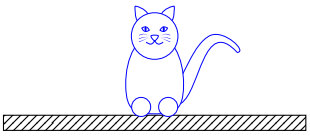
Name: Date: Period:

Newton #2 (Free-Body Diagrams)

1. A cat sits at rest on the top of a table.
   (a) Is the cat at mechanical equilibrium? How do you know?

   (b) Draw the free body diagram.
   Make sure to include the net force.

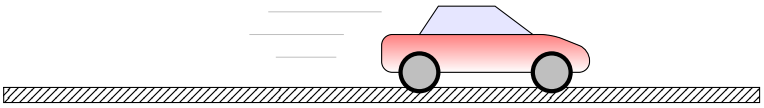


   (c) If the cat's weight (that is, force of gravity) is 90 Newtons, what is the normal force acting on the cat?

---

2. A car is moving east along the interstate **at a constant speed**.
   (a) Is the car at mechanical equilibrium? How do you know?

   (b) Draw the free body diagram.
   Make sure to include the net force.

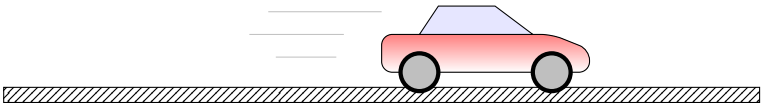


   (c) The car has an applied force of 700 Newtons and a frictional force of 300 Newtons. Find the magnitude of the air resistance.

---

3. The same car is now **accelerating forward**.
   (a) Is the car at mechanical equilibrium? How do you know?

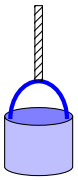
   (b) Draw the free body diagram.
   Make sure to include the net force.



   (c) The frictional force and air resistance are the same as in the last problem, but this time, the car has an applied force of 900 Newtons. Calculate the net force.

4. You are lifting a bucket with a rope. The force on the rope is 45 Newtons and the bucket has a weight (that is, force of gravity) of 23 Newtons.

   (a) Draw the free body diagram.
   Make sure to include the net force.



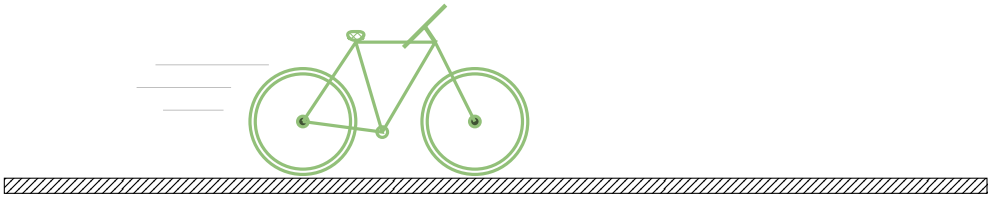
   (b) Calculate the net force on the bucket.

---

5. Newton's Second Law gives us the equation $F_{NET} = ma$. A bicycle has a mass of 120 kg. It accelerates at a rate of $1.2\,\text{m/s}^2$.

   (a) Calculate the net force acting on the bicycle.

   (b) The bicycle experiences 52 N of friction.
   Draw a free body diagram.
   Ignore Air Resistance.

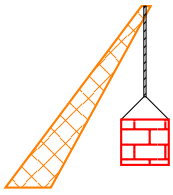


   (c) Calculate the applied force on the bicycle.

---

6. A large load has a weight (that is, force of gravity) of 12 000 N. It is being lifted by a crane.

   (a) Draw a free body diagram.



   (b) The net force is 1500 N upward. Calculate the **tension** being provided by the crane.