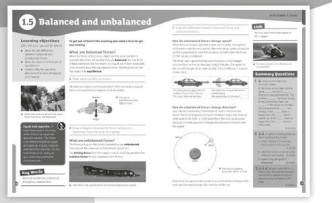
1.5 Balanced and unbalanced



Physics NC link:

- using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces
- forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)
- change depending on direction of force and its size
- opposing forces and equilibrium: weight held by a stretched spring or supported on a compressed surface.

Working Scientifically NC link:

- present observations and data using appropriate methods, including tables and graphs.

Band	Outcome	Checkpoint	
		Question	Activity
Developing	Identify familiar situations of balanced and unbalanced forces (Level 4).	1	
	Define equilibrium (Level 4).	A	
	Identify when the speed or direction of motion of an object changes (Level 4).		Main 1, Starter 1
	Present observations in a table with help (Level 3).		Main 1
Secure	Describe the difference between balanced and unbalanced forces (Level 6).	C	Main 1, Plenary 1
	Describe situations that are in equilibrium (Level 5).	B	
	Explain why the speed or direction of motion of objects can change (Level 6).	2	Starter 2
	Present observations in a table including force arrow drawings (Level 6).	B	Main 1
Extending	Explain the difference between balanced and unbalanced forces (Level 7).	2	
	Describe a range of situations that are in equilibrium (Level 7).	B	Main 1
	Explain why the speed or direction of motion of objects can change using force arrows (Level 7).		Main 1
	Predict and present changes in observations for unfamiliar situations (Level 7).		Main 1

Maths
In the student-book activity students use proportion when estimating force arrows.

In the practical activity students can carry out calculations involving +, −, ×, ÷, either singly or in combination.

Literacy
Students make connections within/across a range of texts when reading an account of Newton's work on forces.

APP
Use abstract ideas such as force arrows to explain how resultant forces affect motion (AF1).

Plan and use investigative approaches to compare forces (AF4).

Key Words
balanced, equilibrium, unbalanced, driving force, resistive forces

Answers from the student book

In-text questions	**A** An object is in equilibrium if the forces on it are balanced. **B** Diagram of mass with arrow pointing up labelled 'tension' and the same size arrow pointing down labelled 'weight'. **C** Balanced forces cancel out/are equal in size and opposite in direction. Unbalanced forces are not of equal size/direction/do not cancel out.
Summary questions	**1** size, opposite/opposing, equilibrium, balanced, speed, driving, resistive, resistive, driving (9 marks) **2a** Force diagram with an arrow showing that the resistive force is bigger than the driving force. (1 mark) **b** Arrow pointing backwards labelled resistive, arrow pointing forwards labelled driving. (1 mark) **c** The forces are unbalanced. (1 mark) **3** Example answers (6 marks): An object speeds up or slows down when the forces acting on it are unbalanced. An object is stationary or moving at a steady speed when the forces acting on it are balanced. Ride will be exciting if there are lots of sections where the forces are unbalanced. The force of gravity acts at all times so there will need to be a mechanism for lifting people up. You can use gravity to accelerate people on different sections of the ride. People will need restraints so that they are safe when they accelerate/decelerate.

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Starter	Support/Extension	Resources
Forces and sport (10 min) Show a short video of a sports activity. Students list what happens as the motion of a person or object changes, for example, the ball was kicked or the player swung a racket. **Changing speed** (10 min) Students describe their motion on a short car/bus journey, explaining how the driver changed the motion, for example, braked, accelerated, turned the steering wheel.	**Extension**: Students identify the type and direction of forces changing the motion.	
Main	**Support/Extension**	**Resources**
Force circus (40 min) Students identify forces acting on several experiments in a circus, deciding if they are balanced or not, and describing the different forces acting on the object. As part of the practical sheet, students sketch the force diagram for each experiment showing the size and direction of the forces acting on the object.	**Support**: The support sheet provides a pre-drawn table. **Extension**: Students identify the relative size and direction of unbalanced forces, linking this to the motion.	**Practical**: Force circus **Skill sheet**: Scientific apparatus
Plenary	**Support/Extension**	**Resources**
Riding a bicycle (5 min) Students describe and act out how to change motion when you ride a bicycle, linking the ideas to the forces. **Balanced and unbalanced forces** (5 min) Interactive resource where students sort statements describing the motion of a football being kicked into balanced or unbalanced forces.	**Support**: Name the forces and ask students to identify the direction, and if one force is larger or smaller than another. **Extension**: Students estimate the size of the different forces.	**Interactive**: Balanced and unbalanced forces
Homework	**Support/Extension**	
Students list different situations at home where forces are balanced or unbalanced. Students name the forces involved in each case, identifying the direction and relative size.	**Support**: Students identify if the forces are balanced or unbalanced. **Extension**: Students name the forces involved and prepare force arrow diagrams.	