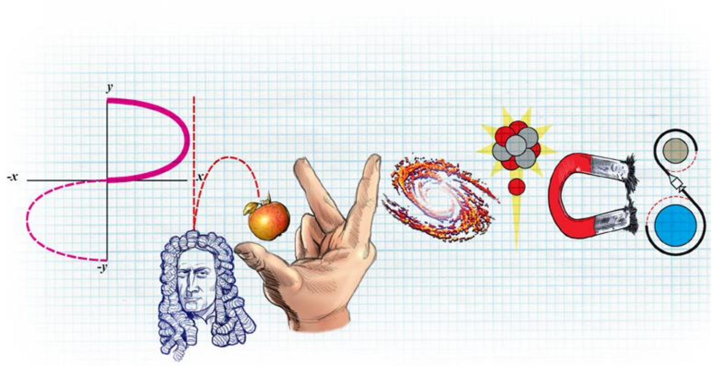
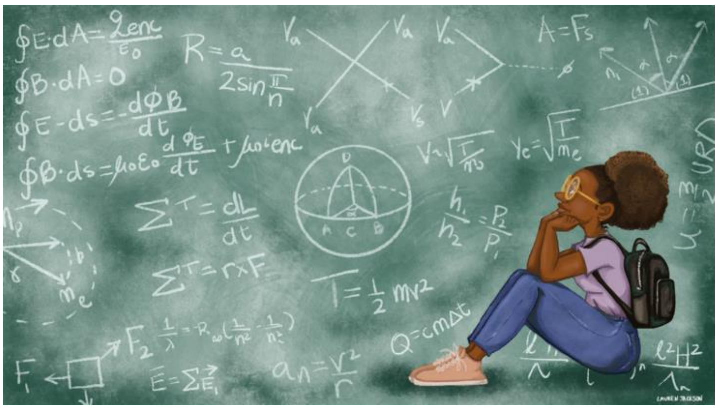
The Friary Sixth Form





Physics Bridging Pack 2025

Course Expectations

As part of your AS/A Level studies you will have nine hours of timetabled lessons across the school's two week timetable. In these lessons you will cover all the theory and practical work required for the course.

To support your learning you will be provided with a textbook for the current AS/A Level course. Your teachers are, of course, an excellent source of support both in and out of lessons. Additional texts are available in the school library and a full copy of the specification, past papers etc. can be accessed via the AQA website.

Equipment

Pen

Pencil

Ruler

Pencil Sharpener

Rubber

Calculator

Highlighters

Protractor

Ruler

Folder with dividers

Teachers

Mr D. Brown (dbrown@friaryschool.co.uk)

Mrs J. Williamson (jwilliamson@friaryschool.co.uk)

Miss W Dransfield-Scott (wdransfieldscott@friaryschool.co.uk)

Course Overview

1. **Outline of Course Specification**

AQA A level Physics

- 1 Measurements and their errors
- 2 Particles and radiation
- 3 Waves
- 4 Mechanics and materials
- 5 Electricity
- 6 Further mechanics and thermal physics
- 7 Fields and their consequences
- 8 Nuclear physics
- 9 Astrophysics

Link to full specification: https://filestore.aqa.org.uk/resources/physics/specifications/AQA-7407-7408-SP-2015.PDF

Tasks

TASK A - Pre-knowledge Topics – Suggested work time – 3 to 4 hours

Below are ten topics that are essential foundations for you study of A-Level Physics. Each topics has example questions and links where you can find our more information as you prepare for next year.

Symbols and Prefixes

Prefix	Symbol	Power of ten
Nano	**n**	**x 10^{-9}**
Micro	**μ**	**x 10^{-6}**
Milli	**m**	**x 10^{-3}**
Centi	**c**	**x 10^{-2}**
Kilo	**k**	**x 10^{3}**
Mega	**M**	**x 10^{6}**
Giga	**G**	**x 10^{9}**

At A level, unlike GCSE, you need to remember all symbols, units and prefixes. Below is a list of quantities you may have already come across and will be using during your A level course

Quantity	Symbol	Unit
Velocity	v	ms^{-1}
Acceleration	a	ms^{-2}
Time	t	S
Force	F	N
Resistance	R	Ω
Potential difference	V	V
Current	I	A
Energy	E or W	J
Pressure	P	Pa
Momentum	p	$kgms^{-1}$
Power	P	W
Density	ρ	kgm^{-3}
Charge	Q	C

Solve the following:

1. How many metres in 2.4 km?
2. How many joules in 8.1 MJ?
3. Convert 326 GW into W.
4. Convert 54 600 mm into m.
5. How many grams in 240 kg?
6. Convert 0.18 nm into m.
7. Convert 632 nm into m. Express in standard form.
8. Convert 1002 mV into V. Express in standard form.
9. How many eV in 0.511 MeV? Express in standard form.
10. How many m in 11 km? Express in standard form.

Standard Form

At A level quantity will be written in standard form, and it is expected that your answers will be too.

This means answers should be written as ….x 10^y. E.g. for an answer of 1200kg we would write 1.2 x 10^3kg.

1. Write 2530 in standard form.
2. Write 280 in standard form.
3. Write 0.77 in standard form.
4. Write 0.0091 in standard form.
5. Write 1 872 000 in standard form.
6. Write 12.2 in standard form.
7. Write 2.4 x 10^{2} as a normal number.
8. Write 3.505 x 10^{1} as a normal number.
9. Write 8.31 x 10^{6} as a normal number.
10. Write 6.002 x 10^{2} as a normal number.
11. Write 1.5 x 10^{-4} as a normal number.
12. Write 4.3 x 10^3 as a normal number.

Rearranging formulae

This is something you will have done at GCSE and it is crucial you master it for success at A level. For a recap of GCSE watch the following links:

www.khanacademy.org/math/algebra/one-variable-linear-equations/old-school-equations/v/solving-for-a-variable

www.youtube.com/watch?v=_WWgc3ABSj4

Rearrange the following:

1. E=m x g x h to find h
2. Q= I x t to find I
3. E = ½ m v^2 to find m
4. E = ½ m v^2 to find v
5. v = u + at to find u
6. v = u + at to find a
7. v^2 = u^2 +2as to find s
8. v^2 = u^2 +2as to find u

Significant figures

At A level you will be expected to use an appropriate number of significant figures in your answers. The number of significant figures you should use is the same as the number of significant figures in the data you are given. You can never be more precise than the data you are given so if that is given to 3 significant your answer should be too. E.g. Distance = 8.24m, time = 1.23s therefore speed = 6.75m/s

The website below summarises the rules and how to round correctly.

http://www.purplemath.com/modules/rounding2.htm

Give the following to 3 significant figures:

1. 3.4527

2. 40.691

3. 0.838991

4. 1.0247

5. 59.972

Calculate the following to a suitable number of significant figures:

6. 63.2/78.1

7. 39+78+120

8. (3.4+3.7+3.2)/3

9. 0.0256 x 0.129

10. 592.3/0.1772

Atomic Structure

You will study nuclear decay in more detail at A level covering the topics of radioactivity and particle physics. In order to explain what happens you need to have a good understanding of the model of the atom. You need to know what the atom is made up of, relative charges and masses and how sub atomic particles are arranged.

The following video explains how the current model was discovered www.youtube.com/watch?v=wzALbzTdnc8

Describe the model used for the structure of an atom including details of the individual particles that make up an atom and the relative charges and masses of these particles. You may wish to include a diagram and explain how this model was discovered by Rutherford

Recording Data

Whilst carrying out a practical activity you need to write all your raw results into a table. Don't wait until the end, discard anomalies and then write it up in neat.

Tables should have column heading and units in this format quantity/unit e.g. length /mm

All results in a column should have the same precision and if you have repeated the experiment you should calculate a mean to the same precision as the data.

Below are link to practical handbooks so you can familiarise yourself with expectations.

http://filestore.aqa.org.uk/resources/physics/AQA-7407-7408-PHBK.PDF

Below is a table of results from an experiment where a ball was rolled down a ramp of different lengths. A ruler and stop clock were used.

1) Identify the errors the student has made.

	Time			
Length/cm	**Trial 1**	**Trial 2**	**Trial 3**	**Mean**
10	**1.45**	**1.48**	**1.46**	**1.463**
22	**2.78**	**2.72**	**2.74**	**2.747**
30	**4.05**	**4.01**	**4.03**	**4.03**
41	**5.46**	**5.47**	**5.46**	**5.463**
51	**7.02**	**6.96**	**6.98**	**6.98**
65	**8.24**	**9.68**	**8.24**	**8.72**
70	**9.01**	**9.02**	**9.0**	**9.01**

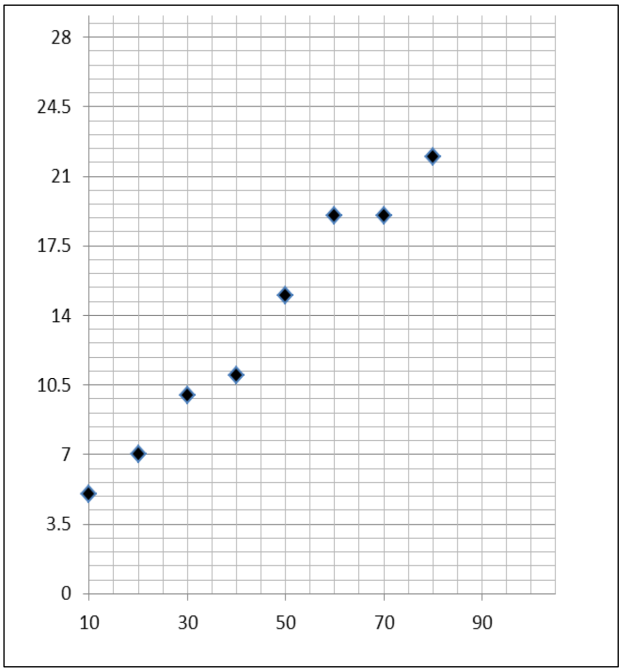
Graphs

After a practical activity the next step is to draw a graph that will be useful to you. Drawing a graph is a skill you should be familiar with already but you need to be extremely vigilant at A level. Before you draw your graph to need to identify a suitable scale to draw taking the following into consideration:

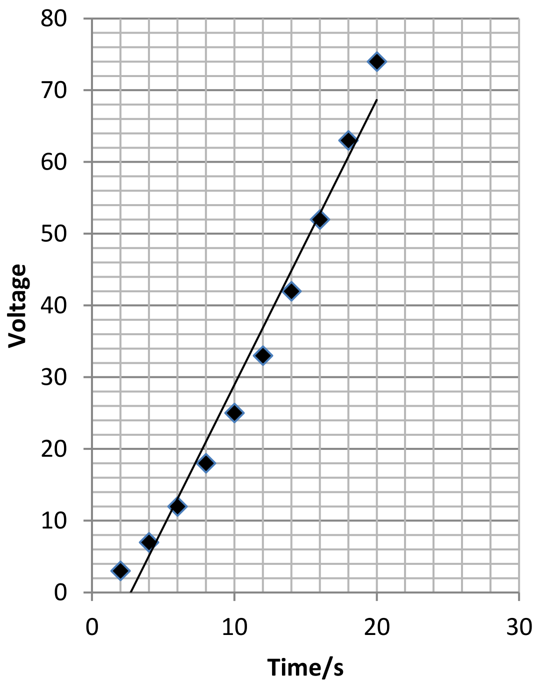
- the maximum and minimum values of each variable
- whether 0.0 should be included as a data point; graphs don't need to show the origin, a false origin can be used if your data doesn't start near zero.
- the plots should cover at least half of the grid supplied for the graph.
- the axes should use a sensible scale e.g. multiples of 1,2, 5 etc)

Identify how the following graphs could be improved

Graph 1



Graph 2



Forces and Motion

At GCSE you studied forces and motion and at A level you will explore this topic in more detail so it is essential you have a good understanding of the content covered at GCSE. You will be expected to describe, explain and carry calculations concerning the motion of objects. The website below cover Newton's laws of motion and have links to these in action.

http://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws

Sketch a velocity-time graph showing the journey of a skydiver after leaving the plane to reaching the ground.

Mark on terminal velocity.

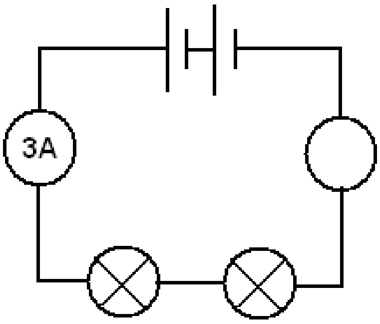
Electricity

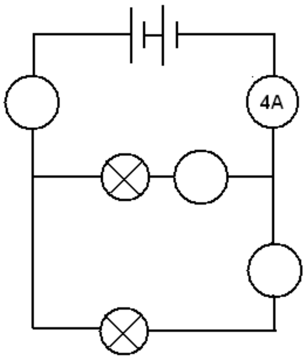
At A level you will learn more about how current and voltage behave in different circuits containing different components. You should be familiar with current and voltage rules in a series and parallel circuit as well as calculating the resistance of a device.

http://www.allaboutcircuits.com/textbook/direct-current/chpt-1/electric-circuits/

http://www.physicsclassroom.com/class/circuits

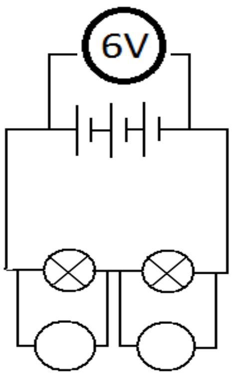
1a) Add the missing ammeter readings on the circuits below.

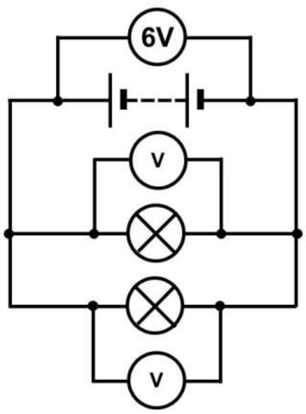




b) Explain why the second circuit has more current flowing than the first.

2) Add the missing potential differences to the following circuits





Waves

You have studied different types of waves and used the wave equation to calculate speed, frequency and wavelength. You will also have studied reflection and refraction.

Use the following links to review this topic.

https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/mechanical-waves/v/introduction-to-waves

https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/mechanical-waves/v/introduction-to-waves

1) Draw and fully label a diagram showing the refraction of a wave through a rectangular glass block. Explain why the ray of light takes this path.

2) Describe the difference between a longitudinal and transverse waves and give an example of each.

3) Draw a wave and label the wavelength and amplitude

TASK B - Use the knowledge from Task A to compete this assessment

Time Allowed – 1 hour

A Level Physics Transition Baseline Assessment

40 Marks – 40 Minutes

A single piece of graph paper is required for the completion of the assessment.

You may use a calculator.

Question Number	Topic	Score
1	Symbols and Prefixes	/3
2	Standard Form	/4
3	Re-arranging Equations	/3
4	Atomic Structure	/3
5	Recording Data	/3
6	Graphing	/4
7	Forces and Motion	/10
8	Electrical Circuits	/5
9	Waves	/5
		Total /40

Q1 Complete the following table:

Unit prefix	Meaning
k (kilo)	x 1000
	X 0.000001
M (mega)	
N (nano)	

[3]

Q2

a) Write the following numbers into standard form.

i. 0.012

ii. 120000

iii. 0.00000012

[3]

b) Complete the following calculations and right your answers to an appropriate number of significant figures.

i. 2.1 X 0.15

ii. 0.345 ÷ 0.114

[4]

Q3 Re-arrange the following equations to make R the subject of the equation.

a) $\boldsymbol{Q = WERTY}$

b) $\boldsymbol{Q^2 = WR^2}$

c) $\boldsymbol{Q = W - RT^2}$

[3]

Q4 Name the 3 particles (from GCSE) that make up an atom.

.... **[1]**

a) Which one of the above particles is not found in the nucleus of an atom?

.... **[1]**

b) Which of the above particles will be found in varying quantities in the nuclei of isotopes of the same element?

.... **[1]**

Q5

a) Complete the following table

Voltage (__)	__________ (A)		
	Repeat 1	Repeat 2	Average
2	0.23	0.26	0.25
4	0.46	0.53	
6	0.69	0.78	0.74
8	0.92	1.04	0.98
10	1.15	1.30	1.23

[3]

Q6

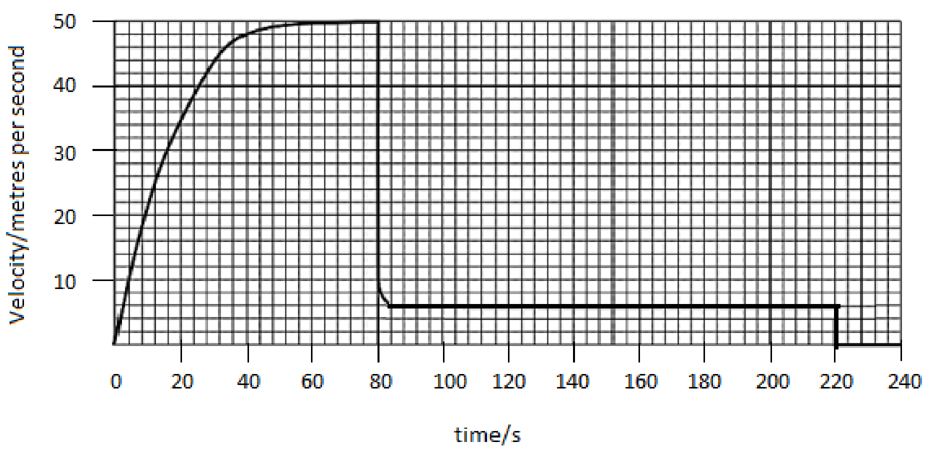
a) Use your piece of graph paper to plot a graph of Current (x-axis) against Voltage (y-axis) drawing a line of best fit through your data points.

[4]

b) Find the gradient of your line of best fit

[3]

Q7 The graph below shows the journey of a skydiver after they have left the plane.



a) Explain the shape of the graph commenting on how and why the forces have changed.

[6]

b) Calculate the distance travelled whilst at the second terminal velocity.

[2]

c) Calculate the **average** acceleration in the first 20 seconds.

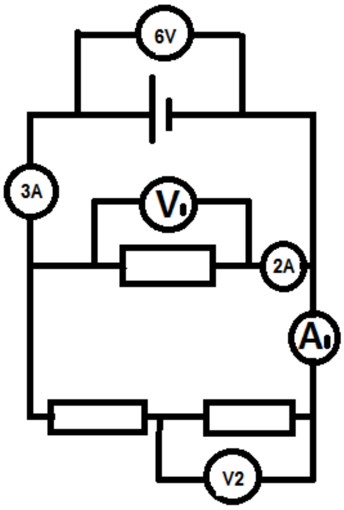
[2]

Q8

a) Draw a circuit diagram to show how the resistance of a filament bulb could be measured using an ammeter and a voltmeter.

[2]

b) Look at the circuit diagram below. All of the resistors are identical.

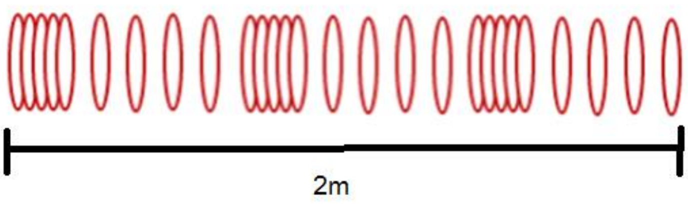


Write the missing values of current and potential difference:

i. V1 =
ii. V2 =
iii. A1 =

[3]

Q9 The diagram below shows a diagram of 3 complete longitudinal wave oscillations on a slinky:



a) State the wavelength of the wave shown

…… **[1]**

b) Label a complete wavelength on the diagram above with the correct symbol used for wavelength in GCSE and A Level Physics

[1]

c) If the above wave had a frequency of 5Hz how long would it take an individual hoop to complete 1 full oscillation?

[1]

d) Calculate the speed of the wave

$$\boldsymbol{wavespeed = frequency \times wavelength}$$

Wave speed = _____________ Unit _______[2]

TASK C - Research Activity – Suggested Work Time – 2 to 3 hours

To get the best grades in A Level Physics you will have to get good at completing independent research and making your own notes on difficult topics. Below are links to 5 websites that cover some interesting Physics topics.

Using the Cornell notes system: http://coe.jmu.edu/learningtoolbox/cornellnotes.html make 1 page of notes **from 3 sites only** covering a topic of your choice.

a) http://home.cern/about
   CERN encompasses the Large Hadron Collider (LHC) and is the largest collaborative science experiment ever undertaken. Find out about it here and make a page of suitable notes on the accelerator.
b) http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html
   The solar system is massive and its scale is hard to comprehend. Have a look at this award winning website and make a page of suitable notes.
c) https://phet.colorado.edu/en/simulations/category/html
   PhET create online Physics simulations when you can complete some simple experiments online. Open up the resistance of a wire html5 simulation. Conduct a simple experiment and make a one page summary of the experiment and your findings.
d) http://climate.nasa.gov/
   NASA's Jet Propulsion Laboratory has lots of information on Climate Change and Engineering Solutions to combat it. Have a look and make notes on an article of your choice.
e) http://www.livescience.com/46558-laws-of-motion.html
   Newton's Laws of Motion are fundamental laws for the motion of all the object we can see around us. Use this website and the suggested further reading links on the webpage to make your own 1 page of notes on the topics.

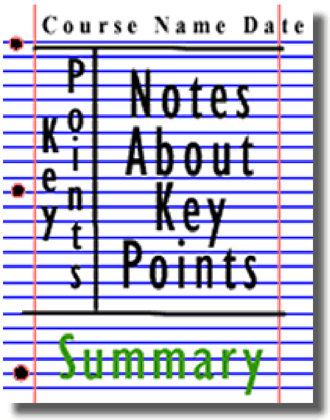


Figure 1: *http://coe.jmu.edu/learningtoolbox/images/noteb4.gif*

TASK D - A Level Exam Question Taster – Suggested Work Time – 2 to 3 hours

Your task is to rise to the challenge of tackling some real past A Level exam questions. Some parts of the questions are linked to GCSE knowledge but you will need to do some extra research to answer other parts. Good luck!

Q1.

A deuterium nucleus and a tritium nucleus fuse together to produce a helium nucleus and particle **X**.

$$^{2}_{1}\text{H} + ^{3}_{1}\text{H} \rightarrow ^{4}_{2}\text{He} + \textbf{X}$$

What is **X**?

A an electron ⬭

B a neutron ⬭

C a positron ⬭

D a proton ⬭

(Total 1 mark)

Q2.

The radioactive nuclide $^{232}_{90}\text{Th}$ decays by one α emission followed by two β^- emissions.

Which nuclide is formed as a result of these decays?

A $^{238}_{92}\text{U}$ ⬭

B $^{230}_{90}\text{Th}$ ⬭

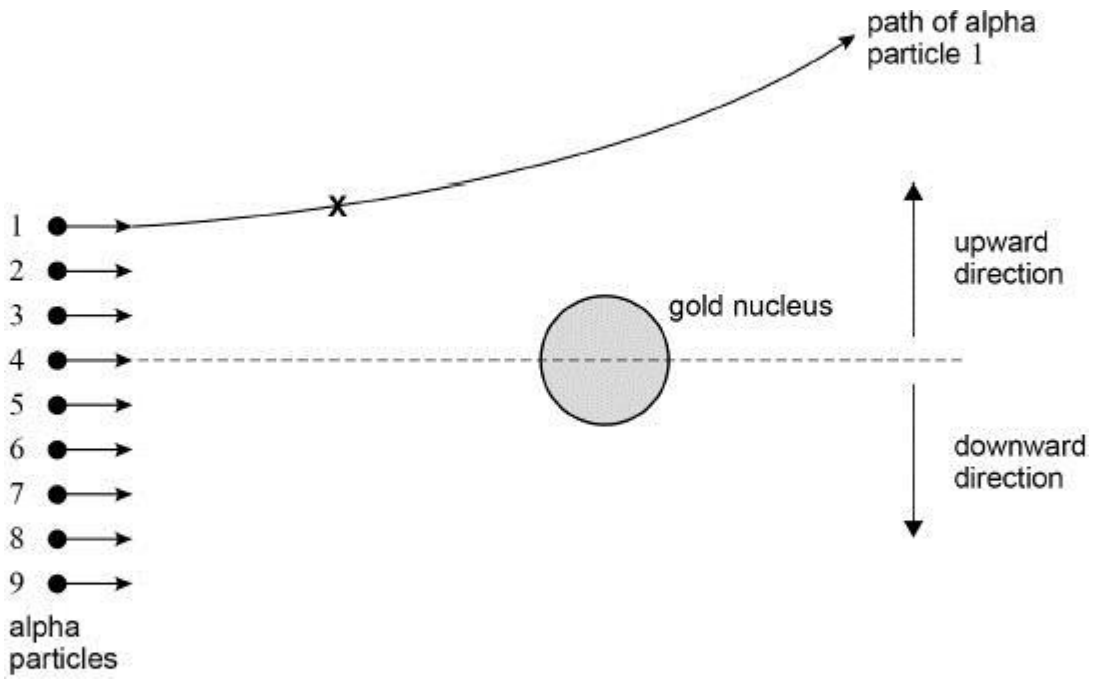
C $^{228}_{90}\text{Th}$ ⬭

D $^{228}_{88}\text{Rn}$ ⬭

(Total 1 mark)

Q3.

The diagram shows alpha particles all travelling in the same direction at the same speed. The alpha particles are scattered by a gold ($^{197}_{79}\text{Au}$) nucleus.
The path of alpha particle **1** is shown.



(a) State the fundamental force involved when alpha particle **1** is scattered by the nucleus in the diagram.

____

(1)

(b) Draw an arrow at position **X** on the diagram above to show the direction of the rate of change in momentum of alpha particle **1**

(1)

(c) Suggest **one** of the alpha particles in the diagram above which may be deflected downwards with a scattering angle of 90°

Justify your answer.

alpha particle number = _______________

____

____

____

____

(2)

Q4.

Which row gives a particle with its quark combination and category?

	Particle	Quark combination	Category	
A	Negative pion	$d\bar{u}$	baryon	⬭
B	Positive pion	$u\bar{d}$	hadron	⬭

C	Negative pion	$u\bar{d}$	meson	⬭
D	Positive pion	$d\bar{u}$	hadron	⬭

(Total 1 mark)

Q5.

A filament lamp with resistance 12 Ω is operated at a power of 36 W.

How much charge flows through the filament lamp during 15 minutes?

A 26 C ⬭

B 1.6 kC ⬭

C 2.7 kC ⬭

D 6.5 kC ⬭

(Total 1 mark)

Q6.

Which is equivalent to the ohm?

A $J\ C^{-2}\ s^{-1}$ ⬭

B $J\ C^{-2}\ s$ ⬭

C J s ⬭

D $J\ s^{-1}$ ⬭

(Total 1 mark)

Q7.

A gas containing doubly-charged ions flows to give an electric current of 0.64 A

How many ions pass a point in 1.0 minute?

A 2.0×10^{18} ⬭

B 4.0×10^{18} ⬭

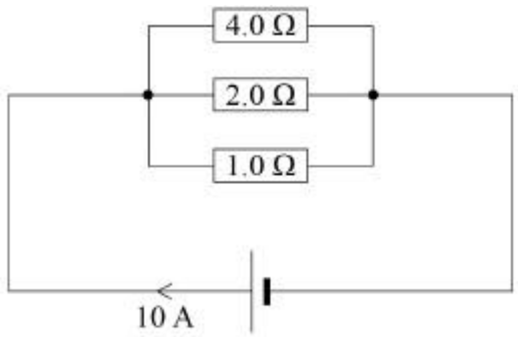
C 1.2×10^{20} ⬭

D 2.4×10^{20} ⬭

(Total 1 mark)

Q8.

The current in the cell is 10 A as shown.



What is the current in the 2.0 Ω resistor?

A 0.35 A

B 2.86 A

C 3.50 A

D 7.14 A

(Total 1 mark)

Q9.

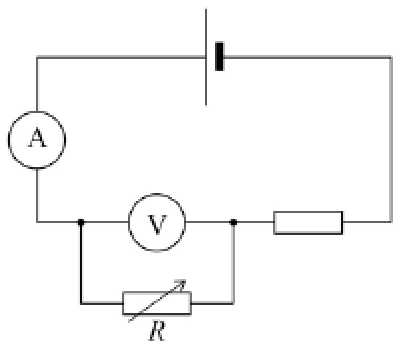
The units of physical quantities can be expressed in terms of the fundamental (base) units of the SI system. In which line in the table are the fundamental units correctly matched to the physical quantity?

	Physical quantity	**Fundamental units**	
A	charge	A s^{-1}	
B	power	kg m^2 s^{-3}	
C	potential difference	kg m^2 s A^{-1}	
D	energy	kg m^2 s^{-1}	

(Total 1 mark)

Q10.

In the circuit shown in the diagram the cell has negligible internal resistance.



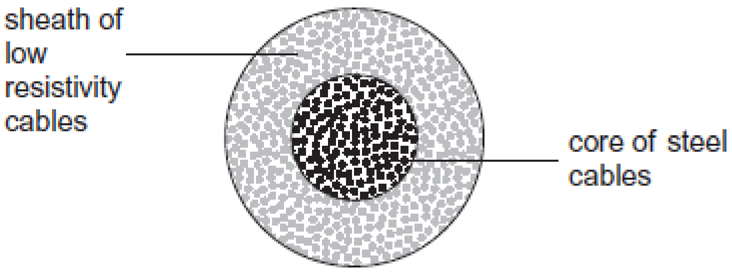
What happens to the reading of both meters when the resistance of R is decreased?

	Reading of ammeter	Reading of voltmeter	
A	increases	increases	⬭
B	increases	decreases	⬭
C	decreases	increases	⬭
D	unchanged	decreases	⬭

(Total 1 mark)

Q11.

The overhead cables used to transmit electrical power by the National Grid usually consist of a central core of steel cables surrounded by a sheath of cables of low resistivity material, such as aluminium.



What is the main purpose of the steel core?

A To force more current into the outer sheath.

B To provide additional current paths through the cables.

C To reduce the power lost from the cables.

D To increase the mechanical strength of the cables.

(Total 1 mark)

Q12.

Which row describes charge and impulse?

	Charge	Impulse	
A	scalar	scalar	⬭
B	scalar	vector	⬭
C	vector	scalar	⬭
D	vector	vector	⬭

(Total 1 mark)

Q13.

Mechanical power

A is a vector quantity. ⬭

B is measured in J. ⬭

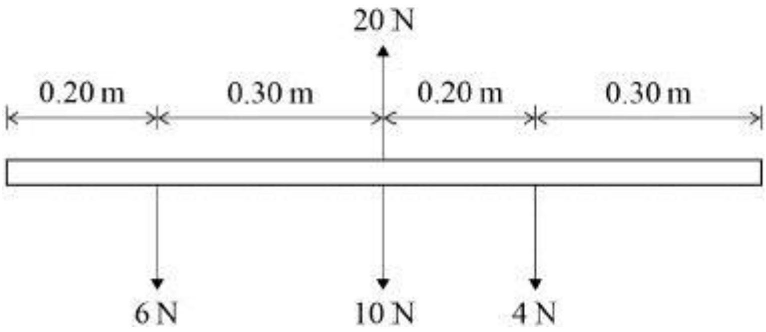
C has base units of kg m^2 s^{-3}. ⬭

D can be calculated from force × distance moved. ⬭

(Total 1 mark)

Q14.

The diagram shows the forces acting on a uniform rod.



Which statement is correct?

A The rod is in equilibrium. ⬭

B For equilibrium, an anticlockwise moment of 1.0 N m is needed. ⬭

C For equilibrium, a clockwise moment of 1.0 N m is needed. ⬭

D For equilibrium, the 10 N force should be increased to 20 N. ⬭

(Total 1 mark)

Q15.

Which row contains vector quantities only?

A	acceleration	mass	⬭
B	displacement	momentum	⬭
C	energy	force	⬭
D	distance	speed	⬭

(Total 1 mark)

Q16.

Two forces of 6 N and 10 N act at a point. Which of the following could **not** be the magnitude of the result?

A 16 N ☐

B 8 N ☐

C 5 N ☐

D 3 N ☐

(Total 1 mark)

Q17.

Which line, **A** to **D**, in the table shows correctly whether the moment of a force, and momentum, are scalar or vector quantities?

	moment of force	**momentum**
A	scalar	scalar
B	scalar	vector
C	vector	scalar
D	vector	vector

(Total 1 mark)

Glossary

Topic 1: Measurements and their Errors

Accuracy: A measure of how close a measurement is to the true value.

Precision: A measure of how close a measurement is to the mean value. It only gives an indication of the magnitude of random errors, not how close data is to the true value.

Random Error: Unpredictable variation between measurements that leads to a spread of values about the true value. Random error can be reduced by taking repeat measurements.

Systematic Error: Causes all readings to differ from the true value by a fixed amount. Systematic error cannot be corrected by repeat readings, instead a different technique or apparatus should be used.

Repeatable: The same experimenter can repeat a measurement using the same method and equipment and obtain the same value.

Reproducible: An experiment can be repeated by a different experimenter using a different method and different apparatus, and still obtain the same results.

Resolution: The smallest change in a quantity that causes a visible change in the reading that a measuring instrument records.

Uncertainty: The interval that a value is said to lie within, with a given level of confidence.

Topic 2: Particles and Radiation

Alpha Decay: The process of an unstable nucleus emitting an alpha particle (two protons and two neutrons) to become more stable.

Annihilation: The process of a particle and its antiparticle colliding and being converted into energy. The energy is released in two photons to conserve momentum.

Antiparticle: All particles have a corresponding antiparticle with the same mass but opposite charge and conservation numbers.

Baryon Number: A quantum number that is conserved in all particle interactions. Baryons have a baryon number of +1 and non-baryons have a baryon number of 0.

Baryon: A class of hadron, that is made up of three quarks. The proton is the only stable baryon.

Beta-Minus Decay: The process of a neutron inside a nucleus turning into a proton, and emitting a beta-minus particle (an electron) and a antineutrino.

Beta-Plus Decay: The process of a proton inside a nucleus turning into a neutron, and emitting a beta-plus particle (a positron) and a neutrino.

Electron Diffraction: The spreading of electrons as they pass through a gap similar to the magnitude of their de Broglie wavelength. It is evidence of the wave-like properties of particles.

Electron-volt (eV): The work done to accelerate an electron through a potential difference of 1V. 1eV is equal to the charge of an electron (E=qv).

Energy Levels: Defined and distinct energies at which electrons can exist in an atom. An electron cannot exist between energy levels.

Excitation: The process of an electron taking in exactly the right quantity of energy to move to a higher energy level.

Gauge Boson: The exchange particles that transmit the four fundamental interactions between particles.

Ground State: The most stable energy level that an electron can exist in.

Hadrons: A class of subatomic particle that experiences the strong nuclear interaction.

Ionisation: The process of an atom losing an orbital electron and becoming charged.

Isotope: Same number of protons but different numbers of neutrons.

Isotopic Data: Data from isotopes that can be used for a purpose, such as carbon dating.

Kaon: A type of meson that decays into pions.

Lepton Number: A quantum number that is conserved in all particle interactions. Both electron lepton numbers and muon lepton numbers must be conserved.

Lepton: A group of elementary subatomic particles, consisting of electrons, muons and neutrinos.

Meson: A class of hadron that is made up of a quark and antiquark pair.

Muon: A type of lepton that decays into electrons.

Neutrino: A subatomic particle whose existence was hypothesised to maintain the conservation of energy in beta decay.

Nucleon Number (A): The sum of the number of protons and neutrons in a given nucleus.

Nucleon: A proton or neutron.

Pair Production: The process of a sufficiently high-energy photon converting into a particle and its corresponding antiparticle. To conserve momentum, this usually occurs near a nucleus.

Photon: A packet of energy.

Pion: A type of meson and the exchange particle for the strong nuclear force.

Positron: A positively charged particle that is the antiparticle of an electron.

Proton Number (Z): The number of protons present in the nucleus of a given element.

Stopping Potential: The minimum potential difference required to stop the highest kinetic energy electrons from leaving the metal plate in the photoelectric effect.

Strange Particles: Particles that are produced through the strong interaction but decay through the weak interaction.

Strangeness: A quantum number that is conserved in strong interactions but not in weak interactions. This reflects that strange particles are always produced in pairs.

Strong Nuclear Force: A force that acts between nucleons in a nucleus to keep it stable. It is attractive at distances of up to 3fm and repulsive at separations less than 0.5fm.

Threshold Frequency: The minimum frequency of photons required for photoelectrons to be emitted from the surface of a metal plate through the photoelectric effect. It is equal to the metal’s work function divided by Planck’s constant.

Work Function: The minimum energy required to remove an electron from a metal’s surface.

Topic 5: Electricity

Ammeter: A device that measures the current in the loop of the circuit that it is connected in series with. An ideal ammeter is modelled to have zero resistance.

Current: The rate of flow of charge in a circuit.

Electromotive Force: The amount of energy transferred by a source, to each unit of charge that passes through it.

Internal Resistance: The resistance to the flow of charge within a source. Internal resistance results in energy being dissipated within the source.

Light Dependent Resistor: A light sensitive semiconductor whose resistance increases when light intensity decreases.

Ohmic Conductor: A conductor for which the current flow is directly proportional to the potential difference across it, when under constant physical conditions.

Ohm's Law: The current and potential difference through an ohmic conductor held under constant physical conditions are directly proportional, with the constant of proportionality being resistance.

Parallel Circuits: Components are said to be connected in parallel when they are connected across each other (separate loops).

Potential Divider: A method of splitting a potential difference, by connecting two resistors in series. The total potential difference is split in the ratio of their resistances.

Resistance: A measure of how difficult it is for current to flow through a material.

Resistivity: A quantity that is proportional to an object's resistance and cross-sectional area, and inversely proportional to the object's length.

Resistors in Parallel: The potential difference across resistors connected in parallel is identical for each resistor. The current is split between the resistors. The total resistance is equal to the inverse of the sum of the inverses of the resistances of the resistors.

Resistors in Series: The current through resistors connected in series is identical for each resistor. The potential difference is split in the ratio of their resistances. The total resistance is equal to the sum of the resistances of the resistors.

Series Circuits: Components are said to be connected in series when they are connected end to end (in one loop).

Superconductor: A material which has zero resistivity when the temperature is decreased to, or below, the material's critical temperature. Superconductors can be used to produce strong magnetic fields and reduce energy loss when transmitting electric power.

Terminal Potential Difference: The potential difference across the terminals of a power source. It is equal to the source's emf minus any voltage drop over the source's internal resistance.

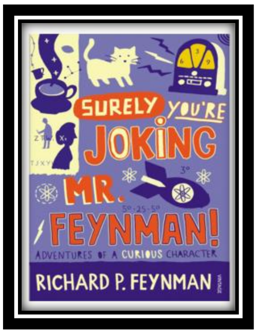
Thermistor: A temperature sensitive semiconductor whose resistance increases when temperature decreases.

Voltmeter: A device used to measure the potential difference across components. An ideal voltmeter is modelled to have infinite resistance.

Additional Reading

Below is a selection of books that should appeal to a physicist – someone with an enquiring mind who wants to understand the universe around us. None of the selections are textbooks full of equation work (there will be plenty of time for that!) instead each provides insight to either an application of physics or a new area of study that you will be meeting at A Level for the first time.

1. **Surely You're Joking Mr Feynman: Adventures of a Curious Character**

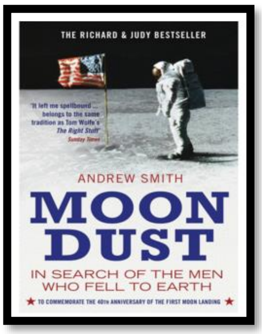


ISBN - 009917331X - Richard Feynman was a Nobel Prize winning Physicist. In my opinion he epitomises what a Physicist is. By reading this books you will get insight into his life's work including the creation of the first atomic bomb and his bongo playing adventures and his work in the field of particle physics.

(Also available on Audio book).

https://www.waterstones.com/books/search/term/surely+youre+joking+mr+feynman++adventures+of+a+curious+character

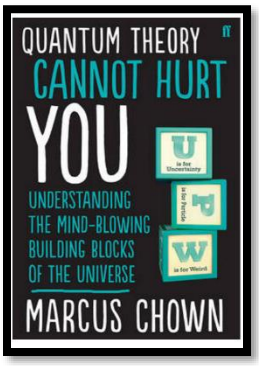
2. **Moondust: In Search of the Men Who Fell to Earth**



ISBN – 1408802384 - One of the greatest scientific achievements of all time was putting mankind on the surface of the moon. Only 12 men made the trip to the surface, at the time of writing the book only 9 are still with us. The book does an excellent job of using the personal accounts of the 9 remaining astronauts and many others involved in the space program at looking at the whole space-race era, with hopefully a new era of space flight about to begin as we push on to put mankind on Mars in the next couple of decades.

https://www.waterstones.com/books/search/term/moondust++in+search+of+the+men+who+fell+to+earth

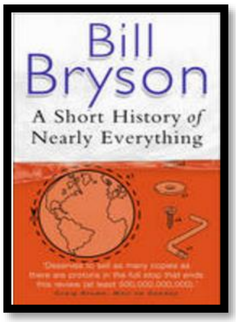
3. **Quantum Theory Cannot Hurt You: Understanding the Mind-Blowing Building Blocks of the Universe**



ISBN - 057131502X - Any Physics book by Marcus Chown is an excellent insight into some of the more exotic areas of Physics that require no prior knowledge. In your first year of A-Level study you will meet the quantum world for the first time. This book will fill you with interesting facts and handy analogies to whip out to impress your peers!

https://www.waterstones.com/book/quantum-theory-cannot-hurt-you/marcus-chown/9780571315024

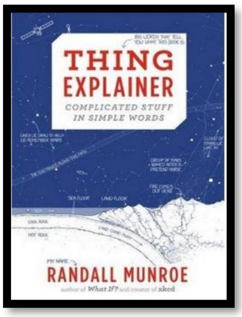
4. A Short History of Nearly Everything



ISBN – 0552997048 - A modern classic. Popular science writing at its best. A Short History of Nearly Everything Bill Bryson's quest to find out everything that has happened from the Big Bang to the rise of civilization - how we got from there, being nothing at all, to here, being us. Hopefully by reading it you will gain an awe-inspiring feeling of how everything in the universe is connected by some fundamental laws.

https://www.waterstones.com/books/search/term/a+short+history+of+nearly+everything

5. Thing Explainer: Complicated Stuff in Simple Words



ISBN – 1408802384 - This final recommendation is a bit of a wild-card – a book of illustrated cartoon diagrams that should appeal to the scientific side of everyone. Written by the creator of online comic XTCD (a great source of science humour) is a book of blueprints from everyday objects such as a biro to the Saturn V rocket and an atom bomb, each one meticulously explained BUT only with the most common 1000 words in the English Language. This would be an excellent coffee table book in the home of every scientist.

https://www.waterstones.com/book/thing-explainer/randall-munroe/9781473620919

Additional Reading Log:

Additional Reading Title	Dates?	Points of interest	How does it link to the course?

Online Clips / Series

1. **Minute Physics –** Variety of Physics questions explained simply (in felt tip) in a couple of minutes. Addictive viewing that will have you watching clip after clip – a particular favourite of mine is “Why is the Sky Dark at Night?”

   https://www.youtube.com/user/minutephysics

2. **Wonders of the Universe / Wonders of the Solar System –** Both available of Netflix as of 17/4/16 – Brian Cox explains the Cosmos using some excellent analogies and wonderful imagery.

3. **Shock and Awe, The Story of Electricity –** A 3 part BBC documentary that is essential viewing if you want to see how our lives have been transformed by the ideas of a few great scientists a little over 100 years ago. The link below takes you to a stream of all three parts joined together but it is best watched in hourly instalments. Don’t forget to boo when you see Edison. (alternatively watch any Horizon documentary – loads of choice on Netflix and the I-Player)

   https://www.youtube.com/watch?v=Gtp51eZkwoI

4. **NASA TV –** Online coverage of launches, missions, testing and the ISS. Plenty of clips and links to explore to find out more about applications of Physics in Space technology.

   http://www.nasa.gov/multimedia/nasatv/

5. **The Fantastic Mr. Feynman –** I recommended the book earlier, I also cannot recommend this 1 hour documentary highly enough. See the life’s work of the “great explainer”, a fantastic mind that created mischief in all areas of modern Physics.

   BBC - The Fantastic Mr Feynman - YouTube

Online Journals/Podcasts

1. https://physicsworld.com/ - you can access weekly podcasts through this website or why not subscribe through you usual podcast provider.

2. https://www.livescience.com/ - For the science geek in everyone, Live Science breaks down the stories behind the most interesting news and photos on the Internet, while also digging up fascinating discoveries that hit on a broad range of fields, from dinosaurs and archaeology to wacky physics and astronomy to health and human behavior. If you want to learn something interesting every day, Live Science is the place for you.

Supporting Resources

1. https://www.physicsandmathstutor.com/ - access topic specific questions, mind maps, summary notes, definitions, pre-made flash cards all for free.

2. https://revisionscience.com/a2-level-level-revision/physics-level-revision/physics-level-past-papers/aqa-level-physics-past-papers - a useful place to download past exam questions.

3. https://filestore.aqa.org.uk/resources/physics/specifications/AQA-7407-7408-SP-2015.PDF - teaching specification

4. https://www.alevelphysicsonline.com/aqa - excellent online videos and topic checklists

5. https://senecalearning.com/en-GB/blog/a-level-physics-revision/ - sign up and access high quality resources.