

Newton's Third Law

Answer the following questions:

1. Explain the difference between scalar and vector quantities.
Scalar quantities have magnitude (size) only whereas vector quantities have magnitude and direction.
2. Give an example of a scalar quantity.
Speed, distance, mass, energy
3. Give an example of a vector quantity.
Velocity, displacement, acceleration, force, weight
4. Describe how to calculate resultant force.
If forces are acting in the same direction, they are added together, if they are in opposite directions, they are subtracted and if they are acting perpendicular to each other the resultant can be found using a scale drawing.
5. State the SI units of force and the piece of equipment used to measure force.
Newtons (N), measured using a Newtonmeter



Newton's Third Law

P3.1.5

Science
Mastery



P3.1.1 Prior Knowledge Review

P3.1.2 Scalars and Vectors

P3.1.3 Resultant Vectors

P3.1.4 Resolving Vectors

➤ **P3.1.5 Newton's Third Law**

P3.1.6 Newton's First Law

P3.1.7 Acceleration

P3.1.8 Acceleration Investigation

Maths in Science Lesson 17

P3.1.9 Velocity-Time Graphs

P3.1.10 Velocity-Time Graphs 2

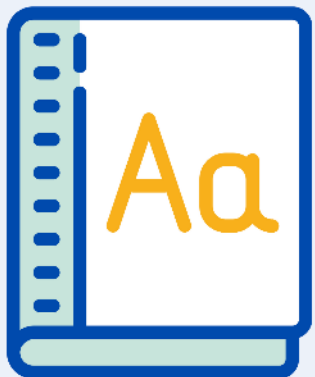
P3.1.11 Acceleration Problems



Following this lesson, students will be able to:

- State Newton's Third Law
- Identify pairs of forces
- Explain why action-reaction pairs are not the same as balanced forces

Key Words:



action

reaction

exert

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

Exit ticket

1. What is the difference between scalars and vectors?

☐ A. Scalars always have a direction

☒ B. Vectors always have a direction

☐ C. Vectors sometimes have a direction

2. Which are the most likely components of this resultant vector?

☐ A. 20 N up and 15 N right

☒ B. 8 N right and 6 N up

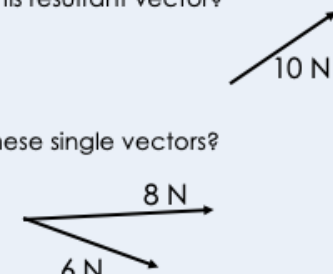
☐ C. 5 N right and 15 N down

3. Which is most likely to be the resultant of these single vectors?

☐ A. 18 N

☐ B. 2 N

☒ C. 13 N



The diagram illustrates vector addition. At the top right, a single vector labeled '10 N' points diagonally upwards and to the right. Below it, two separate vectors are shown: one labeled '8 N' pointing horizontally to the right, and another labeled '6 N' pointing diagonally downwards and to the right. The '8 N' vector is positioned above the '6 N' vector, and they share a common starting point, representing the components of the resultant vector.

Exit ticket

General Definition

Something done or felt in response to an action, event or situation.

Scientific Definition

The force that a body (object) subjected to the action of a force from another body exerts in the opposite direction.

Reaction

“Fear is a reaction. Courage is a decision.”

- Winston Churchill

Synonyms

Reply
Answer
Response

Antonyms

Action
Cause

General Examples

We could tell by his reaction the news wasn't good.

Scientific Examples

Every action has an equal and opposite reaction.

In a chemical reaction, atoms are rearranged but cannot be created or destroyed.



Newton's Third Law

Newton's Third Law states that **every action has an equal and opposite reaction.**

When two objects interact, they exert **equal** and **opposite** forces on each other.

The forces are acting on **different objects.**

e.g. the Moon and the Earth



Did you know?
Isaac Newton's birthday changed after the Gregorian calendar was adopted in England.

Newton's Third Law

Newton's Third Law also explains how objects are able to move

What are the pairs of forces acting in each scenario?



A

The tyres exert a force on the road and the road exerts an equal and opposite force on the tyres.



B

The foot exerts a force on the ground and the ground exerts an equal and opposite force on the foot.



C

The swimmer exerts a force on the water and the water exerts an equal and opposite force on the swimmer.

Quick Quiz:

1. State Newton's Third Law .
Every action has an equal and opposite reaction.
2. Identify the pair of forces acting between the Earth and a satellite.
The force (pull of gravity) of the Earth on the satellite and the force (pull of gravity) of the satellite on the Earth.
3. Identify the pair of forces acting when a girl is pushing off the ground to move her skateboard.
The girl pushing the ground with her foot, the ground exerts an equal and opposite force on the girl's foot.
4. Describe what will happen if two ice skaters push off from each other.
They will move away in opposite directions because they have exerted an equal and opposite force on each other.

Is this correct?

Newton's Third Law means that forces are always balanced because the forces are equal and opposite, which means they cancel each other out

Drill

1. What is a reaction force?
2. What is Newton's third law?
3. If forces are equal and opposite the resultant force will be...
4. If object A exerts a force on object B, what will object B do?
5. Why can you float on water?
6. Why do two skaters move in opposite directions if they push each other?
7. Why does a book stay on the table??

Drill answers

1. A force acting in the opposite direction
2. Newton's third law states that every action has an equal and opposite reaction
3. 0N
4. Object B will exert an equal and opposite force on object A.
5. You float because you exert a force on the water and the water exerts an equal and opposite force on you.
6. Skaters move in opposite directions when they push each other because they have exerted an equal and opposite force on each other
7. The book exerts a force on the table, the table exerts an equal and opposite force on the book.

I: Explain: *to use scientific understanding to make something clear or state the reason for something happening*

Example question:

Explain why a cannon recoils when it fires a cannonball.



Model answer:

- The cannonball fires the ball **forward**, causing the cannon to be pushed **backwards**.
- This is because the cannon and the cannonball exert **equal** and **opposite** forces on each other.

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



We: Explain: to use scientific understanding to make something clear or state the reason for something happening

Example question:

Explain why a skateboard moves backwards when a person jumps off it.

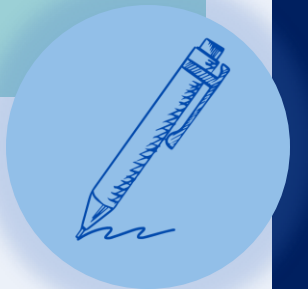


Model answer:

- The person would jump **forward** off the skateboard causing the skateboard to be pushed **backwards**.
- This is because the person and the skateboard exert **equal** and **opposite** forces on each other.

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



You: Explain: to use scientific understanding to make something clear or state the reason for something happening

Example question:

Explain why these ice skaters move off in different directions when they push each other.



Model answer:

- The skaters would move off in opposite directions
- This is because they exert **equal** and **opposite** forces on each other

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



Answer the questions below.

1. Newton's Third Law states that ...

- ☐ A. Objects will exert equal and opposite forces on each other that will cancel out
- ☐ B. If an object exerts a force on another it will exert the same force
- ☒ C. Every action has an equal and opposite reaction

2. The reaction force to the force exerted by a gun on a bullet is...

- ☐ A. The weight of the gun
- ☒ B. The force exerted by the bullet on the gun
- ☐ C. The air resistance of the bullet

3. If a large person and a small person bump into each other what can be said about the forces they exert on each other?

- ☐ A. The large person will exert a larger force
- ☐ B. The small person will exert a larger force
- ☒ C. They will exert the same size force on each other

Lesson P3.1.5

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)
or by emailing sciencemastery@arkonline.org
Thank you!