

Resultant forces

4.5.1.4 · Forces · revision notes

The resultant force is the single force that has the same effect as all the forces acting on an object together. You need to find the resultant of forces along a line.

Key facts

- Resultant force = single force with the same effect as all the forces together
- Balanced forces: resultant = 0 N, so the object is at rest or moves at constant velocity
- Same direction: add; opposite directions: subtract

Notes

Forces along a line

- The forces acting on an object can be replaced by a single **resultant force** that has the same effect as all of them together.
- Forces in the same direction: add them. Forces in opposite directions: subtract, and the resultant acts in the direction of the larger force.
- Example: 700 N forwards and 250 N backwards give a resultant force of 450 N forwards.
- If the resultant force is zero, the forces are **balanced**. The object is either stationary or moving at a constant velocity.

How to answer each type of question

Calculate the resultant of forces along a line

2 marks

Grade 4

- Add up all the forces acting in each direction.
- Subtract the smaller total from the larger.
- Give the size and the direction of the resultant.

Example. A cyclist has a driving force of 180 N forwards. Air resistance of 60 N and friction of 25 N both act backwards.

Calculate the resultant force on the cyclist and give its direction.

Model answer. backward forces = $60 + 25 = 85$ N; resultant = $180 - 85$ (1)
= 95 N forwards (1)

Don't lose marks

-  Giving a resultant force without a direction. A force is a vector.

- ✗ Adding forces that act in opposite directions instead of subtracting them.
- ✗ Thinking a moving object must have a resultant force on it. At constant velocity the resultant force is zero.

More tips

Memory tricks

- Balanced does not mean stopped. A zero resultant means no change in velocity: still, or steady speed in a straight line.
- Along a line, the resultant always acts in the direction of the bigger force.

Exam technique

- Always give the size and the direction of a resultant force.
- Link the resultant to the motion: zero resultant means constant velocity or at rest; a non-zero resultant means acceleration in its direction.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Define resultant force

A single force that has the same effect as all the original forces acting together.

Grade 4

Find the resultant of forces along a line

Add forces acting in the same direction; subtract forces acting in opposite directions.

Grade 5

Recognise balanced forces (zero resultant)

If the resultant force is zero, the object stays at rest or keeps moving at a steady velocity.

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