

Inertia, resultant force and reaction pairs

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

Model answers and mark schemes follow. Award the marks shown for the method, the substitution and the final answer with a correct unit. Allow equivalent wording and follow-through for errors carried forward from an earlier part.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS2-1, GCSE P5

Question 1 Which law? (2 marks)

- a. **First law** (inertia).
- b. **Third law**.

Marking: 1 mark for each correct law.

Question 2 Car acceleration (3 marks)

- a. $4200 - 1500 = \mathbf{2700\ N}$.
- b. $a = F \div m = 2700 \div 1400 = \mathbf{1.9\ m/s^2}$.

Marking: (a) 1 mark. (b) 1 mark for $a = F \div m$, 1 mark for $1.9\ m/s^2$ with unit (1.93 accepted).

Question 3 Block on a rough surface (3 marks)

- a. $50 - 20 = \mathbf{30\ N}$ to the right.
- b. $a = 30 \div 5.0 = \mathbf{6.0\ m/s^2}$.
- c. The resultant force is zero, so the block keeps moving at **constant velocity**.

Marking: 1 mark each part.

Question 4 Tablecloth trick (2 marks)

The plates have inertia and tend to stay at rest. The cloth is pulled so fast that the friction force acts for only a very short time, so the plates gain almost no speed. **No significant resultant force acts on them for long enough.**

Marking: 1 mark for inertia / stays at rest, 1 mark for the force acting very briefly.

Question 5 Kicking a ball (3 marks)

- The **force of the ball on the boot**, equal in size and opposite in direction.
- They act on **different objects**, so they cannot be added.
- Acceleration = force $\div$ mass. The ball has a much smaller mass than the leg, so the same force gives it a **much larger acceleration**.

Marking: 1 mark each part.

Question 6 Terminal velocity (4 marks)

- At first the weight (800 N) is larger than the small air resistance, so the skydiver accelerates downwards. As speed increases the air resistance increases, so the resultant force and the acceleration get smaller. When the air resistance equals the weight the resultant force is zero and the speed stays constant: **terminal velocity**.
- 800 N**.

Marking: (a) 1 mark for accelerates because weight > air resistance, 1 mark for air resistance increases with speed so acceleration decreases, 1 mark for forces balanced at constant speed. (b) 1 mark.

Question 7 Weight on the Moon (2 marks)

- $W = m \times g = 60 \times 1.6 = \mathbf{96\ N}$.
- 60 kg**; mass does not depend on location.

Marking: 1 mark each part.

Question 8 Find the mass (1 mark)

$$m = F \div a = 75 \div 3.0 = \mathbf{25\ kg}.$$

Marking: 1 mark for the correct answer with unit.