

2.3 Newton's Third Law

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS newton's third law 牛顿第三定律 • normal force 法向力 • tension 张力 • force 力
• weight 重力

Objective

Build the skills to answer exam questions on **Newton's third law**.

You must be able to:

- state **Newton's third law** 牛顿第三定律: forces occur in equal, opposite pairs between two interacting objects
- identify the two objects involved and the force each exerts on the other
- explain that the pair acts on **different objects**, so the two forces never cancel
- apply the law to contact, **tension** 张力, and gravitational interactions

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Identifying a third-law pair

“A pushes B” is paired with “B pushes A” — equal in size, opposite in direction, on the **two different objects**. A swimmer pushes the water backward; the water pushes the swimmer forward.

■ Why the pair does not cancel

The two forces act on **different objects**, so they never appear on the same free-body diagram — and forces cancel only when they act on the **same** object.

■ The gravity pair

Earth pulls you down with force mg ; you pull Earth upward with the **same** force mg . Earth's enormous mass means its acceleration is negligible.

2 Practice

2.1 A hammer hits a nail with a force of 50 N. State the force the nail exerts on the hammer. [1]

2.2 A person stands still on the ground. Identify the third-law partner of the person's weight. [2]

2.3 Explain why the two forces of a Newton's third law pair can never cancel out. [2]

3 Exam-style questions

3.1 A car tyre pushes back on the road with 2000 N. The road pushes on the tyre [1]

- **A** forward with 2000 N
- **B** backward with 2000 N
- **C** forward with a smaller force
- **D** with zero force

3.2 Which statement about a Newton's third law pair is correct? [1]

- **A** the two forces act on the same object
- **B** the two forces are equal in size and opposite in direction
- **C** the larger object exerts the larger force
- **D** the two forces always cancel

3.3 A book of weight 8.0 N rests on a table.

- (a) State the third-law partner of the book's weight. [1]
- (b) State the third-law partner of the normal force the table exerts on the book. [1]
- (c) Explain why the book's weight and the normal force on the book are **not** a third-law pair. [1]

Solutions

2.1 50 N in the opposite direction, acting on the hammer.

2.2 the gravitational pull of the person **on the Earth**, equal in size and directed upward on the Earth.

2.3 the two forces act on **different** objects; forces can cancel only when they act on the **same** object.

3.1 A.

3.2 B.

3.3 (a) the gravitational pull of the book on the Earth (upward, on the Earth). (b) the force of the book pushing down on the table. (c) they act on the **same** object (the book) and are different types of force (gravity and contact); a third-law pair must act on two **different** objects.