

Pushes, pulls and balanced forces

Grade 7 science (Year 8 · Class 7) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to name forces, classify them, read a spring scale, draw force arrows and combine forces into a net force. They begin with recall and finish with multi-force reasoning and interaction pairs.

They suit Grade 7, Year 8 and Class 7 learners, and match NGSS middle school and early GCSE and IGCSE physics.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-1, MS-PS2-2

Problem 1 Contact or non-contact? (easy)

Classify each force as contact or non-contact.

1. Pushing a door open.
2. A magnet pulling a nail.
3. Friction on a skateboard wheel.
4. The pull of Earth on an apple.
5. Tension in a kite string.

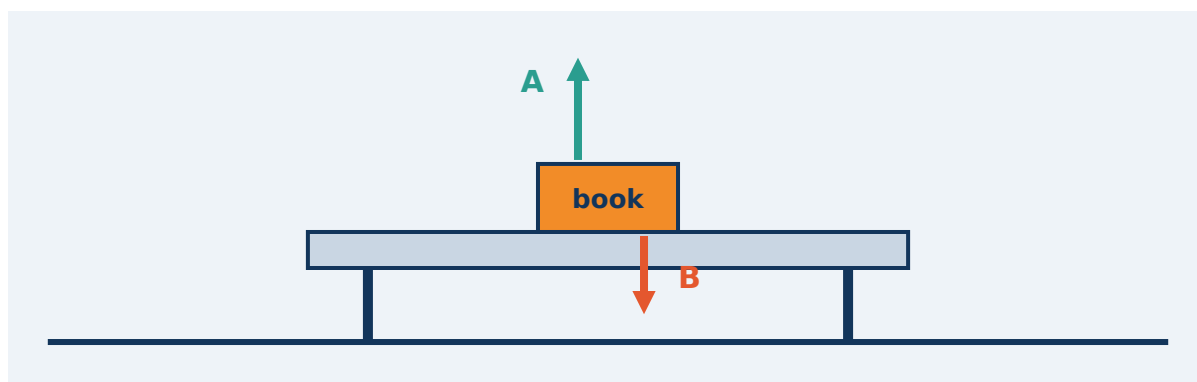
Problem 2 Unit and instrument (easy)

Answer these quick questions.

1. State the unit of force and its symbol.
2. Name the instrument used to measure force.
3. State what you should check before you use it.

Problem 3 Forces on a book (easy)

A book rests on a table as shown.

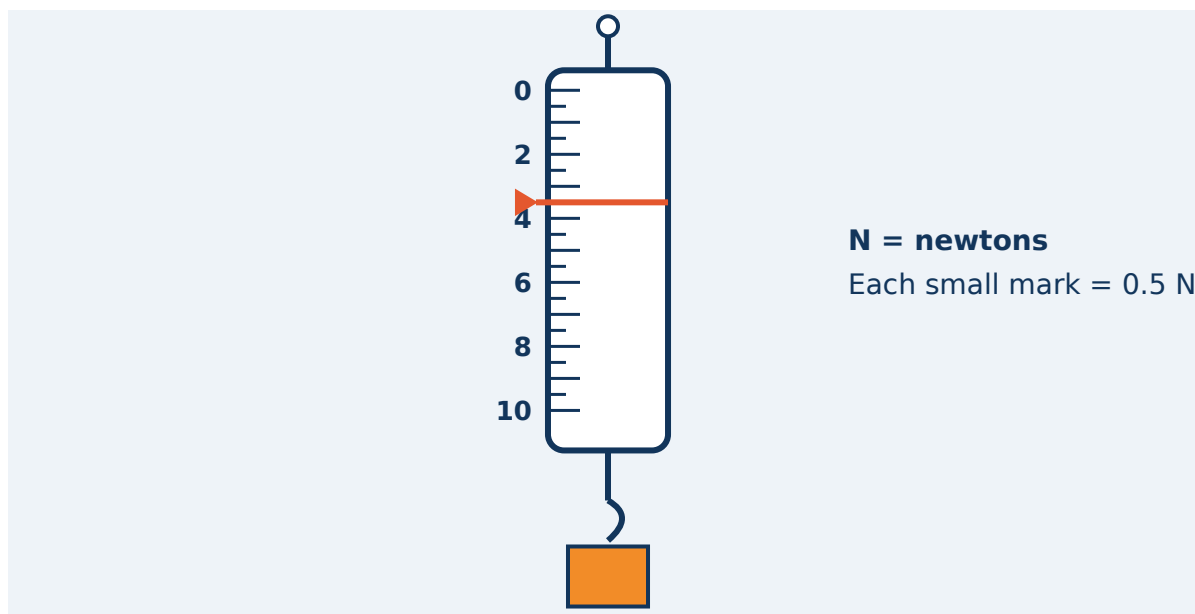


Two forces on a book at rest.

1. Name force A.
2. Name force B.
3. Compare the sizes of A and B and explain.

Problem 4 Read the scale (easy)

Kofi in Accra hangs a bag from a spring scale.



Spring scale with the pointer to be read.

1. State the largest reading on the scale.
2. State the value of one small division.
3. Read the force shown (the pointer is 7 small divisions from zero).

Problem 5 Arrow lengths (easy)

A diagram uses the scale 1 cm = 5 N. Calculate the arrow length for each force.

1. 20 N.
2. 35 N.
3. 12.5 N.

Problem 6 Balanced or unbalanced? (easy)

Decide whether the forces on each object are balanced.

1. 10 N to the right and 10 N to the left.
2. 15 N up and 5 N down.
3. 8 N to the right and 3 N to the left.

Problem 7 Pushing on a wall (easy)

Imran in Karachi pushes on a brick wall with a force of 40 N.

1. State the force the wall exerts on Imran.
2. State its direction.
3. Explain why the wall does not move.

Problem 8 Tug of war (medium)

In a school tug of war in Nairobi, the red team pulls with 520 N to the right and the blue team pulls with 485 N to the left.

1. Calculate the net force.
2. State its direction.
3. Describe what happens to the rope.

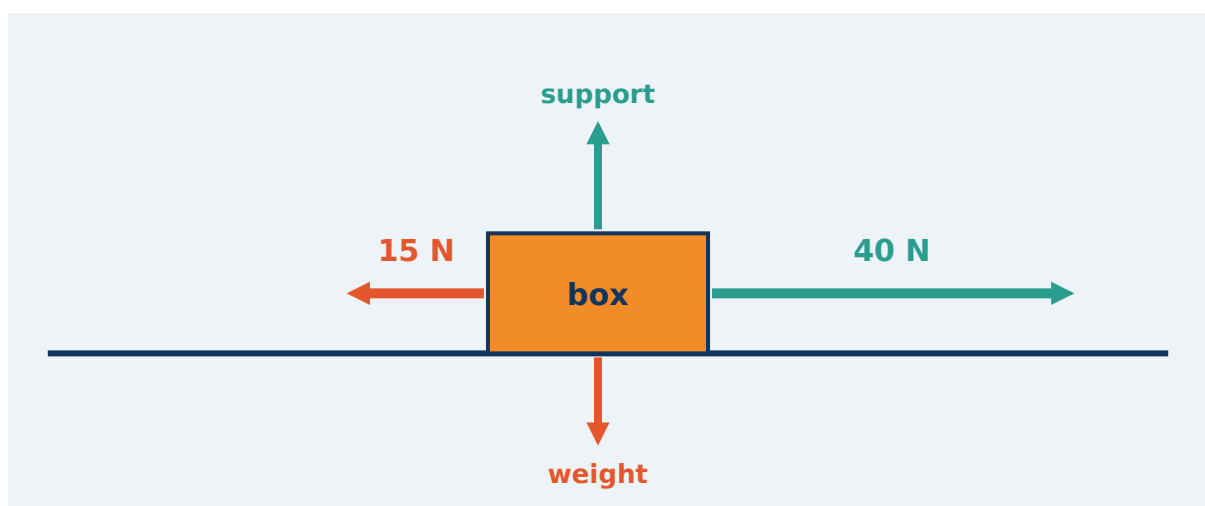
Problem 9 Steady speed (medium)

Sakura in Kyoto pushes a heavy cart at a steady speed with a force of 60 N.

1. State the net force on the cart.
2. State the size and direction of the friction force.
3. Explain what happens if she pushes with 80 N.

Problem 10 Net force on a box (medium)

A box is pushed with 40 N to the right while friction is 15 N to the left. The support force and the weight are both 50 N.



Forces on the box.

1. Calculate the net horizontal force.
2. Calculate the net vertical force.
3. Describe how the box moves.

Problem 11 Parachutist (medium)

A parachutist has a weight of 700 N.

1. State the air resistance when she falls at a steady speed.
2. Soon after jumping, air resistance is 300 N. Calculate the net force and give its direction.
3. Describe how her speed is changing at that moment.

Problem 12 A rolling ball stops (medium)

A football rolls across grass and stops after 20 m. On smooth ice the same ball rolls much further.

1. Name the force that slows the ball.
2. Explain why the ball goes further on ice.
3. Explain what would happen if there were no friction at all.

Problem 13 Mass and speed gained (medium)

The same 4 N net force pushes trolleys of different masses for 2 s. The table shows the speed gained.

Trolley of 1 kg: 8 m/s.

Trolley of 2 kg: 4 m/s.

Trolley of 4 kg: 2 m/s.

1. Describe the pattern.
2. Predict the speed gained by an 8 kg trolley.

Problem 14 Kilonewtons (medium)

Convert these forces.

1. A crane lifts with 3.5 kN. Write this in newtons.
2. A bridge cable pulls with 12 000 N. Write this in kilonewtons.
3. A spring scale reads 0.45 N. Write this in millinewtons ($1 \text{ N} = 1000 \text{ mN}$).

Problem 15 Find the mistake (medium)

Emma in Leeds says: "The box slides at a steady speed across the floor, so there must be an unbalanced forward force on it."

1. Explain why she is wrong.
2. State what the forces on the box must be like.

Problem 16 Cart with three forces (hard)

A cart on a ramp track is pulled with 60 N to the right. Rope tension pulls back with 25 N to the left and friction pulls back with 15 N to the left.

1. Calculate the total force to the left.
2. Calculate the net force.

3. State what the cart does.

Problem 17 Dragging a block (hard)

Diego in Texas drags a wooden block across a table with a spring scale. The scale reads 6.4 N while the block moves at steady speed. He then pulls harder and the scale reads 9.0 N.

1. State the friction force at steady speed.
2. Calculate the net force when the scale reads 9.0 N (friction is unchanged).
3. Describe the motion at 9.0 N.

Problem 18 Stretching a spring (hard)

A spring stretches 3.0 cm when a 2.0 N force pulls it. The stretch is proportional to the force.

1. Calculate the stretch for a 5.0 N force.
2. Calculate the force that produces a 12 cm stretch.
3. Explain how this behaviour is used to make a spring scale.

Problem 19 Two skaters (hard)

Two skaters stand still on ice facing each other. Aarav has a mass of 40 kg and Mei has a mass of 60 kg. Aarav pushes Mei with 120 N.

1. State the force Mei exerts on Aarav.
2. Explain why both skaters move.
3. Explain which skater has the bigger change in speed.

Problem 20 Tension in a tug of war (hard)

At a village festival, two teams each pull on a rope with 500 N and the rope stays still.

1. State the net force on the rope.
2. State the tension in the rope (the force at any point inside it).
3. Explain why the tension is not 1000 N.