

Free Body Diagrams

Newton's laws can be used to analyze the motion of many objects. To help in analyzing these situations, we will draw diagrams called **free-body diagrams**. A free-body diagram is a diagram that represents an object and all the forces acting on it.

Listed below are several common situations that we will analyze:

1. Free fall in a vacuum.



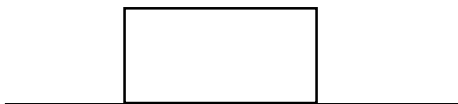
2. Free fall with air resistance.



3. An object resting on top of a table.



4. An object on a frictionless table being pulled to the right.



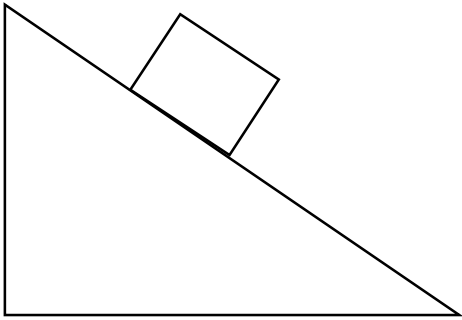
5. An object pulled to the right on a surface with friction.



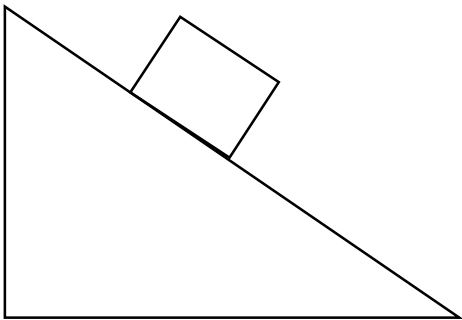
6. An object pulled to the right with an applied force at an angle to the surface.



7. An object on a frictionless incline.



8. An object on an incline with friction.



Free-Body Diagrams

There are 15 questions below. In each case, an object is acted upon by one or more forces. Draw accurate free-body diagrams showing all the forces acting on the object. Assume there is no friction unless otherwise noted in the question. Label the forces using the following symbols:

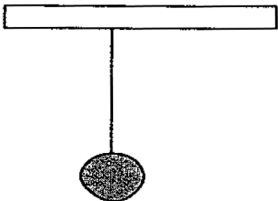
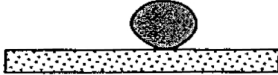
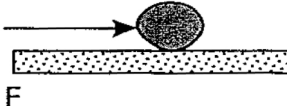

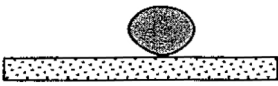

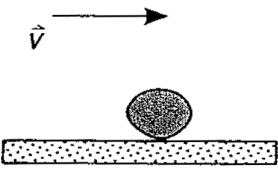


F_g for gravity (or weight)

F_N for the normal force

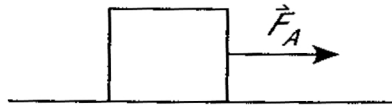
T for tension

F_A for the applied force

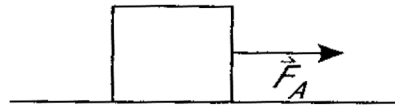
F_f for friction and/or air resistance

<p>1. Equilibrium</p> 	<p>2. Equilibrium</p> 	<p>3. Rock is pushed but remains motionless. Friction acts.</p> 
<p>4. Rock is falling, no friction.</p> 	<p>5. Rock is sliding at constant speed on a frictionless surface.</p> 	<p>6. Rock is falling at a constant (terminal) velocity.</p> 
<p>7. Rock is decelerating because of kinetic friction.</p> 	<p>8. Rock is rising. No friction.</p> 	<p>9. Rock is at the top of its flight, momentarily motionless.</p> 

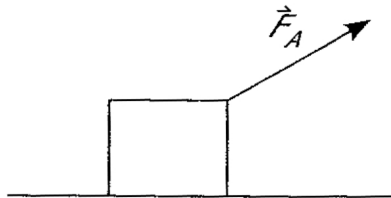
1. The object is pulled horizontally. No friction.



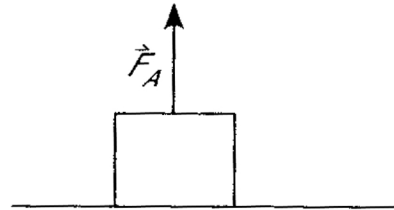
2. The object is pulled horizontally at constant velocity. Kinetic friction acts.



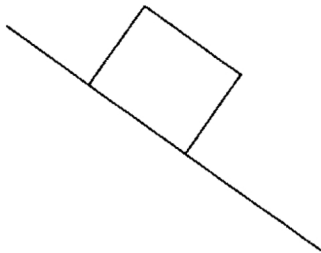
3. The object is pulled by a force acting in the direction shown. Static friction acts. The object is motionless.



4. The object is pulled straight upwards. It is motionless.



5. The object is resting on the plane. No friction acts.



6. The object remains motionless. Static friction acts.

