A level Physics

Edexcel

Summer Transition Booklet

Dr Rahman

nra@slougheton.com

Summer Bridging Work: Physics Y11 into Y12

Welcome to A-Level Physics at Slough and Eton

This is a guide to help you get ready for A-Level Physics. 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.

Assessment

Please bring this completed booklet, textbook and equipment to your FIRST Physics lesson (this could be the first day of school). There will also be a transition test in the second week on all GCSE Physics content, Transition Booklet content and test will determine your suitability for the course.

Introduction

A-level Physics is a big step up from GCSE. In order to prepare for Physics A-level, it is vital that you have an excellent understanding of the following concepts, all of which you covered at GCSE and will study in greater depth over the first year of A-level Physics:

1. Working as a Physicist
2. Mechanics
3. Electric Circuit
4. Waves
5. Particle Nature of Light
6. Materials

To ensure you have an excellent grounding in each of these topics, please continue to review all GCSE Physics content so that you have a solid foundation to starting A-level Physics.

Task -ALL students must complete this

1. Complete the **GCSE prior knowledge quiz** for each of the sections outlined in this booklet. If there is anything you struggle with, write Cornell notes on it using this video for guidance How to make Cornell Notes (ignore AO1/2/3) and put them in your folder.
2. Read through the information provided on **building knowledge** for A-level Physics and complete the questions that follow on for each of the **sections** in this booklet. Revise the content, **answer ALL the questions**. You must **print the booklet** and bring it to your first Physics lesson.

Preparing for A-level Physics Lessons

1. Purchase **A4 lined paper** and a **A4 folder with dividers** and plastic wallets for use in Physics Only. You also should have pens, pencil, highlighters, green pen, calculator, ruler etc. Prepare to be fully equipped every lesson.
2. Purchase the following textbook: Edexcel AS/A level Physics Student Book 1, Mike Benn, George Graham. ISBN 9781471807527 **– try and buy a second-hand book**

Pre-read and make notes on the first few pages from your Edexcel Physics Book 1 Topic 1 and 2.

Activities

The next part of this workbook has a range of activities for you to have a go at. This work is designed to help prepare you for A-level physics. It covers some of the basic skills that will be used throughout the course. Many of these extend and develop ideas you will have come across at GCSE in science and maths. You will need to use a combination of careful reading, research, logic and persistence. You should expect to find some parts difficult, but if you persevere you will often find you can do them!

1. Unit Prefixes

Prefixes are written in front of units to indicate multiplication or division by multiples factors of 1000. So mega means x1,000,000. (One exception is 'centi', as in cm, which means divide by 100)

YOU MUST LEARN THE PREFIXES BY HEART AND BECOME ADEPT AT WORKING WITH THEM.

1. Complete the following table. (You will need to research some of the missing units).

Symbol		Multiplier	Which means…
	terra		
		$\times 10^{9}$	
M			× 1,000,000
k			× 1000
(None)	- - -	- - -	× 1
m			
	micro		/ 1,000,000
n			
		$\times 10^{-12}$	
f			

2. Expand each of these quantities to write out the answer in full (i.e. without the prefixes)

a) 900mV =
b) 12MJ =
c) 1.67mm =
d) 3.456kg =
e) 700nm =
f) 0.72pA =

3. Write each of the following using an appropriate prefix:

g) 0.005A =
h) 30000s =
i) 5×10^5m =
j) 1001m =
k) 0.006V =
l) 2,100,000N =

2. Units (a) The SI system of units

Look up the following terms and write a few sentences about each:

Physical Quantities	
SI Units	
Base Units	
Derived Units	

3. Maths – power of 10 and standard form (aka scientific notation)

You need to be able to use your calculator to work in standard form or use power of ten notation to replace unit suffixes.

[Tip: you should use the [x10^x] button on your calculator for entering powers of ten.]

1. Rewrite these numbers in standard form, removing any unit prefixes:

a) 3141 .....

b) .00055 .....

c) 2.0002 .....

d) 120000 *(2sf)* .....

e) 120000 *(6sf)* .....

f) 843×10^4 .....

g) 1.5 µm .....

h) 12.0×10^{-2} nm .....

i) 999 MJ .....

j) 245 mg .....

k) 16 pF .....

l) 97.237 GN .....

2. Calculate the following showing your working, giving the answers in appropriate units. (This means removing suffixes, except for grams which need to be converted to kg)

a) Area (m^2) = 120 mm × 250 mm

b) Area (m^2) = 2.4 m × 60 cm

c) Density ($kg \cdot m^{-3}$) = 48 g ⁄ 12 cm^3

d) Charge in coulombs, Q=I t
= 3.0 × kA × 20 µs

e) Speed squared, $v^2 = (16\ m \cdot s^{-1})^2$

f) Force, F = m a = 923000g × 9.8 $m \cdot s^{-2}$

4. Significant figures

Read from the left and start counting sig figs when you encounter the first non-zero digit

1. All non zero numbers are *significant* (meaning they count as sig figs)
   - 613 has three sig figs
   - 123456 has six sig figs
2. Zeros located between non-zero digits are *significant* (they count)
   - 5004 has four sig figs
   - 602 has three sig figs
   - 6000000000000002 has 16 sig figs!
3. Trailing zeros (those at the end) are *significant* only if the number contains a decimal point; otherwise they are insignificant (they **don't** count)
   - 5.640 has four sig figs
   - 120000. has six sig figs
   - 120000 has two sig figs – unless you're given additional information in the problem
4. Zeros to left of the first nonzero digit are *insignificant* (they **don't** count); they are only placeholders!
   - 0.000456 has three sig figs
   - 0.052 has two sig figs
   - 0.00000000000000000000000000000000052 also has two sig figs!

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		0.070	
2.0		82.42		2.483×10^4		69324.8	
500		750000		0.0006		0.0063	
0.136		310		5906.4291		9.81×10^4	
0.0300		3.10×10^4		200000		40000.00	
54.1		3.1×10^2		12.711		0.0004×10^4	

When adding or subtracting numbers

Round the final answer to the least precise number of decimal places in the original values.

E.g: 0.88 + 10.2 – 5.776 = 5.304 = 5.3 (to 1d.p., since 10.2 only contains 1 decimal place)
(Khan Academy- Addition/ subtraction with sig fig excellent video- make sure you watch)

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		
9.07	0.56	3.14		
739762	26017	2.058		
8.15	0.002	106		
152	0.8	0.55		

When multiplying or dividing numbers

Round the final answer to the least number of significant figures found in the initial values.

E.g. 4.02 x 3.1 / 0.114 = 109.315… = 110 (to 2s.f. as 3.1 only has 2 significant figures)

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

Value 1	Value 2	Total Value	Total to correct sig figs
0.91	1.23		
8.764	7.63		
2.6	31.7		
937	40.01		
0.722	634.23		

When calculating a mean

1) Remove any obvious anomalies (circle these in the table)

2) Calculate the mean with the remaining values, and record this to the least number of decimal places in the included values

E.g. Average 8.0, 10.00 and 145.60:

1) Remove 145.60

2) The average of 8.0 and 10.00 is 9.0 (to 1 d.p.)

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

Value 1	Value 2	Value 3	Mean Value	Mean to correct sig figs
1	1	2		
435	299	437		
5.00	6.0	29.50		
5.038	4.925	4.900		
720.00	728.0	725		
0.00040	0.00039	0.000380		
31	30.314	29.7		

5. Rearranging Equations

Rearrange these equations to express them in the terms that follow:

1. $v = x / t$ **a.** $x = ?$ **b.** $t = ?$

2. $F = m\,a$ **a.** $m = ?$ **b.** $a = ?$

3. $a = (v - u) / t$ **a.** $t = ?$ **b.** $v = ?$ **c.** $u = ?$

4. $v^2 = u^2 + 2as$ **a.** $v = ?$ **b.** $a = ?$ **c.** $u = ?$

5. $s = ut + \frac{1}{2} a t^2$ **a.** $u = ?$ **b.** $a = ?$ **c.** $t = ?$

6. $\frac{1}{R_{tot}} = \frac{1}{R_1} + \frac{1}{R_2}$ **a.** $R_{tot} = ?$ **a.** $R_1 = ?$

6. Trigonometry

Trigonometry is a huge part of A-level Physics, but it becomes easy after plenty of practice.

Let's practice so we have the basics.

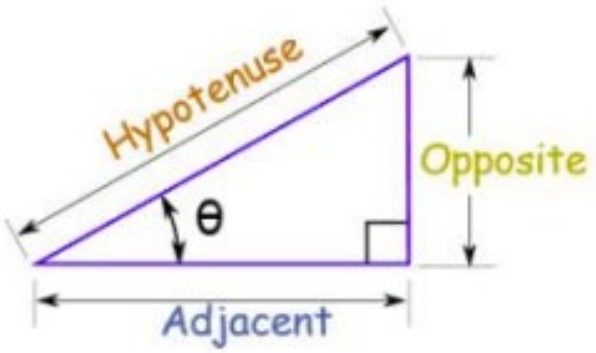
Watch the following videos:

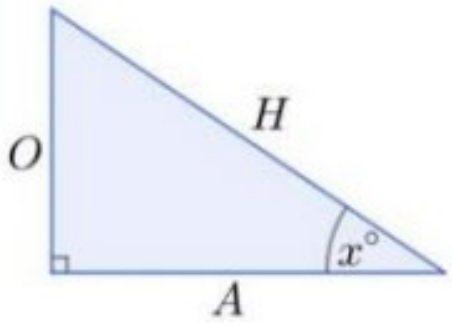
https://www.youtube.com/watch?v=q9ILOIyPmC8

https://www.youtube.com/watch?v=z925v3v9Va4

Finding angle using arc sin and arc cosine

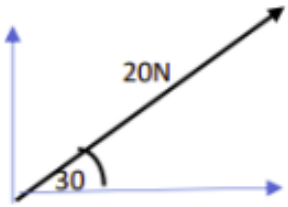
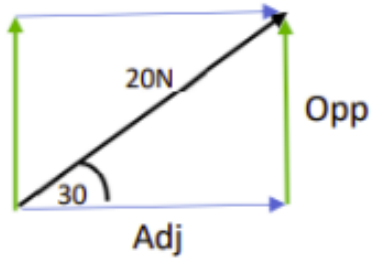
https://www.youtube.com/watch?v=RWyY3n9nTf8





Using trigonometry, resolve these forces into horizontal and vertical components.

Worked example: A force of 20 N at 30° to the horizontal

	Draw it out
	Label your opposiste and adjacent (The green and blue arrow on the same length) To calculate the opposite you will use sine Sin(30) x 20 = 10N To calculate the adjacent you will use cosine Cos(30) x 20 = 17.3N

TRY IT YOURSELF

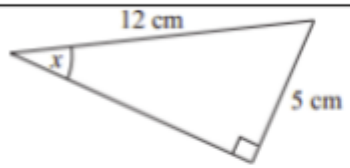
1. A force of 40 N at 35° to the horizontal.

2. A force of 80 N at 75° to the horizontal.

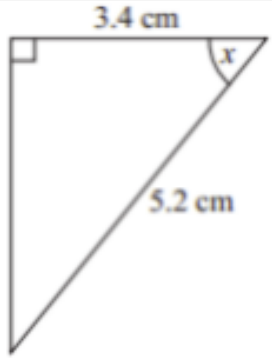
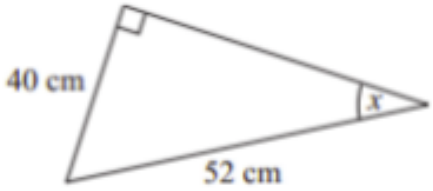
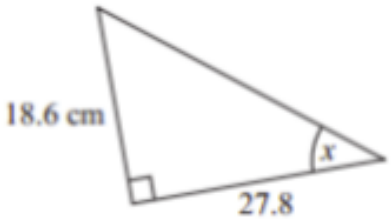
3. A velocity of 30 ms^{-1} at 25° to the horizontal.

Calculating angles:

Example:

	1) Identify the sides you have – Opposite and Hypothenuse 2) Select the funtion that has both of these – Sine 3) Sin(θ) = Opp / Hyp 4) However you're looking for the angle so it becomes: $Sin^{-1}(opp/hyp)$ $Sin^{-1}(5 / 12)$ = 24.6°

TRY IT YOURSELF

7. Show your working clearly

When answering physics questions you need to lay out your working clearly showing all the steps, working left to right and top to bottom. Your final answer should be found to the bottom right of your working and should be underlined. Below is an example for you to base your own answer style on.

Ch6, Q4

A white snooker ball with a kinetic energy of 15J collides with a red ball. On impact the white ball stops, transferring all of its KE to the red ball. The mass of the red ball is 120 g. What would be the velocity of the red ball immediately following the collision?

STEPS:
C – Convert the units
E – Equation being used
R – Rearrange
N – Numbers inserted
A – Answer calculated
U – Units
S – Sig. Fig.

Convert: g into kg → 120 g = 0.12 kg

Equation: $\frac{1}{2}mv^2$

Rearrange: Make velocity as a subject;

$$v^2 = \frac{2KE}{m}$$

$$v = \sqrt{\frac{2KE}{m}}$$

Number: $v = \sqrt{\frac{2x15}{0.12}}$

Answer and **U**nit: v = 15.8 ms^{-1}

Sig. Fig: 16 ms^{-1} (2s.f)

EIGHT STEPS TO IMPROVE THE QUALITY OF YOUR WORKING

- ☐ Show all steps
- ☐ Work left to right and top to bottom
- ☐ Rearrange equations before substituting values
- ☐ If a calculation is two step, underline the answer to the first step before proceeding as this may get marks
- ☐ Your writing should be small and neat. Don't scrawl.
- ☐ You should be able to easily check over your working to find mistakes
- ☐ Plan to use the available answer space wisely
- ☐ Try to leave space for correcting mistakes if you go wrong

8. KS4 REVISION AND EXTENSION

Energy and Power

Look up definitions for each of the following quantities and write down the equations and any notes you think are helpful

Work

Kinetic Energy

Gravitational Energy

Elastic Potential Energy

Efficiency

Power (including electrical power)

Power Questions

1) What is the defintion of power?

.....

.....(2)

2) Which of the following are units of power? (circle all of the correct units)

joule second watt joule second -1 newton metre second-1 amp volt (2)

Explain why power is equal to force × velocity

.....

.....

.....(2)

Explain why power is equal to current × potential difference

.....

.....

..... (2)

3i) In two minutes a rocket gained 370 MJ of kinetic energy and 1300 MJ of gravitational potential energy.

.....

.....Power = W (2)

3ii) In the following 30 seconds the rocket travels at a steady speed of 320 ms^{-1}. Assuming the power of the engines to be constant, calculate the thrust force produced by the engines. (Use P = F x v)

.....

.....Force = N (2)

Speed and acceleration questions

1. A bullet travels 300m in 2.60 seconds what is its velocity in (a) m s^{-1} (b) km h^{-1} ?

.....

.....

.....

2. An alpha particle covers 2.0 cm travelling at 5% the speed of light (speed of light=3.0 x10^8 m s^{-1}). How long does it take to cover this distance?

.....

.....

.....

3. A cyclist is racing on a circular track at an average speed of 8.35 m s^{-1}. She completes three laps in 2 minutes 24.36 seconds. What is the radius of the track?

.....

.....

.....

4. A light-year is the distance light travels in one year. Calculate this distance in metres to 3 significant figures, given that the speed of light is 3.00 × 10^8 m s^{-1}.

.....

.....

.....

5. A horse is cantering at 3.1 m s^{-1} and breaks into a gallop reaching a speed of 5.6 m s-1 in 3.5 seconds. Calculate its acceleration.

.....

.....

.....

6. A car travelling at 16.0 m s-1, brakes for 3.20 s, decelerating at a rate of 3.125 m s-2. What is its final speed?

.....

.....

.....

7. An Olympic diver strikes the water at a speed of 7.2 m s^{-1}, and comes to rest in 1.2 seconds. What is his acceleration?

.....

.....

.....

8. A falling ball strikes a floor with a velocity of 4.2 m s^{-1} and rebounds with a velocity of -3.8 m s^{-1}. It is in contact with the floor for 0.12 seconds. What was its acceleration?

.....

.....

.....