

GCSE Combined Science: Trilogy

Worksheet: Newton's First Law

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Newton's First Law

NAME _____	CLASS _____	DATE _____
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- 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.

0 1

0 1 . 1

Complete the sentence.

If the resultant force on a stationary object is zero, the object will

Tick (✓) **one** box.

start to move

☐

remain stationary

☐

accelerate

☐

move at a constant speed

☐

[1 mark]

0 1 . 2

A car travels at a steady speed along a straight, level road. The driving force on the car is 2400 N.

What is the total resistive force acting on the car?

.....

.....

.....

Resistive force = N

[1 mark]

0 1 . 3

What happens to the velocity of a moving object if the resultant force on the object is zero?

.....

.....

[1 mark]

0 1 . 4

Which statement is correct?

Tick (✓) **one** box.

A resultant force is needed to keep an object moving at a steady speed.

☐

An object can only change direction if a resultant force acts on it.

☐

A moving object always slows down when there is no resultant force.

☐

The resultant force on an object moving at a steady speed is in the direction of motion.

☐

[1 mark]

0 2

0 2 . 1

A driver wears a seatbelt. Which law explains why the seatbelt is needed to stop the driver continuing to move forward when the car suddenly stops?

Tick (✓) **one** box.

Newton's First Law

☐

Newton's Second Law

☐

Newton's Third Law

☐

The law of conservation of energy

☐

[1 mark]

0 2 . 2

Complete the sentence.

An object continues to move at a constant velocity, or remain at rest, unless it is acted on by a

.....

.....

.....

.....

[1 mark]

0 2 . 3

Which **two** of these situations involve a zero resultant force?

Tick (✓) **two** boxes.

A car moving at a constant velocity on a level road

☐

A car accelerating from rest

☐

A book resting on a table

☐

A ball falling with increasing speed

☐

[2 marks]

0 3

A lorry moves at a constant velocity in a straight line. The driving force on the lorry is 5520 N. The air resistance on the lorry is 4115 N, and there is also a friction force (rolling resistance) from the road.

0 3 . 1

Give the size of the resultant force on the lorry.

Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Calculate the size of the friction force from the road.

.....

.....

.....

.....

Force = N

[2 marks]

0 4

Modern cars have a headrest built into the top of each seat.

0 4 . 1

Explain, using Newton’s First Law, why a headrest reduces the risk of whiplash injury to a passenger’s neck in a rear-end collision.

.....

.....

.....

.....

.....

.....

[3 marks]

0 5

A puck slides across an air-hockey table. A cushion of air under the puck means that friction on the puck is negligible.

0 5 . 1

A player hits the puck. Describe and explain the motion of the puck after it leaves the player's bat.

[3 marks]

0 5 . 2

The puck hits the side of the table and bounces back.
Explain why a force must act on the puck during the collision.

[2 marks]

0 5 . 3

The air supply is switched off while the puck is moving, and the puck slows down.
Explain why.

[2 marks]

0 6

A car moves at a constant velocity in a straight line. The driving force on the car is 530 N. The air resistance on the car is 340 N, and there is also a friction force (rolling resistance) from the road.

0 6 . 1

Give the size of the resultant force on the car.
Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Calculate the size of the friction force from the road.

.....

.....

.....

.....

Force = N

[2 marks]

0 7

A cyclist rides along a straight, level road. The driving force from the cyclist is 180 N and the total resistive force is 180 N.

0 7 . 1

Describe the motion of the cyclist.

.....

.....

[1 mark]

0 7 . 2

The cyclist pedals harder, so the driving force increases to 230 N.
Calculate the resultant force on the cyclist and describe its effect on the motion.

.....

.....

.....

.....

Resultant force = N

[2 marks]

0 7 . 3

The driving force stays at 230 N. After a short time the cyclist moves at a new, higher steady speed.
Explain why.

.....

.....

.....

.....

.....

.....

[3 marks]

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 First Law · 32 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: remain stationary

01.2 [1 mark]

Answer: 2400 N

- 2400 (N) (1)
-

01.3 [1 mark]

Answer: It stays constant.

- it stays the same / constant (the object keeps the same speed and direction) (1)
-

01.4 [1 mark]

Correct: An object can only change direction if a resultant force acts on it.

Question 2 (4 marks)

02.1 [1 mark]

Correct: Newton's First Law

02.2 [1 mark]

Answer: Resultant force.

- resultant force (1)

Notes: Allow unbalanced force.

02.3 [2 marks]

Correct: A car moving at a constant velocity on a level road; A book resting on a table

Question 3 (4 marks)

03.1 [2 marks]

Answer: Zero: it moves at a constant velocity, so the forces are balanced.

- 0 N / zero (1)
- the velocity is constant (not accelerating), so the forces are balanced (Newton's First Law) (1)

03.2 [2 marks]

Answer: 1405 N

- $5520 - 4115$ (1)
- 1405 (N) (1)

Question 4 (3 marks)

04.1 [3 marks]

Answer: The body is thrown forward by the seat, but without support the head lags behind (N1L), straining the neck; the headrest pushes the head forward with the body, reducing this strain.

- when hit from behind, the car (and the base of the passenger's body, through the seat) suddenly accelerates forwards (1)
 - without a headrest, there is no resultant forward force on the passenger's head, so by Newton's First Law it tends to remain at rest while the body moves forward, bending the neck backwards sharply (1)
 - the headrest provides a forward force on the head as the seat moves forward, so the head accelerates forwards together with the body, reducing the strain on the neck (1)
-

Question 5 (7 marks)

05.1 [3 marks]

Answer: It moves at constant velocity, because friction is negligible and the weight is balanced, so the resultant force is zero.

- the puck moves at a constant velocity / constant speed in a straight line (1)
- because the resultant force on it is zero (1)
- friction is negligible and the weight is balanced by the upward force from the air cushion (1)

05.2 [2 marks]

Answer: Its velocity changes (the direction reverses), and a change in velocity needs a resultant force.

- the velocity of the puck changes (its direction reverses) (1)
- a change in velocity needs a resultant force (1)

05.3 [2 marks]

Answer: Friction now acts against the motion, giving a backward resultant force, so the puck decelerates.

- friction now acts on the puck (opposite to its motion) (1)
- so there is a resultant force backwards and the puck decelerates (1)

Question 6 (4 marks)

06.1 [2 marks]

Answer: Zero: it moves at a constant velocity, so the forces are balanced.

- 0 N / zero (1)
- the velocity is constant (not accelerating), so the forces are balanced (Newton's First Law) (1)

06.2 [2 marks]

Answer: 190 N

- $530 - 340$ (1)
 - 190 (N) (1)
-

Question 7 (6 marks)

07.1 [1 mark]

Answer: Moving at a constant velocity.

- constant / steady speed in a straight line (constant velocity) (1)

07.2 [2 marks]

Answer: 50 N forwards; the cyclist accelerates

- 50 (N) (forwards) (1)
- the cyclist accelerates / speeds up (1)

07.3 [3 marks]

Answer: Air resistance increases with speed, reducing the resultant force until resistive force = 230 N; then the resultant force is zero and the speed is constant.

- as the speed increases, the air resistance / resistive force increases (1)
 - so the resultant force decreases (1)
 - when the resistive force reaches 230 N the resultant force is zero, so the speed stays constant (1)
-