

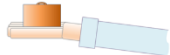





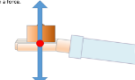
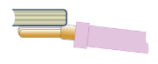
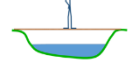

Physics > Big idea PFM: Forces and motion > Topic PFM3: More about force



Key concept (age 11-14)

PFM3.2: Hidden forces

Progression toolkit: Hidden forces

Learning focus	An object resting on the floor squashes it a little and, because at a microscopic level the floor is springy, it pushes back on the object with an equal sized force in the opposite direction to the object's weight.				
As students' conceptual understanding progresses they can:	<div> <div>CONCEPTUAL PROGRESSION</div> <div></div> </div>				
	Describe how a person's hand uses force to support different sized weights.	Describe how the size of force exerted by a spring changes as it is squashed.	Explain how a ruler, made into a bridge, changes to support weights of different sizes.	Explain how objects of different weights can all be supported by the same floor.	Explain how a string can support objects of different weights and hold each one at rest.
Diagnostic questions	A big weight	Squashing a spring	Ruler bridge	Heavy crate	Ball on a rope
				Light crate, heavy crate	
Response activities	Adding more weight		John's plank	Squashing a mattress	Hanging ball
	Holding a book			Box on a table	

A big weight	Squashing a spring	Ruler bridge	Heavy crate	Light crate, heavy crate																																													
<p>BEST STUDENT WORKSHEET</p> <p>A big weight</p> <p>Olivia has pushed on a big weight. Her friends are holding onto the forces that hold it steady.</p>  <p>1. What forces hold the big weight steady? Put a tick (✓) in the box next to the best answer.</p> <p>A It is not moving, so there are no forces. <input type="checkbox"/></p> <p>B The only force is gravity, pushing it only Olivia's hand. <input type="checkbox"/></p> <p>C The only force is Olivia pushing up, so it's held in steady. <input type="checkbox"/></p> <p>D Olivia pushed the weight down and Alex pushed it up. <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>Squashing a spring</p> <p>Sam pushed down on a spring. The spring pushes up a bit.</p>  <p>Sam does not move and the spring stays squashed.</p> <p>1. What forces are pushing? Put a tick (✓) in the box next to the best answer.</p> <p>A There are no forces. <input type="checkbox"/></p> <p>B Sam pushed down - the spring does not push up. <input type="checkbox"/></p> <p>C The spring pushes up - Sam pushed down harder. <input type="checkbox"/></p> <p>D The spring pushes up - Sam pushed down with the same sized force. <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>Ruler bridge</p> <p>A meter ruler is used to model a ruler bridge. Weights are added to show what happens when one or two are on the bridge. A small weight is used for a car. A big weight is used for a lorry.</p>  <p>What do you think about the ruler when each weight is added? For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A The ruler bends with the heavy weight on it.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B The ruler bends with just the small weight.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C The ruler pushes up on the small weight.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D The ruler pushes up harder on the big weight.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A The ruler bends with the heavy weight on it.					B The ruler bends with just the small weight.					C The ruler pushes up on the small weight.					D The ruler pushes up harder on the big weight.					<p>BEST STUDENT WORKSHEET</p> <p>Heavy crate</p> <p>A heavy crate is sitting on the ground.</p>  <p>Which picture shows the forces acting on the crate? Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> There are no forces acting on the crate.</p> <p>B <input type="checkbox"/> The only force on the crate is gravity, pulling it downwards.</p> <p>C <input type="checkbox"/> The only force on the crate is the upward push of the ground.</p> <p>D <input type="checkbox"/> There are two forces on the crate: the downward pull of gravity, and the upward push of the ground.</p>	<p>BEST STUDENT WORKSHEET</p> <p>Light crate, heavy crate</p> <p>A light crate and a heavy crate are both sitting on the same floor.</p>  <p>What is correct about the forces in this situation? For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A Both crates push down on the floor with the same sized force.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B The floor pushes up on each crate because it is squashed a little.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C The floor pushes up on each crate with the same sized force.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A Both crates push down on the floor with the same sized force.					B The floor pushes up on each crate because it is squashed a little.					C The floor pushes up on each crate with the same sized force.				
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<p>BEST STUDENT WORKSHEET</p> <p>Ball on a rope</p> <p>Alfred hangs up a boxing ball. One end is tied to a ring hanging from the ceiling.</p>  <p>Which picture best shows the forces acting on the ball? Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> There are no forces acting on the ball.</p> <p>B <input type="checkbox"/> The only force on the ball is gravity, pulling it downwards.</p> <p>C <input type="checkbox"/> The only force on the ball is the upward pull of the rope.</p> <p>D <input type="checkbox"/> There are two forces on the ball: the downward pull of gravity, and the upward pull of the rope.</p>	<p>BEST STUDENT WORKSHEET</p> <p>Adding more weight</p> <p>This practical activity is about what happens to the forces needed to hold a weight still. To hold a weight in my hand, I need to push up with a force. The weight pushes down with a force.</p>  <p>Equipment: A 1kg weight</p> <p>Produce: What do you think will happen to each force when another weight is added?</p> <p>Explain: Explain why you think this will happen.</p> <p>Observe: Describe what happens to the force you are pushing up with.</p> <p>Explain: How your prediction and explanation connect? Try to improve your explanation to explain this more clearly.</p>	<p>BEST STUDENT WORKSHEET</p> <p>Holding a book</p> <p>Kevin has pushed up on a heavy book. Let's think about holding the forces needed to hold it steady.</p>  <p>Olivia: Kevin's hand pushes up with a force that is the same size as the weight of the book.</p> <p>Parker: Kevin's hand does not push up on the book. It gets in the way to stop it falling.</p> <p>Noah: There are no forces on the book because it is not moving.</p> <p>Mia: Kevin's hand pushes up with a force but the weight of the book is bigger.</p> <p>To explain: 1. What is right about the forces Kevin uses to keep the weight steady? Explain your answer. 2. What mistake do you think the other three students make? Explain what you say to them to help them to understand.</p>	<p>BEST STUDENT WORKSHEET</p> <p>John's plank</p> <p>John has made a bridge using a plank of wood. He stands on the bridge to test it out.</p>  <p>How does the plank support people who weigh different amounts? Put one statement in each row to explain how.</p> <table border="1"> <thead> <tr> <th></th> <th>John is standing on a bridge he made using a plank of wood.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>John's weight pushes on the plank and makes it bend a little bit.</td> </tr> <tr> <td>2</td> <td>The plank supports John's weight without bending at all.</td> </tr> <tr> <td>3</td> <td>The upward force on John is the same force.</td> </tr> <tr> <td>4</td> <td>The plank pushes up on John with a force bigger than his weight.</td> </tr> <tr> <td>5</td> <td>John's hand pushes firm on the bridge and the plank goes down in the middle.</td> </tr> <tr> <td>6</td> <td>The plank pushes up with the same size force as before.</td> </tr> </tbody> </table>		John is standing on a bridge he made using a plank of wood.	1	John's weight pushes on the plank and makes it bend a little bit.	2	The plank supports John's weight without bending at all.	3	The upward force on John is the same force.	4	The plank pushes up on John with a force bigger than his weight.	5	John's hand pushes firm on the bridge and the plank goes down in the middle.	6	The plank pushes up with the same size force as before.	<p>BEST STUDENT WORKSHEET</p> <p>Squashing a mattress</p> <p>Some mattresses contain a lot of springs. Some students lay using a mattress to think about objects resting on the floor. They are thinking about a light crate and a heavy crate sitting on the floor. They want to model the forces acting on the floor and on the crates.</p>  <p>To answer: State three ways in which this is a good representation of the crates resting on the floor.</p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>State three ways in which this is not an accurate representation of the crates resting on the floor.</p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p>																															
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Box on a table	Hanging ball
<p>BEST STUDENT WORKSHEET</p> <p>Box on a table</p> <p>A box is resting on a table. The box is quite heavy.</p>  <p>Some friends are talking about the forces acting on the box.</p> <p>Freddie: The box is not moving, so I don't think there are any forces here.</p> <p>Geordie: The only force is gravity, pulling the box down.</p> <p>Ian: The table is pushing the box upwards and this balances the force of gravity.</p> <p>Harley: A table cannot push. It is just in the way of the box and stops it falling.</p> <p>Taskmaster</p> <ol style="list-style-type: none"> 1. What do you think is right about the forces on the box? Explain your answer. 2. What mistakes do you think the others made? What about you, why do these not help them to understand? <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document is for personal use only. It may not be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without prior permission from the University of York Science Education Group and the Salters' Institute. © University of York Science Education Group and the Salters' Institute 2015.</small></p>	<p>BEST STUDENT WORKSHEET</p> <p>Hanging ball</p> <p>A ball is hanging from a string, which is fixed to the ceiling.</p>  <p>Some friends are talking about the forces acting on the ball.</p> <p>Mollie: The string is pulling upwards on the ball and this balances the force of gravity.</p> <p>Niamh: The ball is not moving, there are no forces acting on it.</p> <p>Lucas: The only force on the ball is the force of gravity pulling it down.</p> <p>Oliver: A string cannot push. It just stops the ball from falling.</p> <p>Taskmaster</p> <ol style="list-style-type: none"> 1. What do you think is right about the forces on the ball? Explain your answer. 2. What mistakes do you think the others made? What about you, why do these not help them to understand? <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document is for personal use only. It may not be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without prior permission from the University of York Science Education Group and the Salters' Institute. © University of York Science Education Group and the Salters' Institute 2015.</small></p>
Talking heads	Talking heads