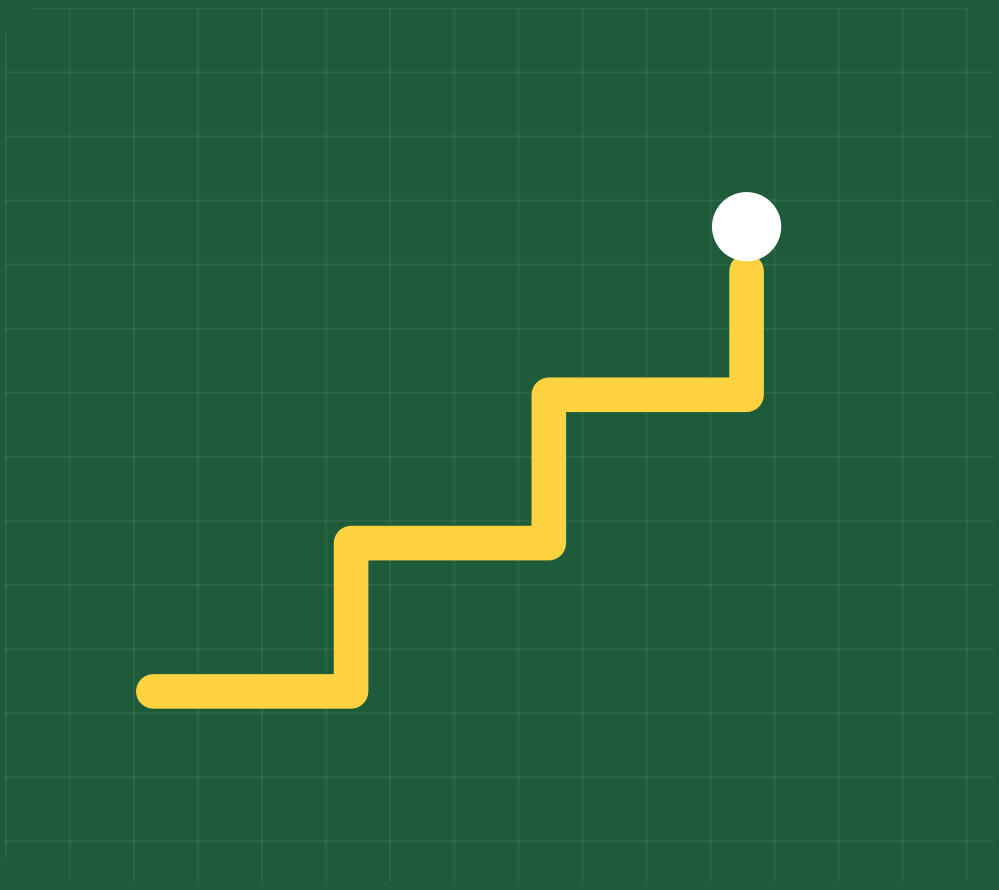
UpOnly Learning



GRADE 8

FREE SAMPLE WORKBOOK

Science Grade 8

One step at a time. · Ages 13–14 · Free sample: 1 of 8 topics

UO-SCI-8

OUR STORY

One step at a time

I'm Dr. Evan J. Hasson. I've run a specific chiropractic practice for over twelve years, and I'm a dad of three. My work is about alignment: get the structure right, and everything else works better.

At home, nothing was aligned. I was spending thousands a month on tutors, extracurriculars and programs, and when I asked about enrolling a second or third child the answer was always the same: that'll be double, that'll be triple. The charter school had a waiting list. The good public school had a waiting list. The private schools had the kind of list where it helps to know someone, or to give generously first.

And underneath all of it, the same quiet threat: if you don't pay for this, your child will fall behind. Not sold with evidence. Sold with fear.

So I did my own research, and here is what I found: none of it is secret. The standards are published. The order a child should learn in is written down and freely available. It is just scattered. Nobody had done the work of pulling it together, putting it in order and handing it over. So I did.

When every step has its place, confusion has nowhere to hide.

I built this for my own kids. I'm giving it to yours.

Dr. Evan J. Hasson, DC
Founder and dad of three

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No guaranteed results, and mistakes happen. Every student learns differently. We write and review every question and answer key carefully, and we still get things wrong. An answer key can be wrong, and a question can be worded badly or have two defensible answers. Check the answer key before you hand it over, and trust your own judgment over ours. Found a problem? **Photograph the page and email it to support@uponlylearning.com**. The picture tells us more than a description, and we fix it for every family.

Safety. Some activities use household items such as scissors, coins or food. An adult should supervise and skip anything unsafe for the student.

Not professional advice. This workbook does not replace an evaluation by a qualified educator or specialist. The founder is a Doctor of Chiropractic; UpOnly Learning does not provide medical or health advice.

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INTRODUCTION

How to use this workbook

Each topic follows the same steps, so your student always knows what comes next.

① **Quick Check.** 10 questions before you teach. Read them aloud for younger students. A high score means you can move faster.

② **Learn It.** Key words, step-by-step teaching with lines you can read aloud, worked examples and the mistakes to watch for.

③ **We Do It Together.** 10 questions you do side by side. The answer and the "why" are printed right after each question, so you can talk it through.

④ **You Try.** 10 questions your student does alone.

Answers with short explanations for every question are in the **Answer Key** at the end of each topic, so students can work without peeking. Go over each wrong answer together using the explanation.

This workbook is printed in full color. To save ink, choose "Black and white" or "Grayscale" in your printer settings; every page still works in black and white.

Want online checks that score themselves and track each student's progress? Visit uponlylearning.com.

GRADE 8

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Topic 1 · Forces and changes in motion **6**

How net force and mass determine changes in an object's motion MS-PS2-2

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Forces and changes in motion

The student will plan an investigation showing that an object's change in motion depends on the sum of the forces on it (net force) and on its mass.

① Quick Check

Do this before the lesson. It shows what your student already knows. Score: ____ / 10

1. Which surface has more friction?

   A Wet soap **B** Carpet **C** Ice **D** Polished glass

2. Which forces act on a book resting on a table?

   A Only gravity pulling the book down toward the floor **B** No forces

   C Gravity down and the table pushing up

3. What is the formula for force?

   A F = m × a **B** F = m + a **C** F = m ÷ a

4. If an object is not moving, are there no forces on it?

   A Yes, only gravity **B** No, only friction acts **C** Yes, there are no forces on a book at rest

   D No, balanced forces may still act

5. Noor's car rolled 60 cm, 64 cm and 56 cm. What is the average?

   A 180 cm **B** 64 cm **C** 60 cm

6. A force of 45 N accelerates a mass at 5 m/s². What is the mass?

   A 9 kg **B** 225 kg **C** 40 kg **D** 0.11 kg

7. Team A pulls 520 N and team B pulls 480 N. What is the net force?

   A 480 N **B** 40 N toward team A **C** 520 N **D** 1,000 N toward team A

8. A 12 kg object has a net force of 60 N. What is its acceleration?

   A 0.2 m/s² **B** 48 m/s² **C** 720 m/s² **D** 5 m/s²

9. A team wants to test how mass affects stopping distance. What should they change?

   A The surface the cart rolls over each time **B** The mass of the cart **C** The starting speed

10. A crate has a net force of 60 N right and mass 15 kg. What is its acceleration?

    A 900 m/s² **B** 0.25 m/s² **C** 45 m/s² **D** 4 m/s²

② Learn It

MATERIALS a toy car or small box that slides; a rubber band; a ruler or measuring tape; coins or small washers to add mass; tape; a smooth floor or table; paper for a data table

Key words

- **force**: a push or pull, measured in newtons (N)
- **net force**: the total of all forces acting on an object, taking direction into account
- **balanced forces**: forces that cancel out, so the net force is zero and motion does not change
- **unbalanced forces**: forces that do not cancel, so the object speeds up, slows down or changes direction
- **mass**: the amount of matter in an object, measured in kilograms or grams
- **acceleration**: a change in speed or direction
- **friction**: a force that opposes motion between surfaces that touch

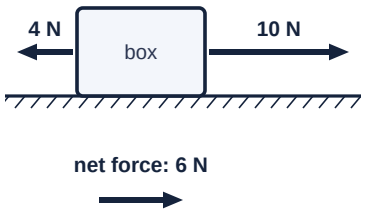
Warm-up

1. Ask: which is easier to push into motion, an empty shopping cart or a full one?
2. Ask: what happens in a tug of war when both sides pull equally hard?

> *How objects move depends on how hard you push and how much stuff they're made of. Let's test it.*

Teach

1. Explain net force with arrows: 10 N right and 4 N left gives 6 N right. 5 N right and 5 N left gives 0 N, so motion does not change.



2. Explain Newton's second law in words: a larger net force gives a larger change in motion; a larger mass gives a smaller change for the same force. As a formula, F = m × a.
3. Set up the launcher: tape the ruler to the table, loop the rubber band around two fixed points (like chair legs or taped pencils), pull it back a set distance and release the car. Safety: wear safety glasses, and never aim the rubber band or the car at anyone. Rubber bands contain latex, so use a latex-free band if anyone has a latex allergy.
4. Trial A (force): first predict what will happen when you pull back farther. Then pull back 2 cm, then 4 cm, keeping mass the same. Measure and record how far the car rolls.

2. Trial B (mass): first predict what extra coins will do. Then pull back 4 cm each time, adding 0, 5 and 10 coins to the car. Measure and record how far it rolls.

> *More net force means more change in motion. More mass means less change for the same push.*

Guided practice

1. Record three runs for each setting and find the average distance.

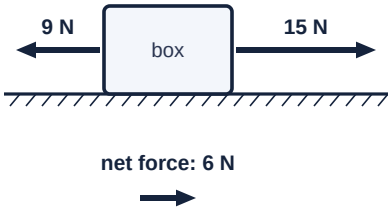
Setting	Distances (3 runs)	Average
Pull back 2 cm		
Pull back 4 cm		
4 cm, 5 coins		
4 cm, 10 coins		

2. Ask: what happened and why? The student explains the results using net force and mass.
3. Discuss how friction acts as a force slowing the car and why the car eventually stops.

> *Use your data. What happened when the force went up? When the mass went up?*

Worked examples

A box has 15 N pushing right and 9 N of friction to the left. What is the net force?



6 N to the right. Forces in opposite directions subtract: 15 - 9 = 6.

Using F = m × a, what acceleration does a 2 kg cart have with a net force of 10 N?
5 m/s². a = F ÷ m = 10 ÷ 2 = 5.

Watch for these mistakes

Mistake: An object that is moving must have a force pushing it forward all the time.
Fix: A moving object keeps moving at the same speed and direction unless an unbalanced force acts on it. Things stop on Earth because friction is a force acting against them.

Mistake: If an object is not moving, no forces are acting on it.
Fix: A book on a table has gravity pulling down and the table pushing up. The forces are balanced, so the net force is zero and it stays still.

PARENT TIP Mark the release point with tape so every launch starts in exactly the same place; small changes in setup are the biggest source of error.

GO FURTHER Draw force diagrams (arrows with labels in newtons) for a person standing still, an elevator speeding up, and a bike coasting to a stop.

③ We Do It Together: 10 questions

Do these side by side. Read each question together, let your student answer, then read the answer and the "why" right below it and talk it through.

1. What are unbalanced forces?

A Forces with no direction **B** Forces equal in size

C Forces that cancel out, so nothing about motion changes

D Forces that do not cancel, so motion changes

Answer: D Forces that do not cancel, so motion changes
Why: If forces do not cancel, the net force is not zero, so speed or direction changes.

2. What unit is force measured in?

A Meters (m) **B** Newtons (N) **C** Kilograms (kg) **D** Joules (J)

Answer: B Newtons (N)
Why: Force is measured in newtons; kilograms measure mass, meters measure length and joules measure energy.

3. Which is an example of balanced forces?

A A falling leaf speeding up **B** A kicked ball **C** A book resting on a table

Answer: C A book resting on a table
Why: The table's upward push cancels gravity, so the net force on the book is zero.

7. In F = m × a, what does a stand for?

A Amount **B** Altitude **C** Acceleration **D** Area, the size of a surface in square meters

> **Answer: C** Acceleration
> **Why:** a is acceleration.

8. Two teams pull a rope with 500 N each in opposite directions. What is the net force on the rope?

A 0 N **B** 1,000 N **C** 500 N

> **Answer: A** 0 N
> **Why:** They balance.

9. A 3 kg cart gets a 9 N net force. What is the acceleration?

A 27 m/s² **B** 3 m/s² **C** 12 m/s²

> **Answer: B** 3 m/s²
> **Why:** 9 ÷ 3 = 3.

10. Look at the data from the force trial. What does it show?

Pull-back (cm)	Distance rolled (cm)
2	40
4	80

A Force does not matter **B** A larger pull-back force made the car roll farther **C** Mass changed

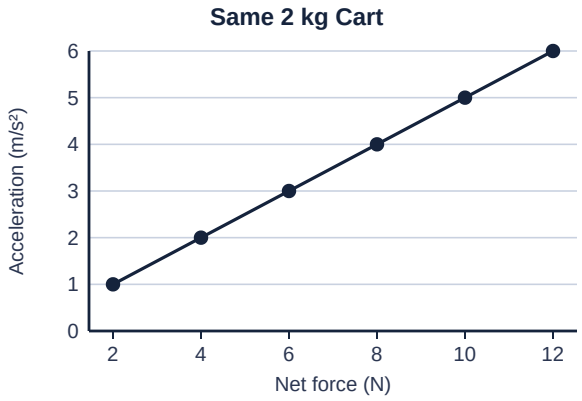
> **Answer: B** A larger pull-back force made the car roll farther
> **Why:** Larger force gave a larger change in motion.

11. A 1,200 kg car accelerates at 3 m/s². A 3,000 kg truck has the same net force. What is its acceleration?

A 7.5 m/s² **B** 0.12 m/s² **C** 1.2 m/s² **D** 3 m/s²

> **Answer: C** 1.2 m/s²
> **Why:** F = 1,200 × 3 = 3,600 N; 3,600 ÷ 3,000 = 1.2.

2. A 2 kg cart is pushed with different net forces. Look at the graph. What pattern does it show?



A Acceleration rises as force rises **B** Acceleration falls as force rises **C** Acceleration is flat

> **Answer: A** Acceleration rises as force rises
> **Why:** Since a = F ÷ m, a larger net force on the same mass gives a larger acceleration.

3. A 10 kg box is pushed with 50 N and friction is 20 N. What is its acceleration?

A 7 m/s² **B** 5 m/s² **C** 2 m/s² **D** 3 m/s²

> **Answer: D** 3 m/s²
> **Why:** Net force is 30 N; 30 ÷ 10 = 3.

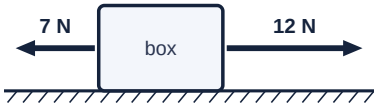
④ You Try: 10 questions

> *Now your student works alone. Check answers in the Answer Key at the end of this topic. Score: ____ / 10*

1. An object moving at a constant speed in a straight line has what net force?

A Zero **B** A growing force **C** A backward force **D** A forward force

2. Look at the force diagram. In which direction is the net force on the box?



A Left, the direction of the smaller force **B** Up **C** Right

3. In the launcher trial, what does adding coins to the car change?

A Its color **B** Its force **C** Its mass

4. A 3 kg cart has a net force of 12 N. What is its acceleration?

A 0.25 m/s² **B** 15 m/s² **C** 4 m/s² **D** 36 m/s²

6. How does a truck's mass compare to a car's in terms of the force needed to change motion?

A It needs less force for the same acceleration **B** It needs the same **C** It needs none

D It needs more force for the same acceleration

7. Why do scientists keep everything else the same when testing mass in the launcher?

A To make the test longer and harder to do **B** To change the force **C** To confuse the test

D So only mass affects the result

8. A person pushes on a heavy box, but the box does not move. Why not?

A No force acts, so the box just stays put **B** Friction balances the push **C** Gravity only

D Mass pushes back

9. Why should you run each trial three times instead of once?

A Repeating trials reduces the effect of random errors **B** It guarantees the same result

C It makes the force larger **D** It changes the mass

10. A crate is pushed right with 70 N and left with 30 N while also pulled right with 20 N. What is the net force?

A 120 N right **B** 40 N right **C** 60 N right **D** 80 N right

11. A student claims friction is not a force. What evidence shows it is?

A It does not push or pull **B** It has no direction, so it cannot be a force

C It changes the motion of sliding objects

Forces and changes in motion: Answers and explanations

① Quick Check

1. Which surface has more friction?

   B Carpet

   Rough carpet grips the surface of a sliding object, so it has more friction than ice.

2. Which forces act on a book resting on a table?

   C Gravity down and the table pushing up

   Gravity acts downward and the table pushes upward; these two forces are equal and balanced.

3. What is the formula for force?

   A F = m × a

   Newton's second law is force equals mass times acceleration.

4. If an object is not moving, are there no forces on it?

   D No, balanced forces may still act

   A resting object can have several forces on it, such as gravity and a support, that cancel.

5. Noor's car rolled 60 cm, 64 cm and 56 cm. What is the average?

   C 60 cm

   Add the three distances to get 180 cm and divide by 3 trials to find the average.

6. A force of 45 N accelerates a mass at 5 m/s². What is the mass?

   A 9 kg

   m = 45 ÷ 5 = 9.

7. Team A pulls 520 N and team B pulls 480 N. What is the net force?

   B 40 N toward team A

   The two pulls act in opposite directions, so subtract: 520 N minus 480 N is 40 N.

8. A 12 kg object has a net force of 60 N. What is its acceleration?

   D 5 m/s²

   60 ÷ 12 = 5.

9. A team wants to test how mass affects stopping distance. What should they change?

   B The mass of the cart

   Mass is the variable to be tested, so the team changes it and keeps everything else equal.

10. A crate has a net force of 60 N right and mass 15 kg. What is its acceleration?

    D 4 m/s²

    60 ÷ 15 = 4.

④ You Try

1. An object moving at a constant speed in a straight line has what net force?

   A Zero

   Steady speed in a straight line means no acceleration, so the forces must cancel.

2. Look at the force diagram. In which direction is the net force on the box?

   C Right

   Forces in opposite directions subtract: 12 minus 7 leaves 5 N toward the larger force, to the right.

3. In the launcher trial, what does adding coins to the car change?

   C Its mass

   Coins add matter to the car, so its mass increases while the band force stays the same.

4. A 3 kg cart has a net force of 12 N. What is its acceleration?

   C 4 m/s²

   Acceleration is net force divided by mass, so 12 N ÷ 3 kg gives 4 m/s².

5. How does a truck's mass compare to a car's in terms of the force needed to change motion?

   D It needs more force for the same acceleration

   More mass means more force for the same change.

6. Why do scientists keep everything else the same when testing mass in the launcher?

   D So only mass affects the result

   If anything besides mass changed, you could not tell which change caused the result.

7. A person pushes on a heavy box, but the box does not move. Why not?

   B Friction balances the push

   The box does not move because friction cancels the push, giving zero net force.

8. Why should you run each trial three times instead of once?

   A Repeating trials reduces the effect of random errors

   Averages of repeated trials are more reliable.

9. A crate is pushed right with 70 N and left with 30 N while also pulled right with 20 N. What is the net force?

   C 60 N right

   Add the rightward forces (90 N) and subtract the leftward 30 N to get 60 N right.

10. A student claims friction is not a force. What evidence shows it is?

    C It changes the motion of sliding objects

    A push or pull that changes motion is a force.

THE FULL WORKBOOK

Keep going with the full Science workbook

You just tried one topic. The full Grade 8 workbook has every topic below, each with a Quick Check, a lesson, We Do It Together, up to 90 You Try questions, Show What You Know and a full answer key.

1. Forces and changes in motion MS-PS2-2
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3. Wave properties MS-PS4-1
4. Heredity and Punnett squares MS-LS3-2
5. Natural selection MS-LS4-4
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One step at a time.

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