MR SULLY UNFOLDS PHYSICS ANSWERS

Newton's laws and terminal velocity

AQA 4.5.6.2 · RP7
Forces · Paper 2
Foundation & Higher · Required practical 7

Name _____ Class _____ Date _____

Newton's three laws explain how forces affect motion, from cars to skydivers.

KEY IDEAS

- **First law**: if the resultant force is zero, a stationary object stays still and a moving object keeps the same velocity.
- **Second law**: F = ma. Acceleration is proportional to the resultant force and inversely proportional to mass.
- **Third law**: when two objects interact, they exert equal and opposite forces on each other.

Section A · Recall and calculate

Grade 4–5

1 State Newton's First Law. [2]

If the resultant force on an object is zero, a stationary object stays still and a moving object continues at the same speed in the same direction.

2 Calculate the resultant force needed to accelerate a 1200 kg car at 2.5 m/s². [2]

F = 1200 × 2.5 = 3000 N

3 A 60 N resultant force acts on a 15 kg trolley. Calculate its acceleration. [2]

a = F ÷ m = 60 ÷ 15 = 4 m/s²

Section B · Apply

Grade 5–6

4 A person pushes against a wall with a force of 200 N. Describe the force the wall exerts on the person. [2]

200 N (equal in size), acting in the opposite direction, on the person (Newton's Third Law).

5 Describe how a skydiver reaches terminal velocity after jumping from a plane. [4]

At first, weight is bigger than air resistance, so she accelerates.
As speed increases, air resistance increases.
The resultant force decreases, so the acceleration decreases.
When air resistance equals weight, resultant force is zero: terminal velocity.

Section C · Stretch

Grade 7+

6 Explain what is meant by inertial mass. (Higher) [2]

A measure of how difficult it is to change an object's velocity.
Defined as force ÷ acceleration.

Exam-style question

AQA style

7 A student investigates how the force on a trolley affects its acceleration, using masses on a string over a pulley.

a Explain why the student moves masses from the trolley to the hanger to increase the force. [2]

This keeps the total mass of the system constant,

so mass is a control variable and only the force changes.

b Suggest why light gates give better results than a stopwatch. [1]

They remove human reaction time, so timings are more accurate.

c State the relationship the student should find between force and acceleration. [1]

Acceleration is directly proportional to the resultant force.

d With a resultant force of 1.2 N, the trolley's acceleration is 0.8 m/s². Calculate the total mass being accelerated. [2]

m = F ÷ a = 1.2 ÷ 0.8 = 1.5 kg

e The student now keeps the force at 1.2 N and adds masses to the trolley. Describe how the acceleration changes as the mass increases. [2]

The acceleration decreases;

acceleration is inversely proportional to mass (doubling the mass halves the acceleration).

Total: _____ / 22

How confident am I?	Not yet	Nearly	Got it
I can state and apply Newton's three laws	☐	☐	☐
I can use F = ma	☐	☐	☐
I can explain terminal velocity	☐	☐	☐