

# GCSE Combined Science: Trilogy

## Worksheet: Newton's Third Law

|                |                   |                       |                            |
|----------------|-------------------|-----------------------|----------------------------|
| TIME<br>25 min | TOTAL<br>23 marks | CALCULATOR<br>Allowed | DIFFICULTY<br>Easy, Medium |
|----------------|-------------------|-----------------------|----------------------------|

Topics: Newton's Third Law

|      |       |      |
|------|-------|------|
| NAME | CLASS | DATE |
|------|-------|------|

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

A person jumps forwards off a stationary rowing boat on a lake.

01.1

Explain, using Newton’s Third Law, why the boat moves backwards as the person jumps forwards.

[2 marks]

02

02.1

State Newton’s Third Law.

[2 marks]

0 2 . 2

A swimmer pushes backwards on the water with a force of 150 N.  
Give the size and direction of the force that the water exerts on the swimmer.

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[2 marks]

0 3

0 3 . 1

A book rests on a table. Which force forms a Newton's Third Law pair with the table's upward push on the book?

Tick (✓) **one** box.

The weight of the book

☐

The book's downward push on the table

☐

The gravitational pull of the book on the Earth

☐

Friction between the book and the table

☐

[1 mark]

0 3 . 2

Which **two** of these are true of a Newton's Third Law pair of forces?

Tick (✓) **two** boxes.

They act on the same object

☐

They act on two different objects

☐

They are always equal in size

☐

They are always in the same direction

☐

[2 marks]

0 4

A person pushes horizontally on a wall with different forces while standing still. A force sensor on the wall records the wall's push back on the person each time.

Table 1

| Person's push on the wall in N | Wall's push on the person in N |
|--------------------------------|--------------------------------|
| 120                            | ?                              |
| 85                             | ?                              |
| 200                            | ?                              |

0 4 . 1

Complete Table 1 by giving the size of the wall's push on the person in each case. Name the law you used.

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.....

[2 marks]

0 4 . 2

When the person pushes with 200 N, the wall pushes back on the person with 200 N, but the person does not move backwards. Explain why.

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.....

[2 marks]

.....

0 5

A book rests on a table. The weight of the book is 8.0 N.

0 5 . 1

The weight of the book is the gravitational force of the Earth on the book.

Describe the force that forms a Newton's Third Law pair with the weight of the book.

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**[3 marks]**

0 5 . 2

The table exerts a normal contact force of 8.0 N upwards on the book.

A student says:

'The weight of the book and the normal contact force are a Newton's Third Law pair.'

Explain why the student is wrong.

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.....

.....

**[2 marks]**

0 6

An aircraft's jet engines push exhaust gases backwards with a total force of 45 kN. The aircraft flies horizontally at a constant velocity.

0 6 . 1

Give the size and direction of the force that the exhaust gases exert on the engines.

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.....

.....

[2 marks]

0 6 . 2

Name the law that you used to answer the previous part.

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.....

.....

[1 mark]

0 6 . 3

The aircraft moves at a constant velocity, even though the exhaust gases push it forwards with this force.

Calculate the air resistance (drag) on the aircraft, and explain your answer.

.....

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[2 marks]

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**END OF QUESTIONS**

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

# Mark scheme

## GCSE Combined Science: Trilogy · Worksheet: Newton's Third Law · 23 marks

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### Question 1 (2 marks)

#### 01.1 [2 marks]

**Answer:** The person pushes back on the boat to jump forward; by N3L the boat feels an equal backward push and moves backward.

- the person's feet push backwards against the boat, in order to jump forwards (1)
  - by Newton's Third Law, the boat exerts an equal and opposite (forward) force on the person, while the person's backward push on the boat sends the boat moving backwards (1)
- 

### Question 2 (4 marks)

#### 02.1 [2 marks]

**Answer:** When two objects interact, the forces they exert on each other are equal and opposite.

- when two objects interact, they exert forces on each other (1)
  - that are equal (in size) and opposite (in direction) (1)
- 

#### 02.2 [2 marks]

**Answer:** 150 N forwards.

- 150 (N) (1)
  - forwards (1)
- 

### Question 3 (3 marks)

#### 03.1 [1 mark]

**Correct:** The book's downward push on the table

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#### 03.2 [2 marks]

**Correct:** They act on two different objects; They are always equal in size

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## Question 4 (4 marks)

### 04.1 [2 marks]

**Answer:** 120 N, 85 N and 200 N (Newton's Third Law).

- 120, 85 and 200 (N) respectively (1)
  - Newton's Third Law (1)
- 

### 04.2 [2 marks]

**Answer:** Friction from the floor on the person's feet balances the wall's push, so the resultant force on the person is zero.

- a friction force from the floor acts on the person's feet, towards the wall (1)
  - this friction force balances the wall's push, so the resultant force on the person is zero (the two forces in the Newton's Third Law pair act on different objects, so they do not cancel each other) (1)
- 

## Question 5 (5 marks)

### 05.1 [3 marks]

**Answer:** The gravitational force of the book on the Earth: 8.0 N, upwards.

- the gravitational force of the book on the Earth (1)
  - 8.0 N (1)
  - upwards (towards the book) (1)
- 

### 05.2 [2 marks]

**Answer:** Both forces act on the book (a third-law pair acts on two different objects), and they are different types of force.

- both forces act on the same object (the book), but the forces in a Newton's Third Law pair act on different objects (1)
  - they are different types of force (gravitational and contact) / the partner of the normal contact force is the downward push of the book on the table (1)
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## Question 6 (5 marks)

### 06.1 [2 marks]

**Answer:** 45 kN forwards.

- 45 kN / 45 000 N (1)
  - forwards (1)
- 

### 06.2 [1 mark]

**Answer:** Newton's Third Law.

- Newton's Third Law (1)
- 

### 06.3 [2 marks]

**Answer:** 45 kN: at constant velocity the resultant force is zero, so the drag balances the 45 kN forward force.

- 45 kN (45 000 N) (1)
  - the velocity is constant, so the resultant force is zero: the drag must be equal and opposite to the forward thrust (Newton's First Law) (1)
-