




### Strand 3.3 Force Affects Motion

Forces act on objects and have both a strength and a direction. An object at rest typically has multiple forces acting on it, but they are balanced, resulting in a zero-net force on the object. Forces that are unbalanced can cause changes in an object's speed or direction of motion. The patterns of an object's motion in various situations can be observed, measured, and used to predict future motion. Forces are exerted when objects come in contact with each other; however, some forces can act on objects that are not in contact. The gravitational force of Earth, acting on an object near Earth's surface, pulls that object toward the planet's center. Electric and magnetic forces between a pair of objects can act at a distance. The strength of these non-contact forces depends on the properties of the objects and the distance between the objects.

Standard	Resource/Link/PDF	Description	Teacher Tip
<b>3.3.1 Plan and carry out investigations</b> that provide evidence of the <b>effects</b> of balanced and unbalanced forces on the motion of an object. Emphasize investigations where only one variable is tested at a time. Examples could include an unbalanced force on one side of a ball causing it to move and balanced forces pushing on a box from both sides producing no movement. (PS2.A, PS2.B)	<a href="#">Balanced Forces Investigation</a>  <a href="#">Balanced Forces Investigation PDF</a>	<p>Students <b>carry out an investigation</b> about the effect of balanced forces on object motion.</p> <p>Students will need the following materials:</p> <ul style="list-style-type: none"> <li>• Paper Card</li> <li>• Cup</li> <li>• Water</li> </ul>  <p>After the investigation students read two articles about balanced and unbalanced forces and <b>develop two iterations of a model</b> to explain the phenomenon.</p>	<p>*The 3.1 lessons are in sequential order.</p> <p>Prior to the investigation <b>students record 3-5 questions/wonderings</b> about the phenomenon, "A cup with water is covered with a paper card and turned over, the water stays in the cup even when you remove your hand from holding the card.".</p> <p><a href="#">A model is an abstract representation of phenomena that is a tool used to predict or explain the world. Models can be represented as diagrams, 3-D objects, mathematical representations, analogies or computer simulations.</a></p> <p>INSTRUCTIONAL LEADERSHIP FOR SCIENCE PRACTICES (ILSP)</p> <p>At the end of the lesson students use evidence from the investigation and text to explain their thinking about the phenomenon. This could be done orally in an online live sharing circle or written.</p>

<p><b>3.3.3 Construct an explanation</b> that the gravitational force exerted by Earth <b>causes</b> objects to be directed downward, toward the center of the spherical Earth. Emphasize that “downward” is a local description depending on one’s position on Earth. (PS2.B)</p>	<p><a href="#">Forces Including Gravity Investigation</a></p> <p><a href="#">Forces Including Gravity Investigation PDF</a></p>	<p>Students <b>plan and carry out an investigation</b> about the effect of balanced forces including the concept of gravity as a force. Students will need the following materials:</p> <ul style="list-style-type: none"> <li>• Paper Card</li> <li>• Cup</li> <li>• Coin</li> </ul> <p>After the investigation students <b>develop a model</b> to explain the results of their investigation and read an article about balanced and unbalanced forces.</p>	<p>Prior to the investigation <b>students record 3-5 questions/wonderings</b> about the phenomenon, “removing a tablecloth from underneath dishes and the dishes don’t move”.</p>
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