# Acceleration Investigation

**Answer the following questions:**

1. Define acceleration.
   **The rate of change of velocity.**
2. State the SI unit for acceleration.
   **Metres per second squared ($m/s^2$)**
3. State the equation used to calculate acceleration.

$$Acceleration = \frac{Change\ in\ velocity}{Time}$$

4. Explain the difference between speed and velocity.
   **Speed is the distance covered per unit time and is a scalar quantity, whereas velocity is a vector and is speed in a given direction.**
5. Describe how to calculate the speed of an object.
   **Measure a distance and measure the time taken for the object to travel that distance.**

$$Speed = \frac{Distance}{Time}$$

Do Now

22/05/2024

# Acceleration Investigation

## P3.1.8

Science
**Mastery**

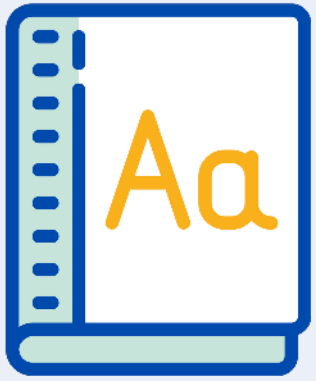

P3.1.1 Prior Knowledge Review
P3.1.2 Scalars and Vectors
P3.1.3 Resultant Vectors
P3.1.4 Resolving Vectors
P3.1.5 Newton's Third Law
P3.1.6 Newton's First Law
P3.1.7 Acceleration
➢ **P3.1.8 Acceleration Investigation**

Maths in Science Lesson 17
P3.1.9 Velocity-Time Graphs
P3.1.10 Velocity-Time Graphs 2
P3.1.11 Acceleration Problems

**Following this lesson, students will be able to:**

- Measure the final and initial velocity of an object.
- Calculate acceleration from an experiment.
- Identify anomalous results.

**Key Words:**




**force** **acceleration** **velocity**

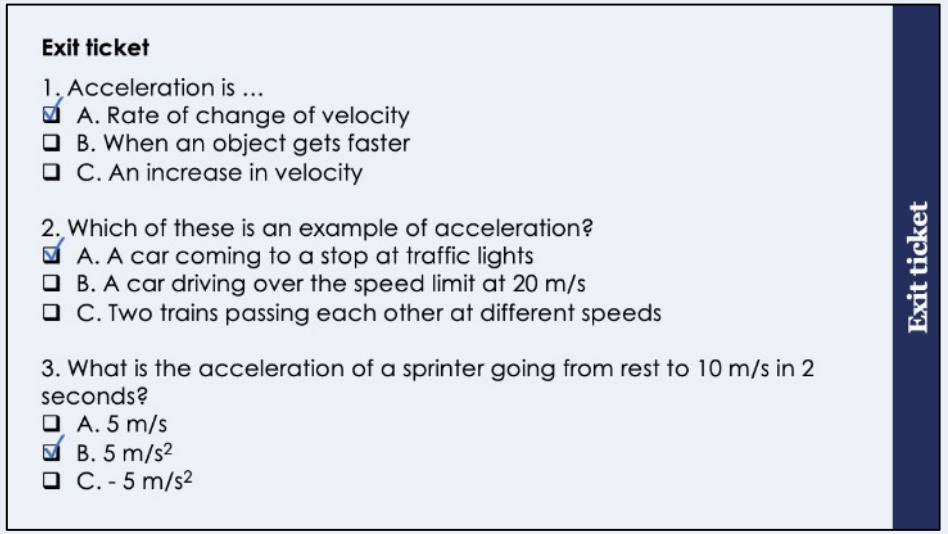
**initial** **final** **anomalous**

Lesson Objectives

# This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.




Fix-it

# How many links can you make between forces and acceleration?

*Are they scalar or vector quantities?*

*What are the units for each?*

*If an object is accelerating, what can be said about the forces acting on it?*

*If an object is not accelerating (it is stationary or at a constant velocity), what can be said about the forces acting on it?*

Talk Task

# Acceleration

Acceleration is the **rate** of **change** of **velocity**.

To calculate the acceleration of an object we need to know its **initial velocity**, its **final velocity** and the **time** taken for the velocity to change.

Velocity is speed in a given **direction**.

$$Acceleration = \frac{Change\ in\ velocity}{Time}$$

$$a = \frac{\Delta v}{t}$$

# Anomalous Results

Anomalous results are results that do not fit the pattern.

If they are caused by experimental error, they should be ignored when calculating a mean.

The following measurements were taken before calculating the acceleration of a toy car. Students carried out 4 trials using the same car and recorded the initial and final velocity in each trial.

| Trial | Initial Velocity | Final Velocity |
|---|---|---|
| **1** | 0 m/s | 1 m/s |
| **2** | 0 m/s | 1.5 m/s |
| **3** | 0 m/s | 1 m/s |
| **4** | 0 m/s | 6 m/s |
| **Mean** | **0 m/s** | **1.17 m/s** |

**Which is the anomalous result?**

**6 m/s**

**What should we do when calculating the mean?**

**The anomalous result should be ignored before calculating the mean.**

## Quick Quiz:

1. What values do you need to be able to calculate acceleration?
   **Initial velocity, final velocity and time taken**

2. What values do you need to be able to calculate speed?
   **Distance and time**

3. What is the difference between speed and velocity?
   **Velocity has a direction, speed does not.**

4. What is an objects initial velocity if it starts from rest?
   **0 m/s**

Check for understanding

# Drill

1. What is velocity?
2. What is acceleration?
3. What are the quantities needed to calculate acceleration?
4. What is initial velocity?
5. What are the two quantities needed to find velocity?
6. What is an anomaly?
7. If an anomaly occurs, what should you do with this value?
8. Students measured the time taken for a toy car to travel 1 m. Their results were: 2.5 s, 2.4 s, 2.8 s and 2.5 s. Which number is the anomaly?
9. Calculate a mean for the following accelerations: 6.2 $m/s^2$, 6.7 $m/s^2$, 6.6 $m/s^2$, 6.7 $m/s^2$, 6.6 $m/s^2$

Check for understanding

# Drill answers

1. Velocity is the rate of change of distance.
2. Acceleration is the rate of change of velocity. Can be referred to as speeding up or slowing down.
3. Initial velocity, final velocity and time are needed to calculate acceleration.
4. Initial velocity is the starting velocity.
5. Displacement and time are needed to calculate velocity.
6. An anomaly is a result that does not fit a pattern.
7. When anomaly occurs you should ignore it before calculating the mean.
8. 2.8s is the anomaly.
9. $\frac{6.7+6.6+6.7}{3}$ = 6.67 s

Check for understanding

# I: Describe: *to recall facts, events or processes in an accurate way*

Example question:

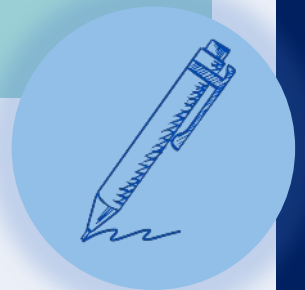
**Describe** how to use initial and final velocity to measure acceleration of an object.

Model answer:

- **Acceleration** is the **rate of change of velocity.**
- This means we need to measure how much the velocity changes by and how long this takes
- We can measure the **initial** speed of an object by measuring a **distance** and timing **how long** it takes the object to cover this distance, then use **speed = distance/time**
- We can measure the **final** speed in the same way
- Change in velocity is the difference between the final speed and the initial speed in a given **direction**
- We can measure the time taken for the change in velocity
- Finally, we can calculate **acceleration** using **acceleration = change in velocity/time**

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.



Writing like a scientist

# We: Describe: *to recall facts, events or processes in an accurate way*

Example question:

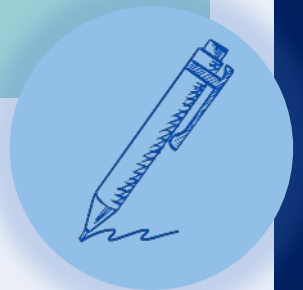
**Describe** how to **measure** velocity.

Model answer:

- **Velocity** is speed in a given direction
- This means we need to measure speed and determine the direction
- We can use speed = distance/time
- The velocity must be written with a direction

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.



Writing like a scientist

# You: Describe: *to recall facts, events or processes in an accurate way*

Example question:

**Describe** how to **measure** acceleration.

Model answer:

- **Acceleration** is the **rate of change of velocity.**
- This means we need to measure how much the velocity changes by and how long this takes
- We can measure the **initial** velocity and the **final** velocity
- Change in velocity is the difference between the final speed and the initial speed in a given **direction**
- We can measure the time taken for the change in velocity
- Finally, we can calculate **acceleration** using **acceleration = change in velocity/time**

To 'describe', your answer should:

- Use **bullet points.**
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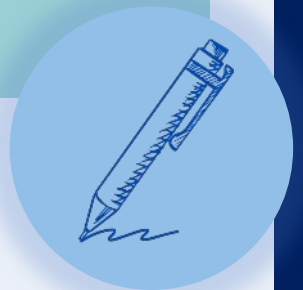

Writing like a scientist

**Answer the questions below.**

1. What was the dependent variable in this experiment?

- ☐ A. Force applied
- ☐ B. Mass of the car
- ☑ C. Acceleration

2. Acceleration can be calculated by…

- ☑ A. Change in velocity divided by time
- ☐ B. Distance divided by time
- ☐ C. Velocity divided by time

3. An object accelerates from rest to 10 m/s in two seconds. What is its initial velocity?

- ☐ A. 2 m/s
- ☐ B. 10 m/s
- ☑ C. 0 m/s

Exit ticket

Feedback

| Lesson P3.1.8 | |
|---|---|
| What was good about this lesson? | What can we do to improve this lesson? |
| | |

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!