

Exercise walk-through

Newton's First Law ■ 2.4

eXercise

You must be able to

- state **Newton's first law** 牛顿第一定律: an object keeps constant velocity unless a net force acts
- describe **inertia** 惯性 as the resistance to a change in motion
- apply the **equilibrium** 平衡 condition: net force zero means constant velocity (or rest)
- relate mass to inertia

Method — The law of inertia

With no net force, an object at rest stays at rest and a moving object keeps a constant velocity in a straight line. Motion needs no force to continue – only a *change* in motion needs one.

Method — Equilibrium

If the net force is zero, the object is in equilibrium: either at rest or moving at constant velocity. On a free-body diagram, the forces balance.

Method — Mass is inertia

More mass means more inertia – harder to start, stop, or turn. A loaded truck resists changes in motion far more than a bicycle.

Practice 2.1 ■ 1 mark

State what happens to a moving object when no net force acts on it.

Solution 2.1

Worked steps

It keeps moving at constant velocity in a straight line **B1**.

Practice 2.2 ■ 1 mark

Define inertia in one sentence.

Solution 2.2

Worked steps

Inertia is an object's resistance to a change in its motion **B1**.

Practice 2.3 ■ 1 mark

A crate moves at constant velocity. State the net force on it.

Solution 2.3

Worked steps

Zero (it is in equilibrium) **B1**.

Practice 2.4 ■ 1 mark

Which has more inertia: a 1 kg ball or a 10 kg ball?

Solution 2.4

Method: Mass is inertia

Worked steps

The 10 kg ball (more mass, more inertia) **B1**.

Exam-style 3.1 ■ 1 mark

An object moves at constant velocity. The net force on it is

A in the direction of motion

B opposite to the motion

C zero

D equal to its weight

Solution 3.1

A in the direction of motion

B opposite to the motion

C zero



D equal to its weight

Worked steps

C — constant velocity means zero net force.

Exam-style 3.2 ■ 1 mark

Inertia depends on an object's

A velocity

B mass

C colour

D position

Solution 3.2

Method: The law of inertia

A velocity

B mass



C colour

D position

Worked steps

B — inertia depends on mass.

Exam-style 3.3 ■ 1 mark

A hovering drone stays perfectly still in mid-air.

- (a) State the net force on it.
- (b) Name the two forces that must balance.

Solution 3.3

Method: Equilibrium

Worked steps

(a) Zero **B1**. (b) Weight (down) and the upward lift/thrust (up) **B1** **B1**.

Exam-style 3.4 ■ 2 marks

A passenger lurches forward when a bus suddenly brakes.

- (a) Explain this using inertia.
- (b) State whether a force pushes the passenger forward.

Solution 3.4

Method: The law of inertia

Worked steps

(a) The passenger's inertia keeps them moving forward while the bus decelerates beneath them **M1** **A1**. (b) No — no forward force acts; it is the absence of one **B1**.