

Exercise walk-through

1.1

Forces interactions and motion

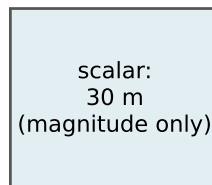
OxfordAQA · International GCSE · Physics

1

The method

Method — Interactions and vectors

Non-contact: gravity, electrostatic, magnetic. Contact: friction, air resistance, tension, normal. Weight: $W = mg$.



vector: 30 m due East
(length = magnitude,
arrow = direction)



vectors: displacement, velocity,
acceleration, force, momentum
scalars: distance, speed, time, mass

A scalar is a size; a vector is an arrow: length = magnitude, direction = arrow.

Method — Springs and graphs

$F = ke$ below the limit of proportionality; beyond it the distortion becomes inelastic (P). Distance–time gradient = speed; velocity–time gradient = acceleration, area = distance.

Worked check. A 3 kg mass at $g = 10 \text{ N/kg}$ hangs from a spring of $k = 60 \text{ N/m}$: $F = 30 \text{ N}$, extension $e = 30/60 = 0.5 \text{ m}$.

Exercises 2.1·2.3

2.1 Give one contact force and one non-contact force. [2]

2.2 Which two of these are vectors: mass, velocity, distance, acceleration? [2]

2.3 Calculate the weight of a 12 kg dog at $g = 10 \text{ N/kg}$. [2]

Exercises 2.1·2.3

2.1 Give one contact force and one non-contact force. [2]

2.1 Contact – friction (or tension, air resistance, normal); non-contact – gravity (or electrostatic, magnetic).

2.2 Which two of these are vectors: mass, velocity, distance, acceleration? [2]

2.2 Velocity and acceleration.

2.3 Calculate the weight of a 12 kg dog at $g = 10 \text{ N/kg}$. [2]

2.3 $W = 12 \times 10 = 120 \text{ N}$.

Exercises 2.4·3.1

2.4 A spring stretches 4 cm under a 6 N load. Calculate k in N/m. [3]

2.5 State what the gradient and the area represent on a velocity–time graph. [2]

3.1 A cyclist accelerates from 4 m/s to 12 m/s in 8 s. Calculate the acceleration and the distance travelled. [4]

Exercises 2.4·3.1

2.4 A spring stretches 4 cm under a 6 N load. Calculate k in N/m. [3]

2.4 $e = 0.04$ m; $k = F/e = 6/0.04 = 150$ N/m.

2.5 State what the gradient and the area represent on a velocity–time graph. [2]

2.5 Gradient – acceleration; area – distance travelled.

3.1 A cyclist accelerates from 4 m/s to 12 m/s in 8 s. Calculate the acceleration and the distance travelled. [4]

3.1 $a = (12 - 4)/8 = 1$ m/s²; distance = area = $\frac{1}{2}(4 + 12) \times 8 = 64$ m.

Exercises 3.2·3.3

3.2 A 1200 kg car has a driving force of 3000 N and resistive forces of 600 N. Calculate its acceleration. [3]

3.3 Describe how two coplanar forces of 30 N East and 40 N North may be combined by scale drawing, and state the resultant's size. [3]

Exercises 3.2·3.3

3.2 A 1200 kg car has a driving force of 3000 N and resistive forces of 600 N. Calculate its acceleration. [3]

3.2 Resultant = $3000 - 600 = 2400$ N; $a = 2400/1200 = 2$ m/s².

3.3 Describe how two coplanar forces of 30 N East and 40 N North may be combined by scale drawing, and state the resultant's size. [3]

3.3 Draw the 30 N arrow East to scale, then the 40 N arrow North from its tip; join start to finish – the diagonal is the resultant; $R = \sqrt{30^2 + 40^2} = 50$ N.