Year 9 Science – Physics Knowledge Organiser

9H – How fast do things go?

- **Speed** is a measure of **how far something travels in a particular time**.
- To **calculate speed**, measure the time it takes for an object to travel between two points.
- A **measuring tape** or **trundle wheel** can be used to measure the distance.
- A **stopwatch** or **light gates** can be used to measure the time.

Speed = Distance ÷ Time

- **Speed** can be measured in **metres per second** or **m/s.**
- **Instruments** such as speed cameras, speed radar guns, wheel sensors for bicycles and GPS systems such as Satnav can also be used to measure speed.
- Some speeds you should know:

	Speed (m/s)
walking quickly	1.7
sprinting	10
typical speed limit	14
cheetah	33
aeroplane cruising speed	255
sound in air	330
light in air	300 000 000

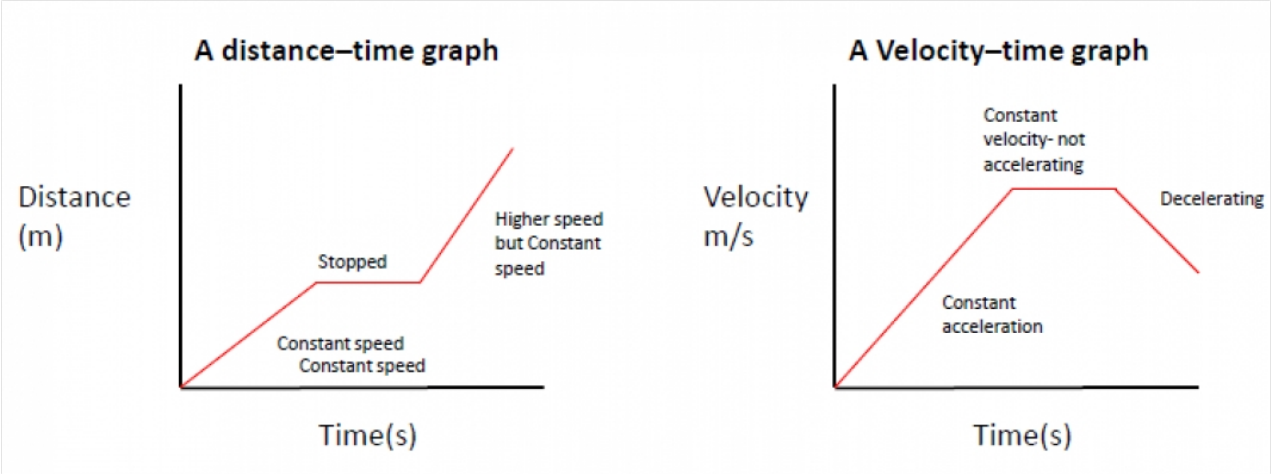
- A **distance-time graph** shows you **the distance an object travels over time.**
- The **gradient** (slope) on the graph tells you the **speed**. The steeper the graph, the greater the speed.

Gradient (speed) = Change in Distance ÷ Change in Time.

- **Acceleration** is a measure of **how speed changes over time**.

Acceleration = Change in Speed ÷ Time

- Acceleration is measured in **metres per second squared** or **m/s^2.**
- A **speed-time graph** shows you **how the speed of an object changes over time.**
- A *speed-time graph* is sometimes called a *velocity-time graph*.
- The **gradient** of the graph at a particular point gives you the **acceleration** at that point.
- The **area under the graph** gives you the **distance** covered during that time interval.



- **Reaction time** is the time from hearing or seeing an event and starting to brake or use a stopwatch. Average human reaction time is **0.2s**.
- Reaction time of catching a falling ruler can be measured by using this formula:

Reaction time = (final velocity(m/s))^2 – (initial velocity(m/s))^2 = 2 x Acceleration (m/s^2) x Distance (m)

- **Thinking distance** is the **distance a vehicle travels** in the **time it takes for the driver to apply the brakes after realising they need to stop.**

Thinking Distance (m) = Speed (m/s) x Reaction Time (s)

- Thinking distance is affected by tiredness, drugs, alcohol and distractions.

- **Braking distance** is the **distance a car travels after the driver has applied the brakes.**

Braking distance (m) = Speed (m/s) x Time Taken to Brake (s)

- Braking distance increases when roads are wet or icy, cars have worn out brakes or tyres, cars travel at higher speeds and cars have a greater mass.
- **Stopping distance** is the **total distance that a car travels from the driver seeing the hazard to the car making a complete stop.**

Stopping distance = Thinking Distance + Braking Distance

- **Large negative accelerations** are dangerous because they can cause compression injuries and damage internal organs when the car slows down suddenly.