



4. Fill in the chart below using the forces we learned about in this chapter.

Force name	Description of when the force is present.	Variable used for the force
Tension		
Friction		
Weight		
Net force		
Centripetal force		

5. Draw two free bodies for a car pulling a trailer at a constant velocity to the left on a rough road. Ignore air resistance.



6. Write the expressions for summing up the forces in the x and y directions for the car and trailer.

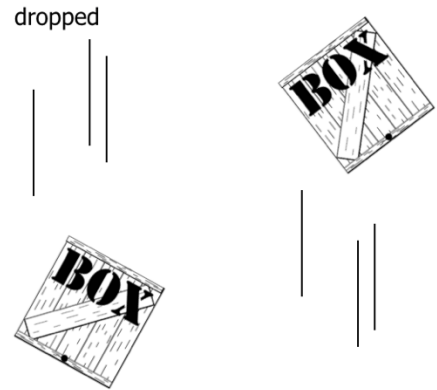
## Free Body Diagrams Solutions

## Mastery Assignment

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Answer these questions on a separate sheet of paper.

7. Draw the free body diagram for a box that is dropped. Draw it for the position where the box is in the air and not touching anything. Include air resistance. "Air resistance" is friction for air. It opposes the direction of motion. The box's weight is greater than the force of air resistance. (Figure 8)



8. Write the expression for summing up the forces in the vertical and horizontal directions for the falling box in the previous question.

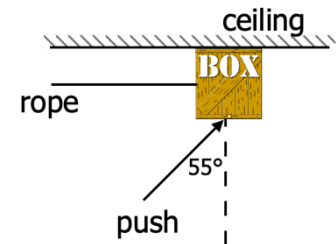
9. Draw the free body diagram for a box that is launched straight up. Draw it for the position where the box is in the air and not touching anything. Include air resistance. "Air resistance" is friction for air. It opposes the direction of motion. The box's weight is greater than the force of air resistance. (Figure 11)



10. Write the expression for summing up the forces in the vertical and horizontal directions for the rising box mentioned in the previous question.

11. A 60 kg snow boarder has reached the bottom of a hill where she is traveling across flat, horizontal, ground initially at 10 m/s. The coefficient of friction between the skier's skis and snow is 0.222. When she looked behind her, she saw a rope attached to her with a bird flying on the other end. This bird was also trying to stop her by applying a tension of 50N to the rope. How much distance will the skier coast before coming to a rest?

12. While fixing a part of an assembly line on the widgets and whirly-gigs toy factory, a factory worker has found himself in a precarious position where he is pushing on a box that is tight against the ceiling. The box is attached to a rope that is experiencing a tension of 200.0 N. The box is moving at 2.00 m/s across the ceiling to the left. The box has a mass of 10.0 kg and is experiencing a frictional force is 50.0 N.



- What is the magnitude of the pushing force exerted by the factory worker?
- What is the magnitude of the normal force that is exerted by the ceiling on the box?