GET BETTER AT PHYSICS · MARK SCHEME

# Scalars & Vectors: tiered multiple choice

AQA A-level Physics · 7407 / 7408 · Specification 3.4.1.1 · 6 questions · 6 marks

1 mark per correct letter | Worked reasoning for every question

**How students did** = from AQA examiner reports, where available

## Answer key

| Q1 | Q2 | Q3 | Q4 | Q5 | Q6 |
|---|---|---|---|---|---|
| B | D | C | C | A | D |

## Easy

Questions 1–3

**1** **B**

Which quantities are vectors? · AQA June 2019 · AS Paper 2 · Q23

Displacement and momentum both have a direction, so both are vectors. Mass, energy, distance and speed are scalars, so every other row contains at least one scalar.

**How students did:** Around 88% of students got this right in June 2019.

**2** **D**

Momentum, mass and velocity · AQA June 2017 · AS Paper 2 · Q15

Velocity is a vector and mass is a scalar. Momentum = mass × velocity, so it has the direction of the velocity: it is a vector.

**How students did:** 87% of students got this right in June 2017.

**3** **C**

Spot the scalar · AQA June 2016 · AS Paper 2 · Q18

Power is the rate of transferring energy and has no direction, so it is a scalar. Momentum and weight (a force) are vectors, and a moment acts in a particular sense of rotation.

**How students did:** 70% of students got this right in June 2016.

## Medium

Questions 4–6

**4** **C**

Picture hanging on a nail · AQA June 2019 · AS Paper 2 · Q22

Each side of the string pulls up and inwards at 30° to the horizontal. The vertical components must balance the weight: $2T \sin 30° = 20$ N. Since $\sin 30° = 0.5$, $T = 20$ N.

> **Watch out:** 10 N comes from sharing the weight between the two sides and forgetting that only the vertical component of each tension holds the picture up.

**How students did:** Less than half of students got this right in June 2019.

**5** **A**

Aircraft in a crosswind · AQA June 2018 · AS Paper 2 · Q25

The wind blows from a direction at θ to due south, so its component along the north–south line is $u \cos \theta$, pointing south. This opposes the aircraft, so its speed northwards is $v - u \cos \theta$ and the time is $D / (v - u \cos \theta)$. The sideways component $u \sin \theta$ does not change progress northwards.

**How students did:** 42.6% of students got this right in June 2018.

**6** **D**

Three forces that can never balance · AQA June 2018 · A-level Paper 1 · Q20

Three forces give zero resultant only if they can form a closed triangle, which needs the largest force to be no bigger than the other two added together. 3 N + 6 N = 9 N, which is less than 10 N, so row D can never balance. A is a 3-4-5 right-angled triangle, B is equilateral and C is an isosceles triangle.

**How students did:** 38.1% of students got this right in June 2018.

## End of mark scheme

Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA.
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