

Newtons Laws Momentum

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Calculate the resultant force needed to accelerate a 1200 kg car at 2.0 m/s². (2 marks)

Step 1 · Write the equation

resultant force = mass × acceleration, $F = m a$

Step 2 · Substitute and calculate

$$F = 1200 \times 2.0 = 2400 \text{ N}$$

Answer: 2400 N

Check: $\text{kg} \times \text{m/s}^2 = \text{N}$.

2. Now try one with the steps

A 1000 kg car has a driving force of 2000 N and air resistance and friction totalling 800 N. Calculate its acceleration. (3 marks)

Step 1 · Resultant force

Step 2 · Rearrange $F = m a$

Step 3 · Calculate

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. State Newton's first law. [2]

2. Calculate the resultant force needed to accelerate a 1200 kg car at 2.0 m/s². [2]

3. A resultant force of 30 N acts on a 6.0 kg mass. Calculate the acceleration in m/s². [2]

4. State Newton's third law. [2]

5. Explain why a lorry needs a bigger force than a car to reach the same acceleration. [1]

6. A resultant force of 450 N gives an object an acceleration of 1.5 m/s^2 . Calculate its mass. [2]

7. A 1000 kg car has a driving force of 2000 N and resistive forces of 800 N. Calculate its acceleration in m/s^2 . [3]

8. A 12 000 kg lorry brakes with a resultant force of 30 000 N. Calculate its deceleration in m/s^2 . [2]

9. A swimmer pushes backwards on the water. Use Newton's third law to explain how this moves her forwards. [2]

10. Describe and explain the motion of a skydiver from leaving the plane until reaching terminal velocity. [4]

11. Explain why opening a parachute reduces the skydiver's terminal velocity. [3]

12. Define inertia. [1]

13. State what is meant by inertial mass. [1]

14. Estimate the resultant force on a 70 kg sprinter who reaches 10 m/s from rest in 2.0 s. [3]

4. Before you hand it in

Using the driving force in $F = m a$ when there are resistive forces

Combine all forces first (forwards – backwards), then use $F = m a$.

"Weight and the normal force on a book are a third-law pair."

Third-law pairs act on different objects and are the same type: the Earth pulls the book; the book pulls the Earth.

"A moving object needs a force to keep it moving."

With zero resultant force it keeps moving at constant velocity. A force is only needed to overcome friction and air resistance.

"At terminal velocity there are no forces."

Weight and air resistance are both still acting; they are equal, so the resultant is zero.