

Combining forces and drawing force diagrams

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Marks are shown for each part. Method marks are given when your working is clear, even if the final answer is wrong, so state the rule you use and always give a direction for forces.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE P5

Question 1 Resultant force (2 marks)

- a. The single force that has the same effect as all the forces acting on the object together.
- b. It stays at **rest or moves at constant velocity**.

Marking: 1 mark each.

Question 2 Weight and reaction (3 marks)

- a. $W = m g = 3.5 \times 9.8 = \mathbf{34.3 \text{ N}}$.
- b. The bag is at rest, so the reaction is **34.3 N upwards**.

Marking: (a) 1 mark equation, 1 mark value; (b) 1 mark.

Question 3 Forces on a line (3 marks)

- a. $8.0 - 5.0 = \mathbf{3.0 \text{ N to the right}}$.
- b. The resultant becomes **8.0 N to the right**.

Marking: (a) 1 mark subtraction, 1 mark direction; (b) 1 mark.

Question 4 Reading a free-body diagram (3 marks)

- a. $40 - 15 = \mathbf{25 \text{ N to the right}}$.
- b. $49 - 49 = \mathbf{0 \text{ N}}$.
- c. The crate **accelerates to the right**.

Marking: 1 mark each part.

Question 5 Perpendicular forces (3 marks)

$R^2 = 9.0^2 + 12^2 = 81 + 144 = 225$, so $R = \mathbf{15 \text{ N}}$. $\tan \theta = 12 \div 9.0 = 1.33$, so $\theta = \mathbf{53^\circ}$ north of east.

Marking: 1 mark for Pythagoras, 1 mark for 15 N, 1 mark for the angle.

Question 6 Constant speed (2 marks)

The velocity is constant, so the resultant force is zero. The **driving force equals the resistive forces** (friction and drag) in the opposite direction.

Marking: 1 mark for resultant zero, 1 mark for the balance of driving and resistive forces.

Question 7 Hanging lamp (2 marks)

$W = m g = 2.0 \times 9.8 = 19.6 \text{ N}$. The lamp is at rest, so the tension equals the weight: **19.6 N** (about 20 N).

Marking: 1 mark for the weight, 1 mark for tension equal to weight.

Question 8 Non-contact forces (2 marks)

Any two of: **gravity** (a ball falling), **magnetic force** (a fridge magnet pulling a pin), **electrostatic force** (a charged comb lifting paper).

Marking: 1 mark for each force with a correct example.