Forces: practical and force arrows

Name: Class: Date:

Page 1 is a practical that loads a metre ruler and measures how far it bends. Page 2 is for measuring weights and drawing force arrows. Page 3 is for explaining what you found.

PRACTICAL Load a ruler and measure the bend

You need. A wooden metre ruler with no cracks, two stacks of books about 10 cm high, a 30 cm ruler, a 100 g mass hanger with four 100 g slotted masses, and a force meter that reads up to 10 N.

1. Work on a bench. Lay the metre ruler flat across the two stacks of books so that it makes a bridge, with 5 cm of each end on a stack. Don't move the stacks once you start.
2. Hold the 30 cm ruler upright on the bench, just behind the middle of the metre ruler. Read the height of the top of the metre ruler and write it in the first row of the table. Measure in the same place every time.
3. Stand the 100 g hanger on the middle of the metre ruler. Read the height again and write it down.
4. Slide one 100 g mass onto the hanger at a time, up to 500 g altogether. Read the height each time. Don't add any more than 500 g, and keep your fingers out from under the ruler.
5. Take the masses off one at a time and watch what the ruler does.
6. Press down on the middle of the ruler with one finger until it bends as far as it did under 500 g. Notice what you feel on your finger.

RECORD Results

Mass on the ruler (g)	Height of the ruler (mm)	Bend (mm)
0		
100		
200		
300		
400		
500		

Bend = height with no masses − height now.

What happened to the bend each time you added 100 g? What happened when you took the masses off?

What did you feel when you pressed the ruler down with your finger? What does that tell you about the ruler and the masses?

MEASURE Measure weights with a force meter

Hang the hanger from the force meter, add one mass at a time, and read the weight in newtons each time.

Mass hung from the force meter (g)	Mass (kg)	Reading on the force meter (N)
100	0.1	
200	0.2	
300	0.3	
400	0.4	
500	0.5	

By how much does the reading go up for each 100 g you add?

CALCULATE Work out weights

On Earth, gravity pulls each kilogram with about 10 N. Work out the weight of each mass.

100 g: _____ N 200 g: _____ N 500 g: _____ N 1 kg: _____ N 2 kg: _____ N

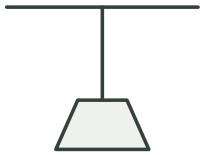
DRAW Draw the force arrows

Draw every force on the object as an arrow that starts on the object. Make a bigger force a longer arrow. Beside each arrow write the name of the force and its size in newtons.

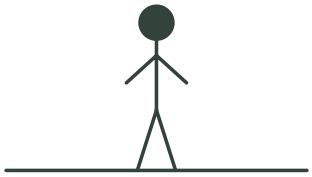
A 1 kg book lying on a table



A 2 kg lamp hanging from a cord



A 50 kg person standing on a floor



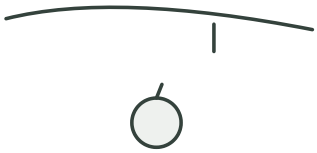
A block with a weight of 10 N, pushed to the right with 3 N. It doesn't move



A 2 kg trolley speeding up. The push is 8 N and the friction is 2 N



A 0.1 kg apple falling from a tree. Don't draw a force from the air



EXPLAIN Explain it

Write each explanation in full sentences. Then tick the ideas your explanation has.

1. Does a table push up on a book that rests on it? Explain how you know. Use the spring, the bending ruler and the table in your answer.

- [ ] A squashed spring pushes back.
- [ ] A table top bends too, by an amount too small to see.
- [ ] A ruler or board bends under a load and pushes back.
- [ ] The push up is as big as the book's weight, so the forces are balanced.

2. You push a heavy box and it doesn't move. Explain why not. Use the word friction.

- [ ] Friction acts along the floor, against the push.
- [ ] The forces along the floor are balanced, so the box stays still.
- [ ] Friction grows to match the push.

3. A trolley is pushed forwards with 8 N, and friction pushes back on it with 3 N. What happens to the trolley, and why?

- [ ] 5 N is left over, forwards.
- [ ] The trolley speeds up.
- [ ] The forces are unbalanced.

4. The lesson compared a table with a spring. Write one way they are alike and one way they are different.