

# Unit 1 - Waves

# Your workbook

At the start of each unit, you will be given a new workbook. The workbook contains all of the notes you require, as well as experimental instructions and problems.

For your convenience, each workbook has the following at the front of it:

- i) A relationship sheet
- ii) A data sheet
- iii) A list of physics prefixes.

# Physics

The physics course is split into 6 units:

- i) Waves
- ii) Radiation
- iii) Dynamics
- iv) Space
- v) Electricity
- vi) Properties of Matter

# Waves Careers



# Physics Basics

## Solving Equations

Learning Intention: To develop the skills required to solve equation-based questions. These skills will be utilised at all levels of physics. How do you calculate the acceleration of a car? Or how dangerous radiation is? Or what resistor you need to protect an LED? We shall find out!

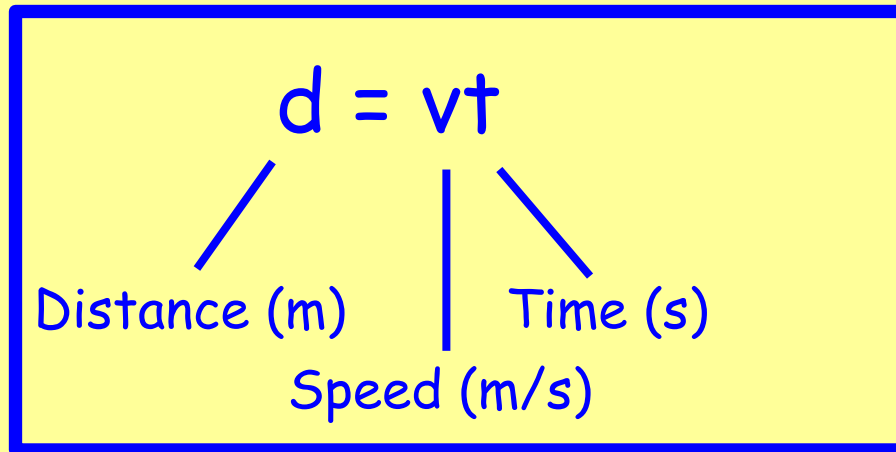
Success Criteria: We will use  $d = vt$  as the basis around which we develop our skills. However, success will be shown by the ability to transfer the skills developed onto questions with different equations.

# Solving Equations

There are many equations used within Physics. Those required for this course are given in the relationship sheet.

The challenge is to memorise what each letter in those equations stands for, as well as any corresponding units. Then, the skills of solving equations can be used.

As an example, we shall use the equation linking distance, speed and time:



# Solving Equations

Example: What speed would a runner have to travel at to cover a distance of 40 metres in 5 seconds?

This is how EVERY physics problem, however difficult, should be laid out:

1) Write down a list of the information you have been given and check that the correct units are being used (have you changed minutes to seconds, are there prefixes? etc.).

$$v = ?$$

$$d = 40 \text{ m}$$

$$t = 5 \text{ s}$$

2) Write down the relevant equation as it is stated on the relationship sheet:

$$d = vt$$



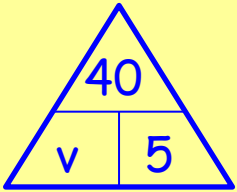
# Solving Equations

Example: What speed would a runner have to travel at to cover a distance of 40 metres in 5 seconds?

3) Replace the letters in the equation with any given numbers:

$$40 = v \times 5$$

4) Re-arrange using either an equation triangle, or algebra:



$$v = \frac{40}{5}$$

5) Solve, using a scientific calculator if required. Remember to give units.

$$v = \underline{8 \text{ m/s}}$$

# Solving Equations

Now, work through this example as a class, completing the solution in your workbook:

**Example:** A car travels at an average speed of 50 m/s. Calculate the distance it would cover in 55 minutes.

Now, solve the examples from your workbook in your classwork jotter showing full working for each one.

Success Criteria: We will use  $d = vt$  as the basis around which we develop our skills. However, success will be shown by the ability to transfer the skills developed onto questions with different equations.

Tick off the box in your workbook when you have met the success criteria.

# Physics Basics

Scientific Notation

Learning Intention: To test and build on knowledge of scientific notation. The ability to use this knowledge will be essential throughout all levels of physics to ensure that quantities are easy to handle.

Success Criteria: To be able to use scientific notation when answering physics problems.

# Scientific Notation

In physics we deal with very large numbers and very small numbers. It is neither convenient nor practical to use these numbers in their normal form.

For example, the speed of light is frequently used; 300,000,000 m/s. It is much easier to enter this into a calculator using scientific notation;  $3 \times 10^8$  m/s.

The main skill that should be developed is how to enter these into your calculator. In physics, you will generally not be asked to change scientific notation into normal form, or vice versa.

# Scientific Notation

If you have not yet purchased a scientific calculator, now is the time to do it!

Different calculators have different buttons to change numbers into standard form. It is usually either an **EXP** or a **x10<sup>x</sup>** button. Ask your teacher for help if you do not have this button.

The example below demonstrates how to enter scientific notation into your scientific calculator. It is exceptionally important to enter them this way to ensure correct answers:

Example - Calculate  $4 \times (1.25 \times 10^3)$  giving your answer in standard form.

Enter into calculator:  $4 \times 1.25 \times 10^3 = 5000$  (or  $5 \times 10^3$ )

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Alternatively:

$4 \times 1.25 \text{ Exp } 3 = 5000$  (or  $5 \times 10^3$ )

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# Scientific Notation

Now, solve the examples from your workbook in your classwork jotter.



Success Criteria: To be able to use scientific notation when answering physics problems.

Tick off the box in your workbook when you have met the success criteria.

# Physics Basics

## Prefixes

Learning Intention: To learn the prefixes which are used throughout the science and engineering world, and how to use them in equations. These can be found throughout the real world, for example, kilometres, milliamps and mega-hertz.

Success Criteria: To successfully identify prefixes and correctly answer questions that include them.

# Prefixes

The table below shows all of the prefixes used in physics. These are also found at the start of this booklet but must be memorised for tests and the final exam.

Symbol	Name	Scientific Notation
G	giga	$\times 10^9$
M	mega	$\times 10^6$
k	kilo	$\times 10^3$
m	milli	$\times 10^{-3}$
$\mu$	micro	$\times 10^{-6}$
n	nano	$\times 10^{-9}$

Example: 40 km would have to be changed into metres.

Replace k with  $\times 10^3$ .

40 km would therefore be written as  $40 \times 10^3$  m.

Now, solve the examples from your workbook in your classwork jotter showing full working for each one.

Success Criteria: To successfully identify prefixes and correctly answer questions that include them.

Tick off the box in your workbook when you have met the success criteria.

# Physics Basics

## Significant Figures

**Learning Intention:** To learn the correct number of significant figures to which the answers to physics calculations should be given. This allows us to give answers in a short, manageable fashion.

**Success Criteria:** To complete physics questions and round answers appropriately.



# Significant Figures

In Physics, answers should always be given to three significant figures.

Example: A runner completes a 100 m race with an average speed of 9.75 m/s.  
Calculate the time it would take to complete the race.

$$d = vt$$

$$100 = 9.75 \times t$$

$$t = \frac{100}{9.75}$$

$$9.75$$

$$t = 10.25641026$$

$$t = \underline{10.3 \text{ s}}$$

Remember, if the answer is less than '0', significant figures only start to be counted after the first non-zero number.

e.g. 0.0020356 would round to 0.00204

Now, solve the examples from your workbook in your classwork jotter.

Success Criteria: To complete physics questions and round answers appropriately.

Tick off the box in your workbook when you have met the success criteria.

Now, use the space in your workbook to produce a summary of the physics basics (solving equations, scientific notation, prefixes and significant figures).

You may wish to produce concise bullet points, or draw a mind-map, or use any other useful revision technique.