

2.3 Newton’s Third Law

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS newton’s third law 牛顿第三定律 • action-reaction pair 作用 • force 力
• free-body diagram 受力图 • normal force 法向力

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: every force has an equal and opposite reaction
- identify an **action-reaction pair** 作用-反作用对 acting on two different objects
- explain why the two forces do not cancel (they act on different bodies)
- apply it to walking, rockets, and collisions

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ **Equal and opposite, on different objects**

If A pushes B, then B pushes A with an equal and opposite force. The two forces are the same size, opposite in direction, and act on **different** objects.

■ **Why they don’t cancel**

Action and reaction act on *different* bodies, so they never appear in the same free-body diagram and never cancel. Only forces on the *same* object can cancel.

■ **Everyday examples**

- Walking: your foot pushes back on the ground; the ground pushes you forward.
- Rocket: the engine pushes gas down; the gas pushes the rocket up.

2 Practice

Now apply the methods above.

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

2.2 State the two properties an action-reaction pair always shares. [2]

2.3 Why do action and reaction forces not cancel each other out? [1]

2.4 When you walk forward, what pushes you forward? [1]

3 Exam-style questions

3.1 Newton’s third law says forces come in pairs that are [1]

- | | |
|---|---|
| A | B |
| C | D |
- A equal and in the same direction
 - B equal and opposite, on the same object
 - C equal and opposite, on different objects
 - D unequal and opposite

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

- | | |
|---|---|
| A | B |
| C | D |
- A 0 N
 - B 1000 N
 - C 2000 N
 - D 4000 N

3.3 A book of weight 8 N rests on a table.

(a) State the reaction to the Earth's gravitational pull on the book. [1]

(b) Explain why this is *not* the normal force from the table. [1]

3.4 A swimmer pushes water backward to move forward.

(a) Identify the action-reaction pair. [2]

(b) State which force of the pair moves the swimmer. [1]