Name:

Sawtry Village Academy

THE ROYAL SOCIETY

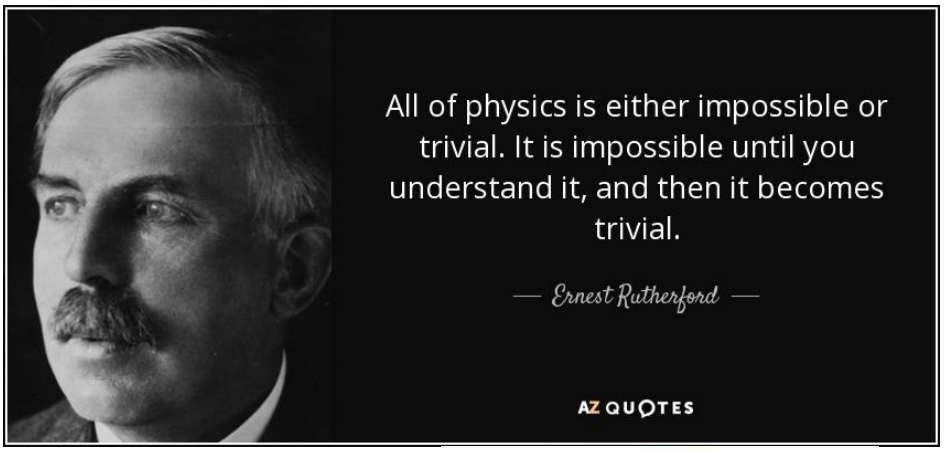
ALevelPhysicsOnline.com

IOP Institute of Physics

Transition Pack 2025-26

A-Level

Physics



isaac Physics.

CHAT PHYSICS

Contents

Welcome to A level Physics!

So, you have chosen to do the most amazing subject… Physics!

A lot of people think it is hard, and it is, if you do not like it or have a passion for it and you do not work for it.

However, over the next two years we hope to inspire you in Physics and drive your passion for it. This, along with some hard work from yourself will mean you will leave this school not only with a fantastic qualification, but a better appreciation of the world around you, skills that you can use for the rest of your life and a problem solving, intuitive, creative brain.

This pack contains a program of activities and resources to prepare you to start A level in Physics in September. It is aimed to be used after you complete your GCSE throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.

SUBMIT ALL WORK TO MR MOORE AT SMOORE@SAWTRYVA.ORG BY 5th September 2024

Course outline

Sawtry Village Academy

This information is readily available on the AQA website at

http://www.aqa.org.uk/subjects/science/as-and-a-level/physics-7407-7408

Subject content

Section	Content	Core / optional
1	Measurements and their errors	Core
2	Particles and radiation	Core
3	Waves	Core
4	Mechanics and materials	Core
5	Electricity	Core
6	Further mechanics and thermal physics	Core
7	Fields and their consequences	Core
8	Nuclear physics	Core
9	Astrophysics	Optional
10	Medical physics	Optional
11	Engineering physics	Optional
12	Turning points in physics	Optional

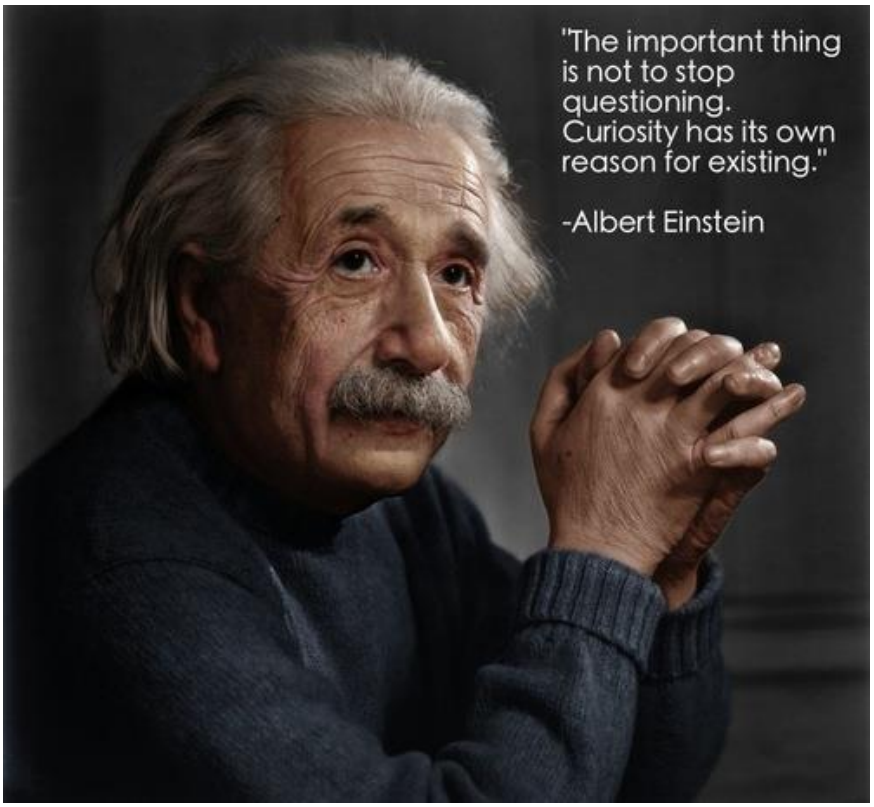
N.b. The optional modules are done on a class vote, with the most popular topic being taught.

A-Level

Paper 1	Paper 2	Paper 3
What's assessed Section 1-5 and 6.1 (periodic motion)	***What's assessed*** Section 6.2 (Thermal Physics), 7 and 8 Assumed knowledge of 1 to 6.1	***What's assessed*** Section A: Compulsory section: Practical skills and data analysis Section B: Students enter for **one** of sections 9, 10, 11, 12 or 13
Assessed • Written exam: 2 hours • 85 marks marks • 34% of A-Level	***Assessed*** • Written exam: 2 hours • 85 marks • 34% of A-Level	***Assessed*** • Written exam: 2 hours • 80 marks • 32% of A-Level
Questions 60 marks of short and long answer questions and 25 multiple choice questions on content	***Questions*** 60 marks of short and long answer questions and 25 multiple choice questions on content	***Questions*** 45 marks of short and long answer questions on practical experiments and data analysis. 35 marks of short and long answer questions on optional topic.

Sawtry Village Academy

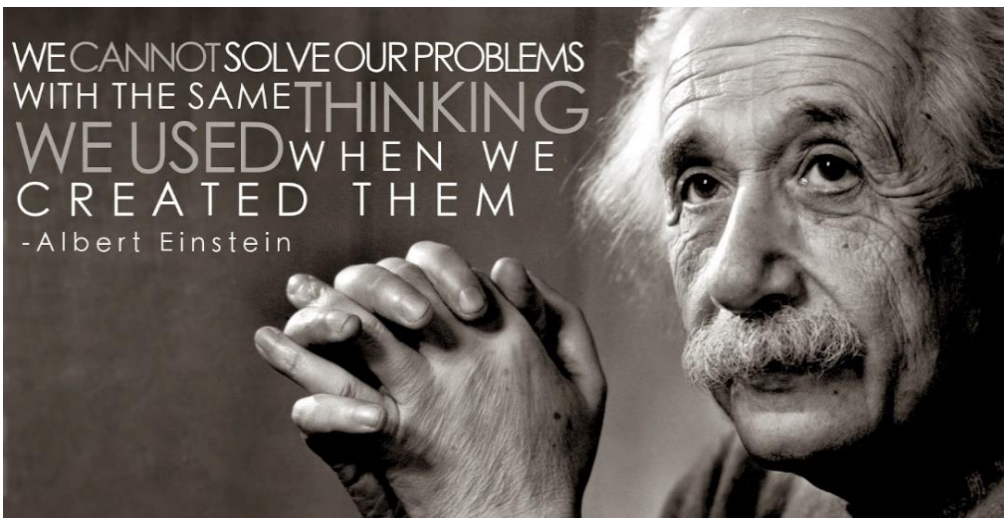
Careers



Using your Physics A level can lead you to many careers, in recent years the students have gone onto the following career pathways:

Astrophysics at Keele University, Physics at Surrey and Lincoln University, Engineering apprenticeships with Rolls Royce, Engineering degrees at Nottingham and De Montfort University, Accounting apprenticeships and degrees, Psychology at St Marys University and Nursing Apprenticeship in association with Addenbrookes Hospital, Veterinary Medicine at Surrey University.

As well as these you can use A level Physics to go into practically any industry or career pathway, including Medicine, Construction, Finance and IT.



Preparation Tasks

Sawtry Village Academy

1. Research a Physicist

- Word limit **500 words ± 10%.** (see requirement below)
- Choose at least one Physicist (**ideally one you have not heard of)** that is in a field of physics you are interested in.
- Who are/were they and what did they discover or are working on.
- How their science applies to everyday modern life today
- Why did you choose this Physicist?
- Include your references (ideally Harvard referencing style – there are plenty of free tools online to help you do this)

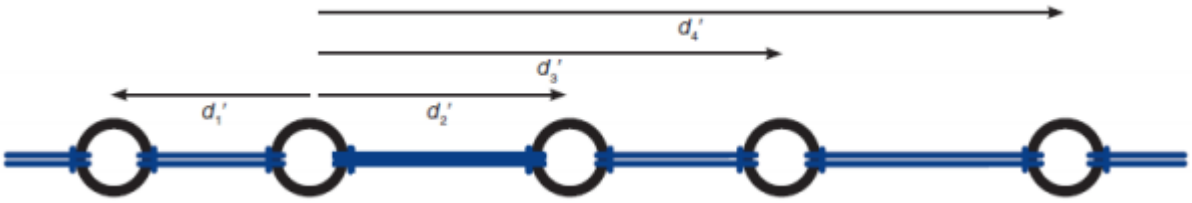
There are lots on Twitter/Instagram that you can get in contact with (they do not have to be super famous or dead or have won a Nobel prize). Or if you do not want to talk to anyone directly you can find long lists of people online.

2. Practical activity – Expanding Universe

Equipment needed:

• 6 assorted washers (or paper clips)
• 5 elastic bands/hairbands of the same thickness (and ideally of different lengths)
• Small stickers
• Ruler or tape measure
• Graph paper (or laptop with Microsoft Excel or similar)
• Sticky tape

Method:



1. Make a model universe from rubber bands and washers, as shown above. Each washer represents a different galaxy.

2. Choose one washer to be the home galaxy, label it with a sticker. Label the other galaxies with letters A to E.

3. Copy the table below.

Galaxy	Distance from home/ cm		Change in distance/ cm
	Initial	Final	
A			
B			
C			
D			
E			

4. Measure the distance from the home galaxy to galaxy A. Repeat for the other galaxies and write the distance in the 'initial' column of the table

5. Expand the universe until it is twice its original length and then tape down the ends to a table or the floor to hold it in place.

6. Measure the new distance from the home to the other galaxies. Fill in the 'final' column of the table.

7. Subtract values in the second column from those in third column to calculate the change in distance.

8. Plot a graph of "change in distance" against "initial distance" and draw a line of best fit.

9. Repeat steps 4 to 8 but with a different galaxy as home galaxy. Compare the gradients of your two graphs. What effect does changing your home galaxy have?

Using the practical to inform the Physics theory

In 1921, Astronomer Edwin Hubble was measuring the speeds of nearby galaxies when he noticed a puzzling thing. When he plotted the speed of the galaxy against its distance, the points from each of the galaxies in his sample seemed to follow an increasing 'straight' line.

This turned out to be the first important clue that the universe was expanding. Each galaxy was moving away from its neighbour. The farther away the galaxy was from the Milky Way, the faster it was moving away from us.

Below is a table of clusters of galaxies, which are known by the constellation in which direction they are found (e.g. the Virgo Cluster is seen in the direction of the constellation Virgo, although the galaxy cluster is vastly further away than the stars we see in the sky). For each galaxy the table lists the speed at which the galaxy is moving away from us and its distance in Megaparsecs (each Megaparsec is equal to 3.25 million LY).

Sawtry Village Academy

Cluster	Velocity (km/sec)	Distance (Megaparsecs)
Virgo	1200	15
Perseus	5400	71
Coma	6600	83
Hercules	10500	150
Ursa Major I	15600	313
Leo	19500	337
Corona Borealis	21600	347
Gemini	23400	402
Bootes	39300	650
Ursa Major II	40200	653
Hydra	60600	831

The table shows the distance and speed of 7 galaxies. The distances are given in mega parsecs (Mpc). One mega parsec equals 3.1 x 10^{19} km. The velocity is given in kilometres per second. Note, the speed of light is 300,000 kilometres/sec.

1. Create a graph on either graph paper or Excel that presents the distance to each galaxy in Mpc on the horizontal axis, and the velocity in kilometres/sec on the vertical axis.

2. What is the range of distances to the galaxies in this sample in kilometres?

3. Does the data show that the distances and velocities of the galaxies are proportional, directly proportional or inversely proportional?

4. Draw a line of best fit that goes through the origin, or in Excel Spreadsheet, plot the data and use the 'Tools' to determine a best-fit line.

5. The **gradient** of the line in this plot is called **Hubble's Constant**. What is your estimate for Hubble's Constant from the data you used?

Hubble's law states that the speed of recession of a galaxy is proportional to the distance to the galaxy.

$$v \propto d$$

inserting the Hubble's constant:

$$v = Hd$$

We can combine this with an equation we have used before (speed = distance/time) to find time:

$$v = \frac{d}{t} = Hd$$ *(you can cancel the d's)*

$$v = \frac{1}{t} = H$$ *(ignore the speed now)*

$\frac{1}{t} = H$ *(flip over to find t)*

$t = \frac{1}{H}$ *(ignore the speed now)*

Therefore, the unit of 1 / H must be one of time.

Calculate the value of time of the universe using your Hubble's constant.

Calculate the time in seconds, days and years.

Help:

- Do 1/your H value.
- Multiply by 3.1 x 10^{19} km

3. Maths skills needed for A level Physics

Below is also a short list of some of the main maths skills you will need for A level Physics. Complete the maths skills questions at the end of the transition questions.

- Prefixes
- Ratios
- Significant figures and rounding
- Drawing graphs and lines of best fit
- Work out gradients
- Rearranging equations
- Using Standard form

4. Cornell note taking practice on scientific journals

Complete the Cornell note taking task for 1 week of the Warwick University Monday Journal club found here:

https://warwick.ac.uk/fac/sci/physics/outreach/journalclub/

Check your answers the following week to see how you got on.

There is no marks here for how accurate your answers are, you are gaining valuable research and notetaking skills, therefore the quality of your research and notes is what is taken into account.

5. ISAACPhysics sign up and transition work

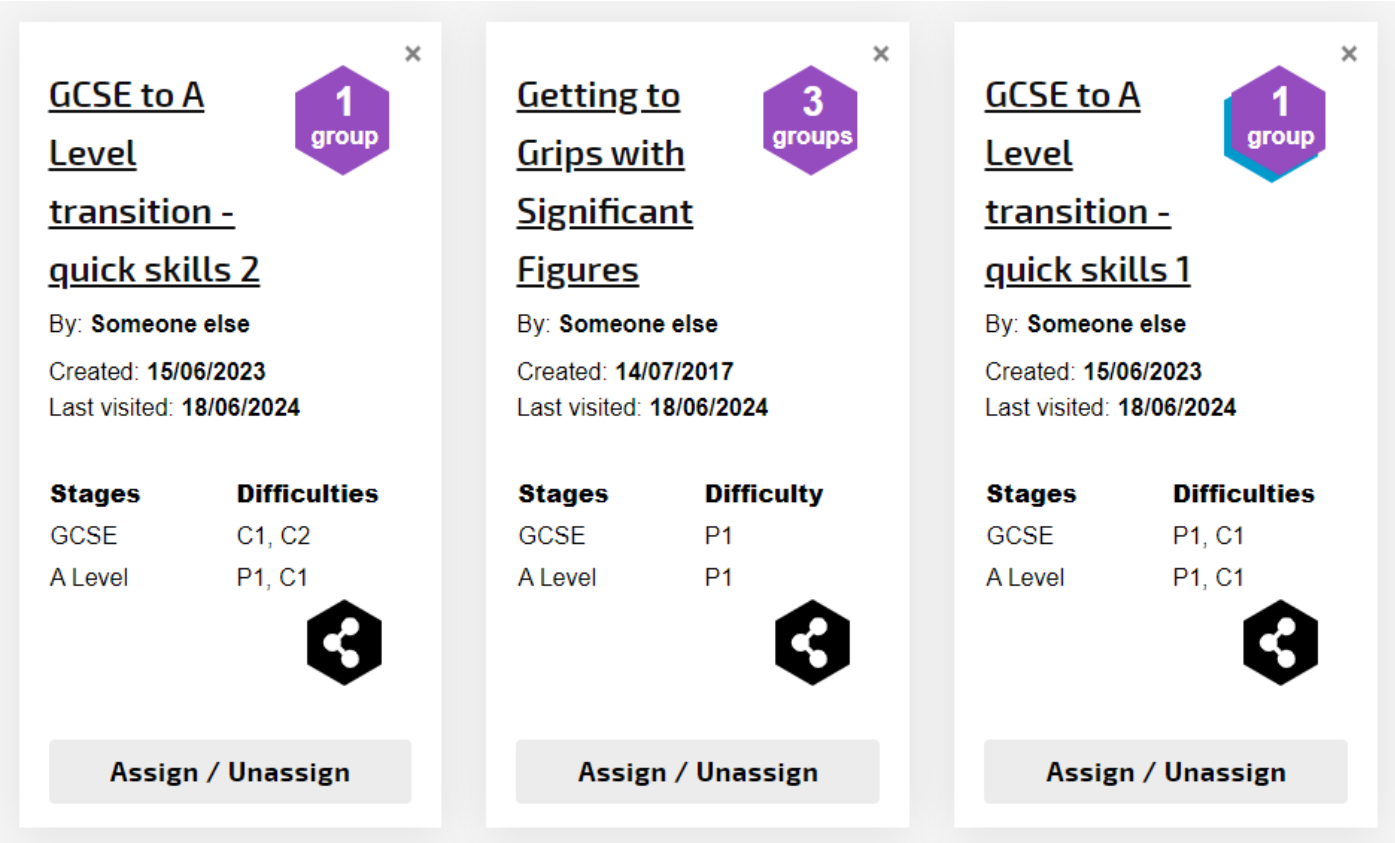
If you have yet to make an account on ISAACPhysics please do so here:

https://isaacphysics.org/login

Next, join the SVA new yr12 physics class using either the code **E63P36** or by following the link below:

https://isaacphysics.org/account?authToken=E63P36

You have been set three boards to complete as shown here:



Last of all you need to sign up to have a personal ISAACphysics mentor here:

https://isaacphysics.org/pages/mentor_scheme_y12_home?stage=a_level

Optional tasks

If you find yourself with spare time and wish to be more prepared for the upcoming A level course you can do any of the following, none of which you need to submit:

1. Work through the CGP Head start to A level physics book, currently free on Kindle.

2. Continue with the Warwick University Physics Journal club.

3. Attempt the 'Prepare for A level Physics' tasks at https://www.gcsephysicsonline.com/pre-a-level

4. Watch some physics related movies or read some physics fiction/non-fiction books and write a review. (see some recommendations below)

5. Complete any of the following course from the Open University:

    a. https://www.open.edu/openlearn/science-maths-technology/particle-physics/content-section-0?active-tab=description-tab
    b. https://www.open.edu/openlearn/science-maths-technology/mathematics-science-and-technology/content-section-overview?active-tab=content-tab
    c. https://www.open.edu/openlearn/science-maths-technology/scales-space-and-time/content-section-0?active-tab=content-tab

If you would like to know more or have any questions please talk to Mr Moore

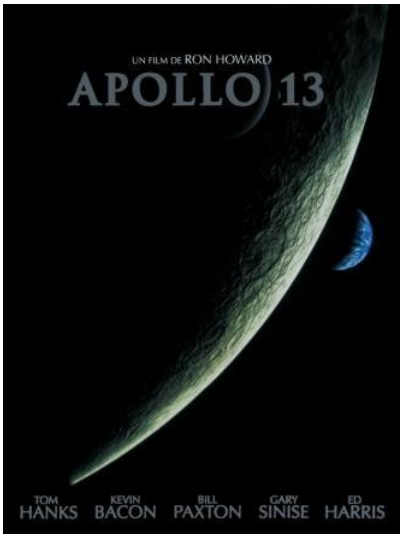
I hope you have a good break, stay safe and see you in September,

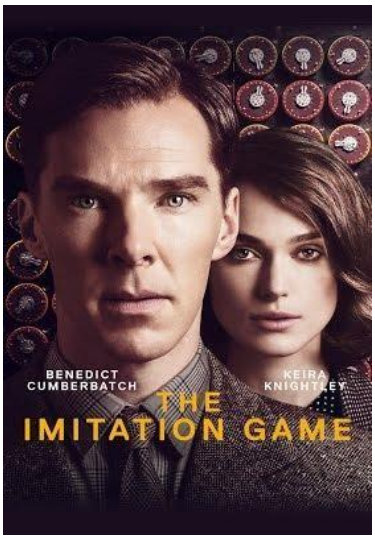
Mr. S Moore
Head of Science

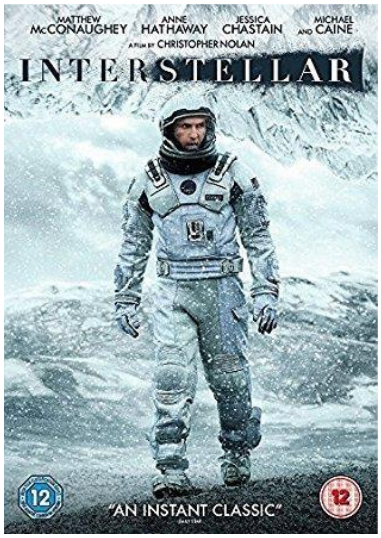
smoore@sawtryva.org

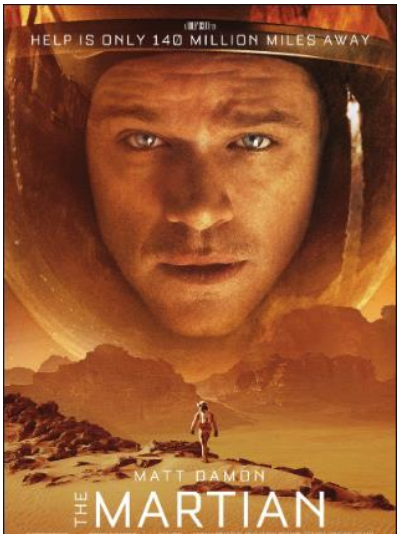
Movie Recommendations

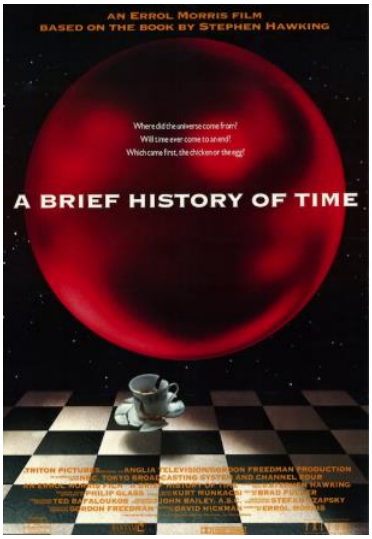
Sawtry Village Academy







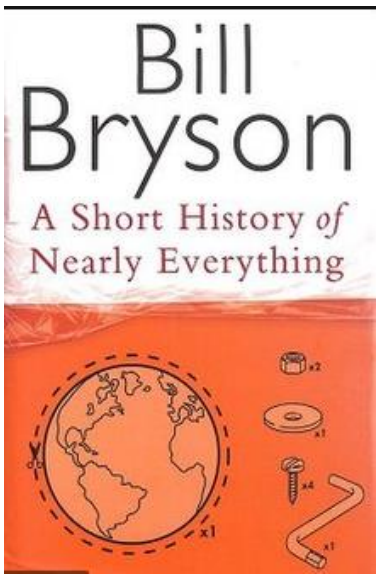


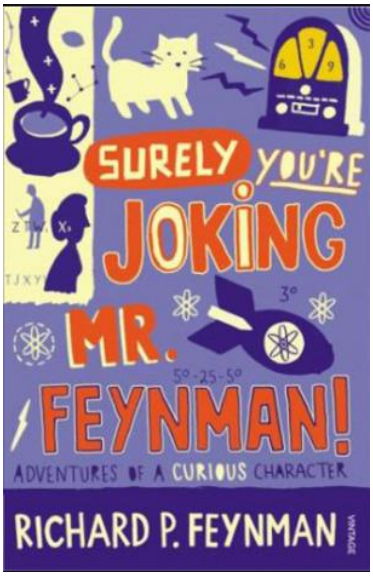


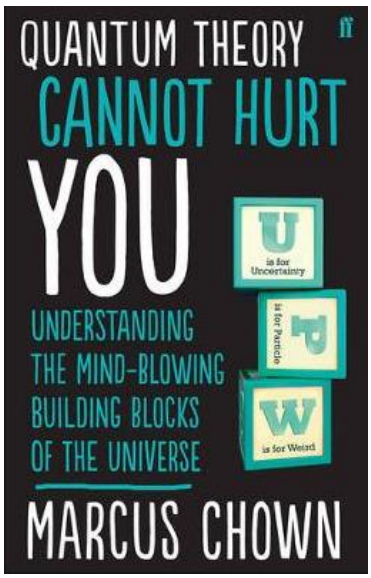
There are some great TV series and box sets available too! You might want to check out: Blue Planet, Planet Earth, Wonders of the Universe, Wonders of the Solar System, NASA TV and Shock & Awe – The Story of Electricity.

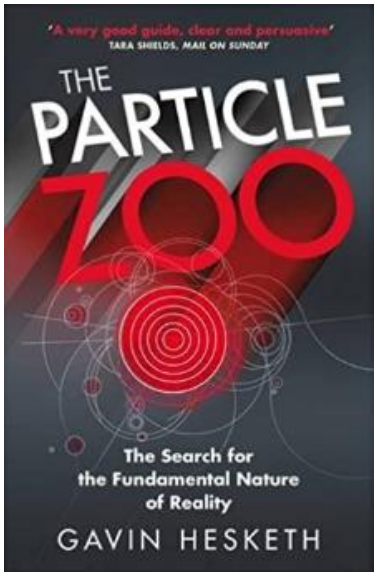
Book Recommendations

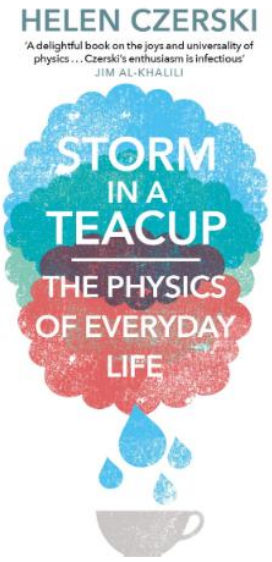
Sawtry Village Academy

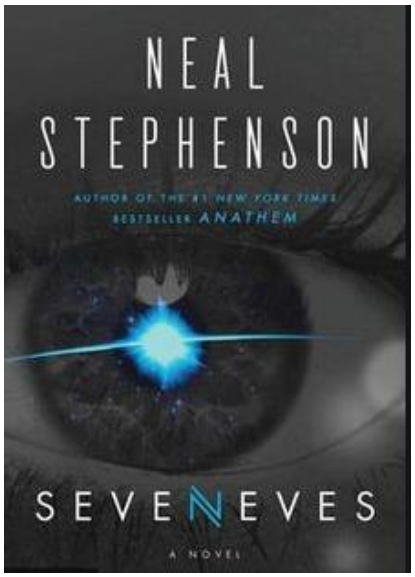


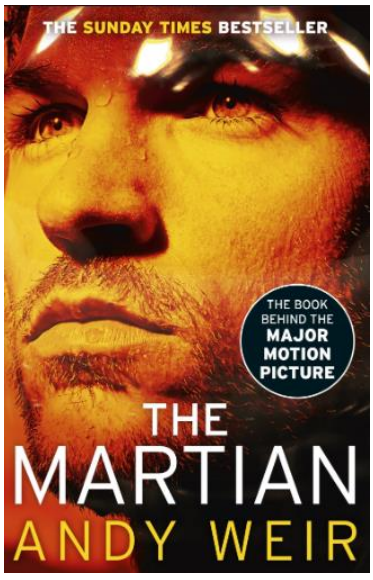


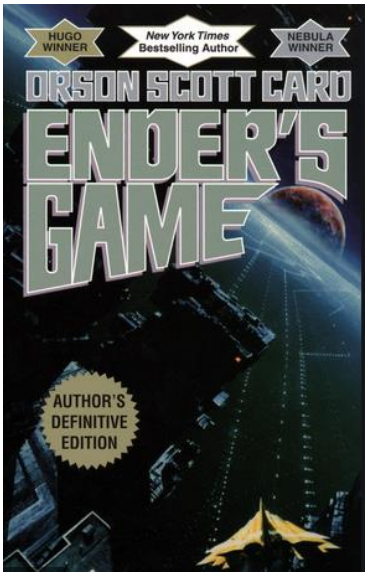


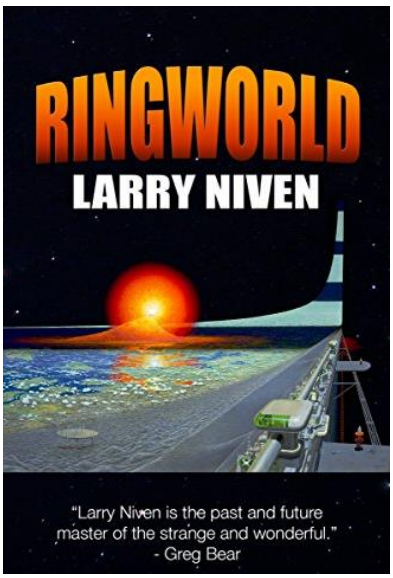












Transition Maths and Practical skills

Sawtry Village Academy

Prefixes

In Physics we have to deal with quantities from the very large to the very small. A prefix is something that goes in front of a unit and acts as a multiplier. This questions will give you practice at converting figures between prefixes.

Symbol	Name	What it means		How to convert	
P	peta	10^{15}	1000000000000000		↓ x1000
T	tera	10^{12}	1000000000000	↑ ÷ 1000	↓ x1000
G	giga	10^{9}	1000000000	↑ ÷ 1000	↓ x1000
M	mega	10^{6}	1000000	↑ ÷ 1000	↓ x1000
k	kilo	10^{3}	1000	↑ ÷ 1000	↓ x1000
			1	↑ ÷ 1000	↓ x1000
m	milli	10^{-3}	0.001	↑ ÷ 1000	↓ x1000
μ	micro	10^{-6}	0.000001	↑ ÷ 1000	↓ x1000
n	nano	10^{-9}	0.000000001	↑ ÷ 1000	↓ x1000
p	pico	10^{-12}	0.000000000001	↑ ÷ 1000	↓ x1000
f	femto	10^{-15}	0.000000000000001	↑ ÷ 1000	

Convert the figures into the prefixes required (in standard form).

s	ms	μs	ns	ps
134.6				
96.21				
0.773				

m	km	mm	Mm	Gm
12873				
0.295				
57.23				

Sawtry Village Academy

Significant figures

For each value state how many significant figures it is stated to.

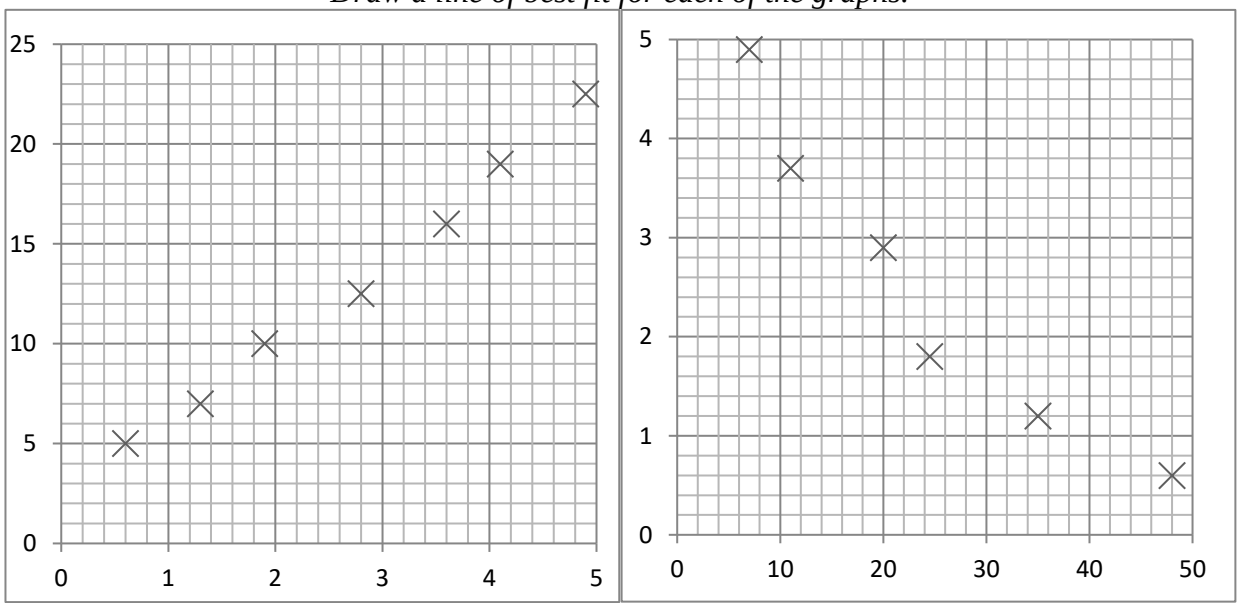
Value	Sig Figs	Value	Sig Figs	Value	Sig Figs	Value	Sig Figs
2		1066		1800.45		0.07	
2.0		82.42		2.483×10^4		69324.8	
2.00		750000		2.483		0.0063	
0.136		310		5906.4291		9.81×10^4	
0.34		3.10×10^2		200000		6717	

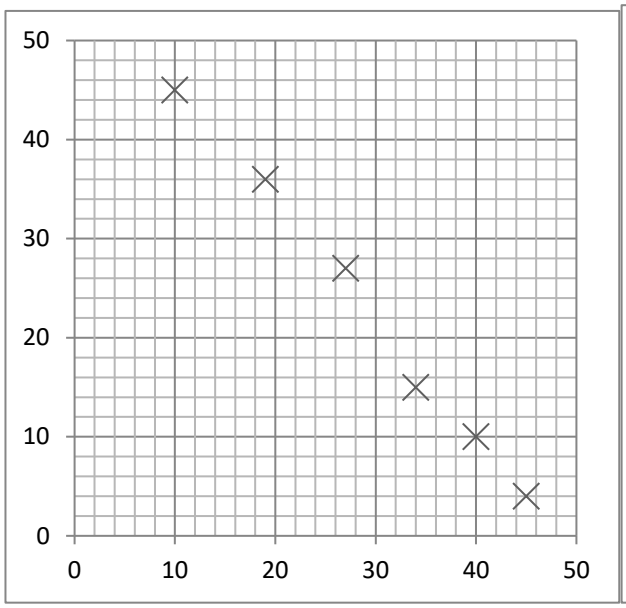
Add the values below then write the answer to the appropriate number of significant figures

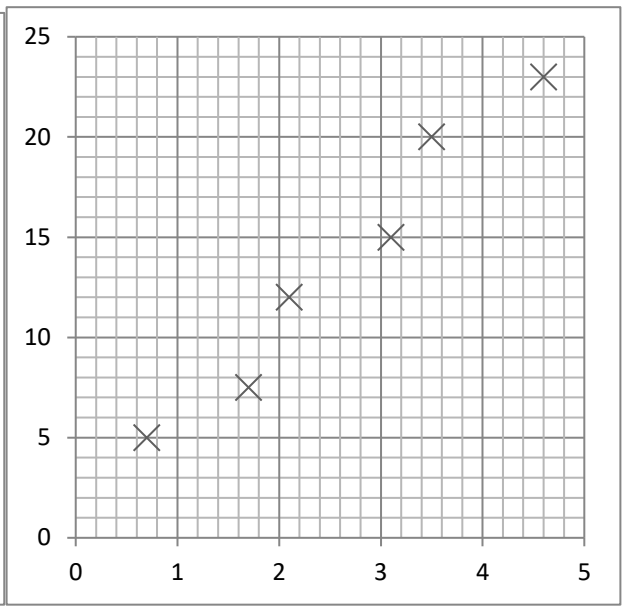
Value 1	Value 2	Value 3	Total Value	Total to correct sig figs
51.4	1.67	3.23		
7146	–32.54	12.8		
20.8	18.72	0.851		
1.4693	10.18	–1.062		

Lines of best fit

Draw a line of best fit for each of the graphs.

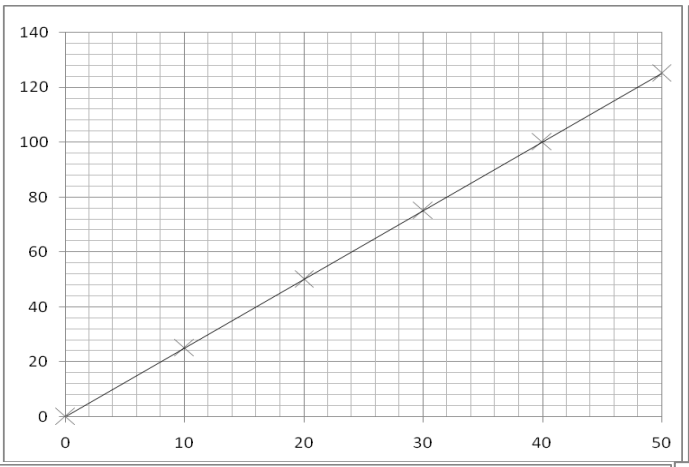


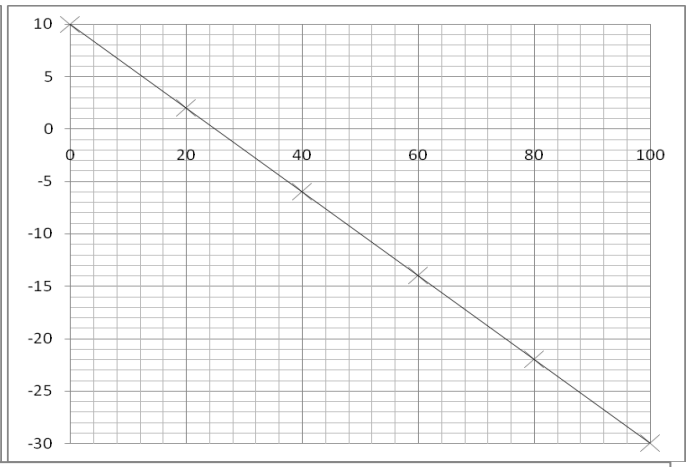


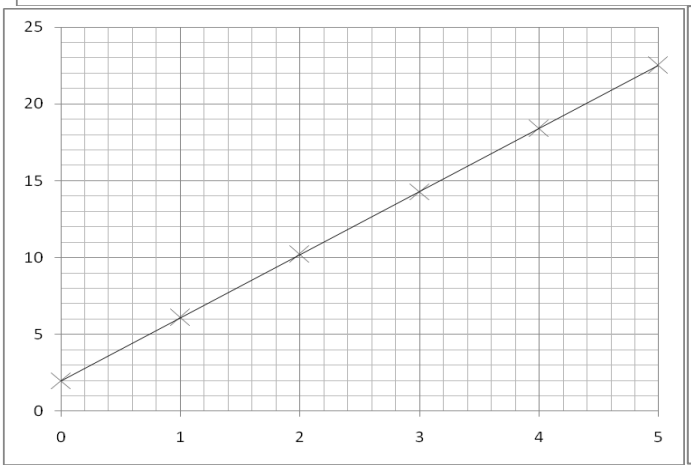


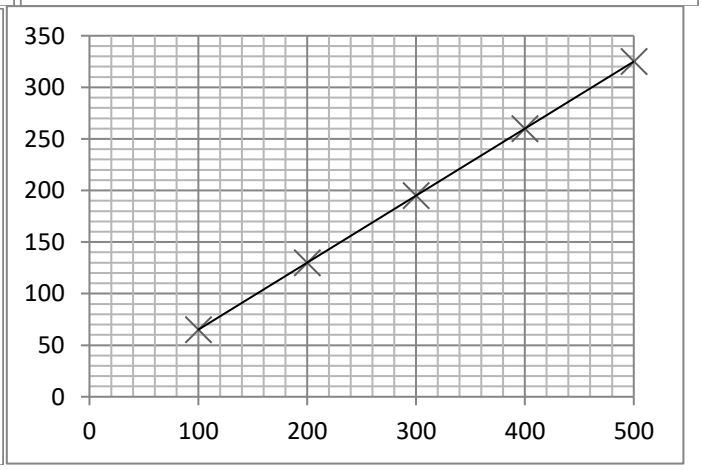
Gradients

Calculate the gradients of the graphs below = difference in y/difference in x (think about y=mx+c from maths).









Sawtry Village Academy

Vernier calipers and micrometers

State the reading on the Vernier Calipers to the left and the micrometers to the right.