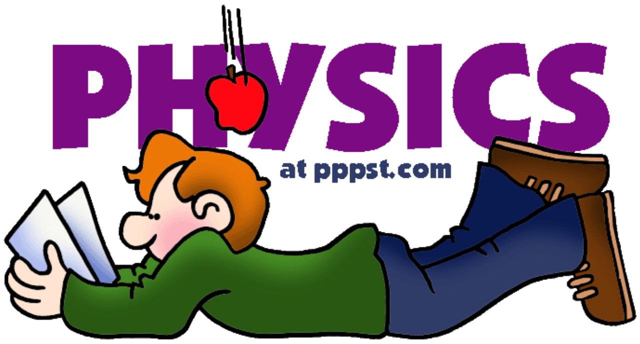

AS Physics

Course Information

2011 - 2012

Course Details:
AS Physics
OCR Physics A H158 (Part of H558)
http://www.ocr.org.uk/qualifications/type/gce/science/physics_a/index.html

Teachers:
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Name: ________________________________

Tutor Group: ____________________________

Contents

Drop –in Study and Homework club

Thursday after school you will be able to go to Sc1 for help with Physics homework and work covered within the week.

Assessment

Course: OCR Physics A H158/ H558

Module	Weightings	Assessment details
Mechanics	15% (30% of AS)	June Yr 12 (60 min)
Electrons, Waves and Photons	25% (50% of AS)	Jan Yr 12 (105 min)
Practical Skills in Physics 1	10% (20% of AS)	Throughout Yr 12
Newtonian World	15%	Jan Yr 13 (60 min)
Fields, Particles and Frontiers of Physics	25%	June Yr 13 (105 min)
Practical Skills in Physics 2	10%	Throughout Yr 13

Assessment Criteria

Exam questions will assess the following objectives in relation to the content covered within each module (see the Learning Objectives section):

- Knowledge and understanding of science and of How Science Works
- Application of knowledge and understanding of science and of How Science Works
- How Science Works

AO weightings in AS GCE

Unit	% of AS GCE			Total
	AO1	AO2	AO3	
AS Unit G481: *Mechanics*	14	14	2	30%
AS Unit G482: *Electrons, Waves and Photons*	21	24	5	50%
AS Unit G483: *Practical Skills in Physics 1*	3	2	15	20%
	38%	40%	22%	100%

	Assessment Objective 1	Assessment Objective 1	Assessment Objective 1
Objectives	**Knowledge and understanding of science and of How Science Works** Candidates should be able to: • recognise, recall and show understanding of scientific knowledge; • select, organise and communicate relevant information in a variety of forms.	**Application of knowledge and understanding of science and of How Science Works** Candidates should be able to: • analyse and evaluate scientific knowledge and processes; • apply scientific knowledge and processes to unfamiliar situations including those related to issues; • assess the validity, reliability and credibility of scientific information.	**How Science Works** Candidates should be able to: • demonstrate and describe ethical, safe and skilful practical techniques and processes, selecting appropriate qualitative and quantitative methods; • make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy; • analyse, interpret, explain and evaluate the methodology, results and impact of their own and others' experimental
A/B boundary Performance Descriptions	Candidates characteristically: a) demonstrate knowledge of most principles, concepts and facts from the AS specification; b) show understanding of most principles, concepts and facts from the AS specification; c) select relevant information from the AS specification; d) organise and present information clearly in appropriate forms	Candidates characteristically: a) apply principles and concepts in familiar and new contexts involving only a few steps in the argument; b) describe significant trends and patterns shown by data presented in tabular or graphical form and interpret phenomena with few errors and present arguments and evaluations clearly; c) explain and interpret phenomena with few errors and present arguments and evaluations clearly; d) carry out structured calculations with few errors and demonstrate good understanding of the underlying relationships between physical quantities.	Candidates characteristically: a) devise and plan experimental and investigative activities, selecting appropriate techniques; b) demonstrate safe and skilful practical techniques; c) make observations and measurements with appropriate precision and record these methodically; d) interpret, explain, evaluate and communicate the results of their own and others experimental and investigative activities, in appropriate contexts.
	Candidates characteristically: a) demonstrate knowledge of some principles and facts from the AS specification; b) show understanding of some principles and facts from the AS specification; c) select some relevant information from the AS specification; d) present information using basic terminology from the AS specification.	Candidates characteristically: a) apply a given principle to material presented in familiar or closely related contexts involving only a few steps in the argument; b) describe some trends or patterns shown by data presented in tabular or graphical form; c) provide basic explanations and interpretations of some phenomena, presenting very limited evaluations; d) carry out some steps within calculations.	Candidates characteristically: a) devise and plan some aspects of experimental and investigative activities; b) demonstrate safe practical techniques; c) make observations and measurements, and record them; d) interpret, explain and communicate some aspects of the results of their own and others experimental and investigative activities, in appropriate contexts.

Course Outline: AS Physics 2011 – 2012

Week	Date	Teacher A (JDT)	Teacher B (JLN)	Assessment
1	5th Sept			
2	12th Sept	2.1.1 (Electric current + charge) + 2.1.2 (Kirchoff's first)	2.4.1 (Wave motion)	
		2.1.3 (Electron drift velocity) + Revision	2.4.2 (Wave terminology)	
3	19th Sept	Revision	2.4.3 (Wave speed)	
		2.2.1 (Electromotive force) + 2.2.2 (Potential difference)	2.4.4 (Wave properties)	
4	26th Sept	2.2.3 (Resis. + Ohm's law) + 2.2.4 (Resis. of circuit comp.)	2.4.5 (Electromagnetic Waves)	
		Revision	2.4.6 (Polarisation)	Unit 2: Module 1 and 2 Homework
5	3rd Oct	2.2.5 (Resistivity) + 2.2.6 (Effect of temp on resistivity)	2.4.7 (Interference)	
		2.2.7 (Electric power) + 2.2.8 (Domestic electric supply)	2.4.8 (Young double-slit)	
6	10th Oct	2.2.9 (Charging for electric energy) + Revision	2.4.9 (Diffraction grating)	
		X		
7	17th Oct	PA	Finish/ help with PA	Unit 2: Practical Assessment
		PA		Unit 2: Modules 1, 2 and 4 Test
8	31st Dec	2.3.1 (Series circuits) + 2.3.2 (Parallel circuits)	2.4.10 (Stationary waves)	
		2.3.3 (Circuit analysis 1) 2.3.4 (Circuit analysis 2)	2.4.11 (Stationary wave experi.)	
9	7h Nov	2.3.5 (The potential divider) + Revision	2.4.12 (Stationary longitudinal)	
10	14th Nov	P.A (Qual Task 2)	Rev	
				Unit 2: Module 3 Homework
11	21nd Nov	P.A (Investigating lamps in series + Parallel)	2.5.1 (Energy of a photon)	
			2.5.2 (Photoelectric effect 1)	
12	28th Nov	Rev	2.5.3 (Photoelectric effect 2)	
			2.5.4 (Wave- particle duality)	
13	5th Dec	Rev	2.5.5 (Energy levels in atoms)	
			2.5.6 (Spectra)	
14	12th Dec	Mock Unit 2		Unit 2: Practical Assessment
				Unit 2 Mock

Week	Date	Teacher A (JDT)	Teacher B (JLN)	Assessment
15	2nd Jan			
16	9th Jan			
17	16th Jan			
18	23rd Jan	1.1.1 (Phys. quant. + units) + 1.1.2 (Est. phys. quant.)	1.3.1 (Work and the joule)	
		1.1.3 (Scalar + vector quant.) + 1.1.4 (Vector calculations)	1.3.2 (The conservation of energy)	
19	30th Jan	1.1.5 (Vector calculations) + 1.1.6 (Def. in kinematics)	1.3.3 (Potential and kinetic energies)	
		1.1.7 (Graphs of motion) + 1.1.8 (Constant accel. equations)	1.3.4 (Power and the watt)	Unit 1: Module 1 Homework
20	6th Feb	1.1.9 (Free fall) + 1.1.10 (Measurement of g)	1.3.5 (Efficiency)	Practical Assessment
		PA	1.3.6 (Deformation of materials)	Unit 1: Module 1 and 3 Test
22	20th Feb	Rev / Catch up	1.3.7 (Hooke's law)	
			1.3.8 (The Yound modulus)	
23	27th Feb	1.2.1 (Force + newton) + 1.2.2 (Motion - non-constant acc.)	1.3.9 (Categories of materials)	
		1.2.3 (Equilibrium) + 1.2.4 (Centre of gravity)		
24	5th March	1.2.5 (Turning forces) + 1.2.6 (Density)	PA	
		1.2.7 (Pressure) + 1.2.8 (Car stopping distances)		Unit 1: Module 2 Homework
25	12th March	1.2.9 (Car safety)	PA	
26	19th March	Rev	PA	
27	26th March	Rev	PA	Practical Assessment
				Unit 1 Test

Lesson Objectives

You will be given an objective sheet at the start of each module. You will use this at the start of each lesson to complete the date section on the handout. You must keep this in your folder and take it to every lesson. See below for an example.

AS Unit G482: Electrons, waves and photons

Module 1 - Electric current	
Charge and current	**Date**
Explain that electric current is a net flow of charged particles.	
Explain that electric current in a metal is due to the movement of electrons, whereas in an electrolyte the current is due to the movement of ions.	
Explain what is meant by conventional current and electron flow.	
Select and use the equation $\Delta Q = I\Delta t$.	
Define the *coulomb*.	
Describe how an ammeter may be used to measure the current in a circuit.	
Recall and use the elementary charge $e = 1.6 \times 10^{-19}$ C.	

Examiners' Tips

AS physics introduces you to four of the main topics of physics:

- mechanics
- current electricity
- waves
- quantum physics.

General guidance

- The first two rules of doing well in any examination are:
- read the question fully; and
- answer the question that is asked, *not* the one that you hoped for.

These might seem silly statements but every year examiners see answers that, although containing correct physics, gain few marks because they do not answer what is required by the actual question. Another common mistake is for candidates to incorrectly transfer a number in the question, such as writing down 36 instead of 30.

- If asked to draw or sketch a graph always ensure you use a sensible scale, draw small crosses or dots for the points and label both axes with both quantities and units.

- Labelled diagrams can often gain marks when the written explanation has been less than adequate. Using bullet points in written explanations can sometimes help you concentrate on the actual answer.

- Remember, scientific words have *specific* meanings and these meanings may differ to those used in everyday language, so take great care when using words such as force, energy and power – they are not the same thing so do not mix them up!

Calculations in AS physics

- A considerable number of marks in any AS physics paper are given over to calculations. Get into the habit of tackling all calculations in the same way:
  - write down the relevant equation;
  - change the subject of the equation into the one that is being asked for in the question;
  - put the *correct* figures from the question into the calculation, checking as you do so that you have written down the correct powers of ten – a common mistake here is to forget that one mm^2 is 10^{-6} m^2;
  - work out the answer; and
  - make sure you have the correct unit. Your answer to a calculation should always be given to the same number of significant figures as the figures in the question.

- Remember, when carrying out calculations it is vital that you explain what you have done as well as the symbols you have used.

- Examiners often comment on the errors made by candidates when using calculators. Make sure you do *not* do either of the following:
  - get the answer 18 to the calculation 12 / 2 x 3; or
  - get 2 x 10^{-3} for the calculation 6 / 3 x 10^2.

If you are not sure about either of these calculations then try them out on your calculator now! If you make mistakes, set yourself a list of simple calculations to do and practice before you go into the examination room.

- Finally, you should always check each line of your answer as you do it. Then make sure your answer makes sense – questions are not set in which the wavelength of light turns out to be 500 m or the charge on an electron C to be 1.6 x 10^{-16}. Making simple mistakes in your arithmetic can bring you down by as much as two grades, so take care!

Points to note by module

Each module of the physics specification consists of a series of *Learning Outcomes* and these outcomes often revolve around specific definitions, for example, the volt or the newton. Make sure you highlight these definitions in your revision and learn them. See the separate Glossary booklet.

You will be given an Examiner's Tips section for each module. See below for an example.

Unit 1: Mechanics

Module 1 - Motion

Key words: scalar; vector; resultant; resolve; displacement; instantaneous speed; average speed; velocity and acceleration; free fall; and acceleration of free fall or acceleration due to gravity.

- The introductory material on *Physical quantities and units* is relevant to the whole specification, so please do make sure you understand it.
- Make sure you learn the relevant power of 10 for the following list of sub-multiples and multiples of units as they will not be given in the examination:
  - pico (p)
  - nano (n)
  - milli (m)
  - centi (c)
  - mega (M)
  - giga (G)

Sample Exam Questions

AS Unit G482: Electrons, waves and photons

Module 1: Electric current

Question 1	**Total marks: 10**
(a) (i) In a time Δt, an amount of charge ΔQ flows through a battery. Write an equation for the magnitude of the electric current I in terms of Δt and ΔQ. **(ii) Define the coulomb.**	
	Marks available: **(i) 1 (ii) 2**

Student answer:

(a) (i) $I = \Delta Q/\Delta t$

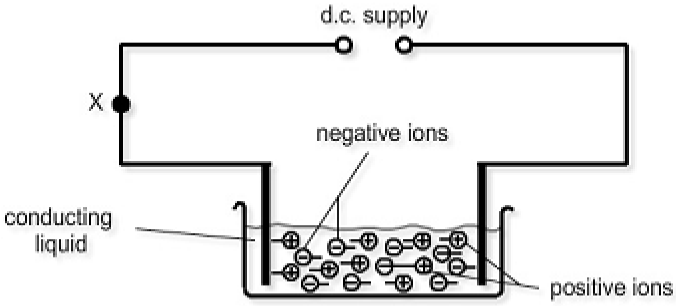
(ii) A coulomb is the amount of charge that flows past a point when a current of one amp flows for one second.

Examiner comments:

(a) (i) Correct.

(ii) Good. A definition of a unit states what that unit measures (charge) and how to measure it.

(b) Figure 9 shows an electrical circuit.



(i) The directions of flow of ions in the liquid are shown. At point X which way is the direction of the electron flow in the wire (up or down)?

(ii) State what is meant by *conventional current.*

A charge of 0.76 C flows past point X in a time of 5.0 minutes.

(iii) Calculate the current in the wire.

(iv) Calculate the number of electrons that pass point X per second.

Marks available:
(i) 1 (ii) 1 (iii) 2
(iv) 3

Student answer:

(b) (i) Down.

(ii) Current flows from the positive terminal.

(iii) $I = \Delta Q/\Delta t$
$I = 0.76/(5 \times 60)$
$= 2.5 \times 10^{-3}$ A

(iv) Charge per second = Q =
$0.76/(5 \times 60)$
$= 2.533 \times 10^{-3}$ C
$Q = Ne$
$N = (2.533 \times 10^{-3})/(1.6 \times 10^{-19}) = 1.6 \times 10^{16}$

Examiner comments:

(b) (i) Good.

(ii) It might have helped if you had added 'to the negative terminal'.

(iii) / (iv) Good explanations for calculations. It was nice to see the use of words in (iv) to help explain what you were doing.

Module 1: Electric current	
Question 2	**Total marks: 10**

(a) **A copper wire contains *n* free electrons per cubic metre. The wire has a cross sectional area *A*. The drift velocity of free electrons in the wire is *v*. The electronic charge is *e*.**

(i) **Write down an expression for the number of free electrons contained in a length *v* of the wire.**

(ii) **Show that the current *I* in the wire is given by the expression $I = nAve$.**

Marks available: (i) 1 (ii) 2

Student answer:

(a) (i) number of free electrons in length $v = nAv$

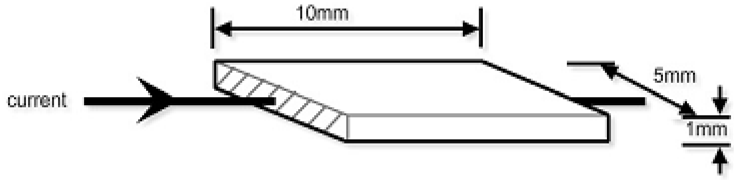
(ii) Imagine electrons flowing past one point.
In one second electrons travel a distance v.
Number of electrons passing one point in one second = nAv
Charge passing this point per second = $nAve$
But charge flowing per second is current.
Therefore $I = nAve$

Examiner comments:

(a) (i) Good. Answer only requires a single expression.

(ii) Good answer. Always remember that this is a proof that requires more words than symbols, but also remember that all proofs require words of explanation.

(b) Figure 10 shows a rectangular slice of copper which has 8.0 × 10^{28} conduction electrons per cubic metre. An electric current flows as shown.



Calculate the drift velocity of the electrons when a current of 50 mA flows through the slice.

Marks available: 3

Student answer:

(b) $v = I/nAe$

$= (50 \times 10^{-3})/((8.0 \times 10^{28}) \times (5 \times 10^{-3}) \times (1 \times 10^{-3}) \times (1.6 \times 10^{-19}))$

$v = 7.8 \times 10^{-7}\,\text{m s}^{-1}$

Examiner comments:

(b) Good; you have shown every step of the calculation. This is a calculation in which the powers of 10 are very important and you must take a great deal of care with them. The advantage of showing each step is that if you make one silly mistake then you might only lose one mark and not all of them.

(c) (i) In terms of the number of free electrons, explain the difference between conductors such as copper, semiconductors and insulators.

(ii) Two slices of material, one a good conductor *C* and one a semiconductor *S*, have identical dimensions and have the same current flowing through them. State and explain the difference in the drift velocity of the electrons in each slice.

Marks available: (i) 2 (ii) 2

Student answer:

(c) (i) Semiconductors have far less free electrons than copper, and insulators have virtually no free electrons.

(ii) If $v = I/nAe$ and I, A and e are the same in both S and C, then the drift velocity in S must be far greater than in C because n_C is far greater than n_S.

Examiner comments:

(c) (i) Correct.

(ii) This might seem strange but it is true.

Practical Assessment

What are practical skills?

- Your practical and investigative skills will be developed during the AS course under the guidance of your teacher(s).
- There is the formal internal assessment of your practical work, entitled *Practical Skills in Physics 1* (unit code G483).
- You will need to carry out three different types of task.

How much are practical skills worth?

- You will be awarded a mark out of 40 which will be scaled by OCR to a mark out of 60.
- The practical skills are worth 60 marks. This is out of a total of 300 marks for the whole AS course, so they represent 20% of the AS course (and 10% of an A level course).
- Remember that for *every* two marks you gain from your practical skills, you will achieve 1% towards your final AS percentage.

Who does the marking and when?

- Your teacher will mark your practical skill tasks as you do them throughout the course, using a mark scheme provided by OCR.
- Within each teaching centre marks will be internally moderated.
- The marking will be checked by OCR moderators. Marks can be changed to bring the marks of your school or college into line with those from other teaching centres.

What proportion of the formal assessment will be done in lessons?

- All the tasks will be carried out under supervision during lesson time.
- Your teacher must be able to say that the work is yours.
- Both you and your teacher will have to sign documents to this effect.

What tasks do I have to do?

- A **qualitative** task worth 10 marks
- A **quantitative** task worth 20 marks
- An **evaluative** task worth 10 marks

What is covered by the qualitative task?

- You have to carry out a practical task using instructions supplied by OCR.
- You are expected to carry out the task skillfully and safely using *qualitative techniques* – this may involve taking some numerical results, plotting a graph and then describing what is shown.
- You will need to make and record valid observations and organise them in an appropriate way.

What is covered by the quantitative task?

- You have to carry out a practical task using instructions supplied by OCR.
- You are expected to carry out the task skillfully and safely using *quantitative techniques* – for example detailed numerical analysis.
- You will need to make and record accurate observations and organise them in an appropriate way.
- You will then process your results to reach valid conclusions.

What is covered by the evaluative task?

- You have to carry out an evaluative task using instructions supplied by OCR.
- Evaluative tasks will be based on a quantitative task.
- Evaluative tasks will *not* require additional data collection.
- You will need to reach valid conclusions.
- You will need to assess the reliability and accuracy of an experimental task.
- You will need to identify anomalies as well as identify significant weaknesses in procedures and measurements.
- You will need to understand and select simple improvements to procedures and measurements.

Do I have to plan a practical?

- No, but you may be required to suggest changes to techniques or apparatus which will improve the accuracy or reliability of the results and/or the validity of the conclusions.

Will every piece of practical work be assessed?

- No. OCR provides certain tasks which can be done at any point during the course, but your teacher should do other work with you to develop your skills.
- The *minimum* number of practical assessments would be one for each of the three types of task. However, it is likely that you will do more than three.

If I do more than three practical assessments, which ones count towards AS?

- Your final mark out of a possible 40 will be comprised of the *best* scores that you achieve for a qualitative task, a quantitative task and an evaluative task.

The qualitative task

Possible qualitative tasks include:

- Use of motion sensors
- Analysing projectile motion
- Determination of centre of gravity
- Force extension relationships for different materials
- Variation of the resistance of a thermistor with temperature.

When carrying out qualitative tasks:

- Describe experimental procedures carefully. Include the necessary detail. Diagrams are often helpful.
- When choosing which measurements to take, use as large a range as possible.
- Make sure the intervals between measurements are sensible and cover the whole range.
- You may be expected to make comments about safety. Such comments must be relevant to the practical you are doing. Do not state standard laboratory precautions such as ’tie hair back’.
- An explanation as to *why* you are taking a safety precaution is helpful.
- All the raw readings should be recorded to the same number of decimal places.
- Measurements should be consistent with the equipment used to make the measurement, for example, if a distance is measured to the nearest millimetre then it should be recorded as 2.0 cm or 20 mm or 0.020 m. Do not add extra zeros.
- Repeat measurements where necessary and calculate an average.
- Take care to include appropriate unit multipliers, for instance, if a current is measured in milliamperes, this needs to be converted to amperes when calculating resistance.
- Record all your results in a table.
- All column headings should be labelled with a quantity *and* a unit.
- Describe carefully any observations. Diagrams may also be helpful.
- Discuss whether a proportional relationship may exist. Use your data to test possible relationships. Always show your working. Try to find a constant of proportionality.
- Use your knowledge of physics to explain your observations.

The quantitative task

Possible quantitative tasks include:

- Investigation of levers
- Weighing of a beam using moments
- Determination of Young’s modulus
- Analysing projectile motion
- Determination of resistivity.

When carrying out quantitative tasks:

- The points already listed for carrying out qualitative tasks also apply to quantitative tasks.
- Scales on graphs must be labelled with the physical quantity being measured along with its unit. Scales must be linear and simple.
- Each axis should have regular labels – no more than two large squares apart.
- The points should occupy at least half of the graph grid in each direction.
- All points must be plotted accurately and clearly. Use a sharp pencil. Check carefully any points that do not appear to fit a trend.
- Draw the best-fit line through your points. The line must be thin and clear. Do not draw ‘point-to-point’ lines.
- When calculating the gradient, clearly show both the points on the best-fit line and the calculation. These points should be at least half the length of the line that has been drawn.
- The *y*-intercept is either read from the *y*-axis where $x = 0$, or if there is a false origin it is calculated by substituting a point that lies on the best-fit line into the equation of a straight line.

- When determining final values use the gradient and *y*-intercept values that you have determined. State clearly how the gradient and *y*-intercept is related to the values. Show your working clearly.
- Give your final answer to an appropriate number of significant figures. The accuracy of the final answer is dictated by the least accurate piece of data. For example, potential difference accurate to 3 sig. figs used with a current accurate to 2 sig. figs would suggest that any final answer of resistance should be quoted to 2 sig. figs. However, it is acceptable to use more sig. figs in your working, although this should be avoided.
- Always give an appropriate unit. Take care when using unit multipliers in earlier data such as kilo or milli to ensure that you have made appropriate allowance in your final answer.

The evaluative task

Possible evaluative tasks include:

- Extensions of the quantitative tasks
- Some data for a quantitative task will be given to you.

When carrying out evaluative tasks:

- Concentrate on the difficulties encountered while actually doing the experiment.
- Explain how these difficulties could have affected your results.
- Do not just describe the procedure you have followed.
- To assess the reliability of the experiment, identify anomalous results and refer to the scatter of points about the best-fit line.
- If you carry out a practical make a note of procedural errors as you go
- You may well be asked to put errors in order of significance.
- You need to be able to calculate the percentage error of measurements. Take care with stopwatches – often a stopwatch will read to 0.01 s; however, human reaction time is at least 0.1 s, therefore Δt is not 0.01 s but 0.1 s.
- When quantities are multiplied or divided, percentage uncertainties are added.
- When working out the error in a final answer it may be helpful to draw the worst acceptable line and work out the worst acceptable gradient and *y*-intercept.
- Explain how these difficulties may be overcome by suggesting improvements to the procedure and to the apparatus used which would improve the accuracy of the experiment. Your improvements *must* relate to the experiment and be possible within a school laboratory.

What you need for a practical assessment

Equipment

- Calculator
- 30 cm ruler
- Sharp pencil
- Pencil eraser
- Blue or black pen

Reference items

- Unless stated otherwise on the front of your assessment, you may not take any reference materials into your practical assessment.

Getting the basics right - study skills

- **Keep your notes organised**

  Your folder (with dividers) should be taken to every lesson. You should have a section in your folder for the following:
  - JDT notes
  - JDT homework
  - JLN notes
  - JLN homework
  - Formal assessments (Anything with a green sticker!)

- **Make sure you know what you are studying**

  This may sound obvious but it is quite easy to get swamped by all the new material. Print out a copy of the specification, which can be found on OCR's website (www.ocr.org.uk) under 'GCE Physics A', and put it in your file. This will tell you exactly what you need to know, including learning outcomes, lists of equations and details of the terms you need to be able to define. Your OCR textbook follows the specification closely, so they can be used in conjunction to help build up your knowledge.

- **Make good use of all the resources**

  There are various resources out there to help you. Have a look at the *New Scientist* website (a link can be found on the Exam Café CD homepage) or the Institute of Physics websites (especially www.physics.org) which contain mini-tests, key definitions and extra tips on how to improve your physics. The Exam Café CD also contains a wealth of materials designed to help you through your AS year. Use them as a base to help you plan your revision, perhaps attempting the multiple choice questions when consolidating a topic. The more material you use the more improvement their will be in your performance.

Getting the basics right - exam skills

Exams can be a scary prospect but they are not designed to catch you out. Their aim is to assess your knowledge in a fair and reliable way. The exams you sit during your AS year are not synoptic. This means that you will only be tested on the material from that unit (e.g. G481 Mechanics or G482 Electrons, waves and photons). There are a few simple things you can do in exams to help make sure you attain the grade you deserve.

- **Equipment**

  Make sure you are prepared for the exam. Don't forget things such as rulers and protractors – drawing accurate vector diagrams is very tricky free hand!

- **Handwriting**

  Make sure your writing is clear. It does not have to be perfect, but when under pressure with limited time, many students rush their writing. This can make key terms very difficult to read.

- **Layout**

  Using a clear layout will help the examiner to see what you have done as well as make it easier for you to spot any mistakes when you are checking your answer. Furthermore, when you're checking your answer, a clear layout will make it easier to spot any mistakes. Make sure you space out your answer, particularly calculations. It should be: formula; substitution; calculation; answer (with unit!) – each on a separate line.

- **Corrections**

  Don't be tempted to overwrite terms, numbers or units. This may make your answer clear to you but not to the examiner. Simply cross out the error by putting a single line through it and then rewrite your answer. If you cross something out by mistake just write 'crossed out by mistake, please mark' and the examiner will do so.

- **Reading the question carefully**

  When under pressure, students can often forget to read questions properly. Do not rush in, make sure you read the question and give the appropriate answer. If the question asks for *two* examples of scalars, give *two* scalars, not one or three, and do not attempt to define a scalar! Pay particular attention to the command words.

- **Graphs and diagrams**

  You will normally be expected to draw a diagram or graph during your AS exams. When doing so, you must use a sharp pencil and make sure you include all labels (for a graph this includes scales, axes and units). A good tip when drawing lines of best fit is to plot the points in pencil, check them, then go over them in pen before drawing the line of best fit in pencil. Then if your line of best fit is a bit suspect you can rub out the line without rubbing out all the points. Remember lines of best fit should be smooth, without kinks or feathers!

- **Pay attention to terms in** bold **or *italics***

  Questions often have terms in bold or italics and these are there to help you answer the question appropriately. Often, terms in italics need to be defined or explained. Be careful to explain *all* the terms in italics. For example, if you are asked to explain what it means to *transfer* or *transform* energy you need to explain both terms not just one. Terms in bold stress key points and they are there to help you. Do not ignore them!

- **Check the number of marks available**

  The AS exams are usually designed to be around one mark per minute. If a particular question is worth four marks it should take you about four minutes. Do not spend 15 minutes on a three-mark question, you will find you run out of time and do not complete the paper. Also think carefully about your answer, make sure you have put down three credit-worthy points, not just one. For example, if the question asks you to describe the key findings of the photoelectric effect, do not just put one finding and move on. This gets easier the more past papers you practise and the more exposure you get to AS exam mark schemes (there are sample answers with examiner annotations on the Exam Café CD).

- **Check the paper when you have finished**

  If you have finished the paper and you have some time left over use it constructively! Go back over the paper and check it. For calculations, put the numbers back into your calculator and check your answer. Reread each question, followed by your answer. Have you answered it appropriately? Most students make one or two silly mistakes in exams, but with careful checking these can be corrected.

Getting the basics right - command words

Command words are used to instruct you *how* to answer a question. In order to answer the question the way the examiner wants you to, you need to spot these words and answer appropriately. The most common command words are listed below.

- **List –** give a simple inventory . The answers could be one word or one sentence. Remember, if it asks you to list two advantages give *two*, not one or three – if you give three and one is incorrect you will only receive one mark!

- **State –** there is no need to explain your answer when asked to state. Just write a simple response.

- **Define –** definitions are not the same as descriptions. You need to give the formal definition for a key term when asked. For example, if asked to define velocity, it is tempting to say, 'how fast an object goes in a particular direction'. This is a good description but not the formal definition, 'rate of change of displacement'. The specification tells you which terms you may be asked to define.

- **Calculate –** you must get into the habit of always showing your workings. If you make a mistake in the calculation you may still be awarded method marks or error carried forward marks if you have a clear set of workings (this could be as much as 3 out of 4!). If you have no workings and you get it wrong you will get no marks!

- **Show that –** similar to calculate, though in this case the answer will already have been given. Treat these as calculate questions, carefully laying out your workings. You may use the value given in your workings and work backwards so long as it is clear to the examiner what you are doing.

- **Determine –** again similar to calculate, though you may need to use other information – for example values for a graph, the gradient of a line, etc. Again, lay out your answer carefully and make it clear to the examiner what you are doing. For example write 'displacement = the area under the line = 0.5 x 8 ms^{-1} x 10 s = 40 m'.

Other command words listed below are more complex and these are explained in *Reach your potential – stretch yourself*.

- **Describe**
- **Explain**
- **Predict**
- **Outline**
- **Sketch**
- **Suggest**

Getting the basics right - practice questions

Here are some questions for you to try. Think carefully about the command words and how you approach answering the question.

1 **List** three examples of vectors.

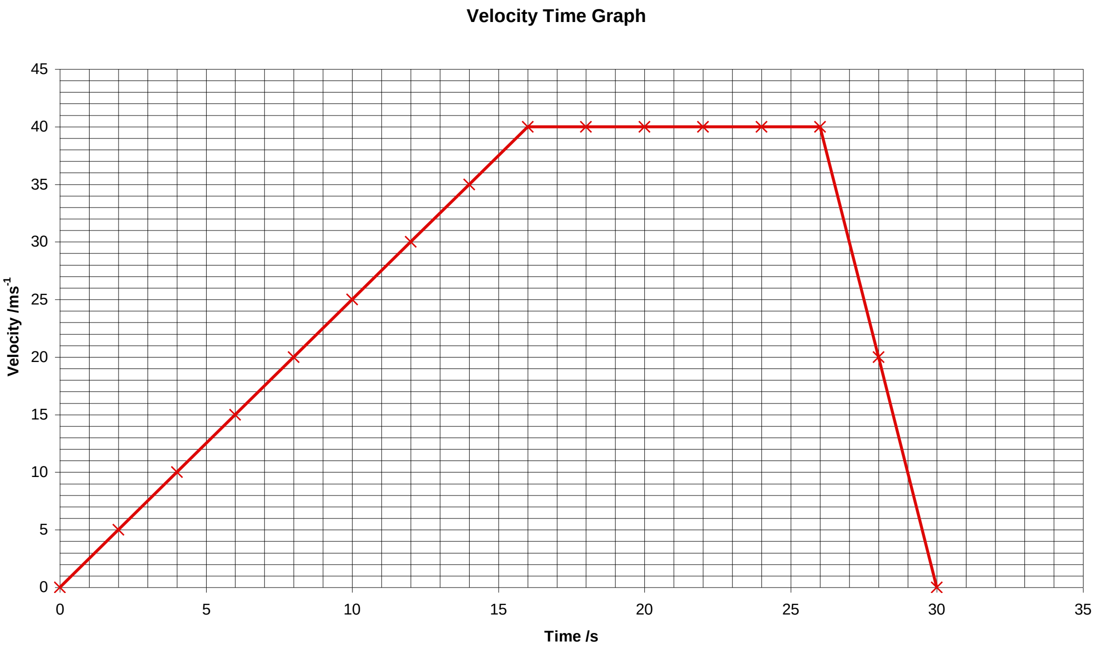
2 **State** Kirchhoff's second law.

3 **Define** the term *acceleration.*

4 **Calculate** the magnitude of the resultant force on a gymnast of weight 420 N when she has a horizontal force on her of 1200 N.

5 **Show** that the velocity of a car of mass 1200 kg with a kinetic energy of 118 000 J is approximately 14 ms^{-1}.

6 Using the graph below **determine** the displacement of the vehicle after 16s:



Stretch yourself - study skills

Once you have mastered the study skills set out for you in the *Reach your potential - getting the basics right* section of the Exam Café CD, to really reach your full potential you'll need to push yourself that little bit harder.

Different strategies work for different students and you need to find the ones that work best for *you*. Here are some suggested methods to help you fulfil your potential.

- **Review and consolidate**

This is discussed in more detail in the *Getting started in AS* section of the Exam Café CD. Keep your physics knowledge fresh by reviewing your work as you progress through the AS course. There are many ways to do this such as making summary notes, flash cards, concept maps, practice questions, etc. It does not really matter how you review your work, but the more practise you get and the more time you spend on your physics, the better chance you will have of improving your final results.

- **Work with your friends**

Try to make studying a more social experience. You will enjoy it more and get even more out of it. Be careful to stay focused. Working with friends to share ideas, explain terms and solve longer calculations is a very effective way to learn.

- **Read around the subject**

The more exposure you get to physics the more the pieces tend to fall into place. Spend time reading some of the popular science magazines such as *Focus* or the *New Scientist* (there is a link to this site on the Exam Café CD). Or perhaps read one of the many popular science books available from bookstores or libraries. These are often accessible, interesting and very informative. All this extra information allows you to form a more complete understanding of the subject and will help you when it comes to the more complex AS and A2 examination questions.

- **Make revision count!**

Revision can be very boring. It's tempting to sit in your room and simply scan through your notes for a couple of hours. This is not effective revision. You need to think carefully about how you revise. Different strategies work for different people and you need to find techniques that work for you. Various suggestions are discussed in the *Getting Started at AS* section of the Exam Café CD, including concept mapping, practice questions, multicoloured highlighting, summary notes etc. Timing is also important; two 40 minute sessions with a 10 minute break is usually much more effective than a 90 minute slog. Plan out your revision (see the *Revision planner* section of the Exam Café CD) and keep your revision varied. Make the best use of the time you have!

Stretch yourself - exam skills

Good exam technique is essential. AS exams are less forgiving than GCSE ones and you need to approach them appropriately. It is quite common for bright students to underachieve the first time they do an AS exam and this can lead to extra stress and needless resits. Make sure you follow the advice in the *Reach your potential – Getting the basics right* section. However, there are a few other important points to consider.

- **Reading the question carefully**

This is mentioned in the *Getting the basics right* section but it is worth stressing. Some students find it useful to underline key terms or values in the question to help them answer as fully as possible. This is particularly important with the more complex, open-ended questions – often ones using the command words listed later in this section. They frequently comprise several marking points relating to different tasks. For example, 'Describe an experiment to show how the velocity of a trolley varies as it travels down an inclined plane. Include a list of the equipment required and a sketch graph of the expected results'. This question has *three* key components, each being worth several marks, and you must make sure all three tasks are addressed in your answer. Don't rush questions, think carefully about your answer before putting pen to paper.

- **Past papers**

Attempting as many past papers as possible will help prepare you for the exam. You should aim to do at least one under timed, mock exam conditions. This will help you get used to the pace at which you will need to work on the day of the exam. If you can, get hold of the marking scheme for your past papers. Then you'll be able to see how the marking points are allocated and how you can achieve more marks for the longer, more complex questions.

- **Making the best use of the time**

Pay attention to the number of marks for each question (remember it is about one mark per minute for AS exams) and use your time wisely. Hopefully, you will have a few minutes at the end of the exam to check over your work. Don't be tempted to sit back and relax. Review the paper carefully, checking *everything*. This includes all values, units, calculations, points on graphs, definitions, etc. If you finish doing this, do it again! You should be working on your paper right up to the time the invigilator asks you to stop writing.

Stretch yourself - command words

You need to know what all the command words mean. There is an explanation of the simpler ones in *Getting the basics right* section. You need to pay particular attention to the more advanced ones – these have been given in italics.

- **List**
- **State**
- **Define**
- **Calculate**
- **Show that**
- **Determine**
- ***Describe*** – you need to give a detailed answer covering the key points. *Describe* questions are usually worth several marks. Your answer may include a diagram or even a sketch graph.
- ***Explain*** – this is a bit more tricky. You will need to use your understanding of physics to explain an observation or phenomenon.
- ***Predict*** – you are expected to use your understanding of the topic to predict a pattern or trend. You do not need to give specifics but general relationships between variables.
- ***Outline*** – you do not need to be specific, just give a simple breakdown of the key points.
- ***Sketch*** – if you are asked to sketch a graph you need to label the axes *carefully* and draw the general shape of the line. This may be straight or curved. If you do know a particular point (e.g. the value of the terminal velocity when asked to sketch a velocity against time graph) it is worth putting it onto the graph. Do not plot, however, simply highlight a known value.
- ***Suggest*** – these can be more difficult because it is probable that you do not know the answer before reading the question. You need to use your knowledge of physics in a new application or context. There are often many possible correct answers to such questions and there may be some clues in previous parts of the question.

Stretch yourself - practice questions

Here are some questions for you to try. Think carefully about the command words and how you approach answering the question.

1 **Describe** an experiment to find the value for the acceleration due to gravity (g).

2 **Explain** why the resistivity rather than the resistance of a material is given in tables of properties of materials.

3 **Predict** how the maximum kinetic energy of photoelectrons emitted by UV compares with that of photoelectrons emitted by blue light.

4 **Sketch** the I-V graph for a diode.

5 **Suggest** why knowledge of ultimate tensile stress (tensile strength) of materials may be vital to an engineer designing a suspension bridge.