Examiners' Report/
Principal Examiner Feedback

Summer 2010

GCE

GCE Physics (6PH06) Paper 1A/ 1B

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Examiners' Report that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

Alternatively, you can speak directly to a subject specialist at Edexcel on our dedicated Science telephone line: 0844 576 0037

Summer 2010

Publications Code UA024552

Introduction

This specification was introduced for teaching in September 2008 and so this unit was available for the first time in June 2010. The previous traditional specification had a practical examination at this level whilst the SHAP specification had a coursework component. This unit is an amalgamation of the best aspects of both of these.

The students are given a briefing paper and asked to produce a plan for a practical investigation; they are then asked to carry out the plan and analyse the data they produce in order to reach a conclusion about the task introduced in the briefing.

Unlike the practical examination, there are no time limits or specified date so the centre can set the task for the students when they feel they are sufficiently prepared and similarly the centre can choose the task – rather like coursework – instead of the task being set by an examiner. The conduct of the task is much more like an examination since the candidate may bring nothing into the laboratory nor may they take anything out in between sessions. So the centre retains a great deal of control over the process but unlike coursework there is no draft marking and what the student produces at the time is what is marked. Students should be discouraged from writing unnecessarily; there is very seldom any correlation between length and mark.

The candidates are given a clean copy of the criteria while doing all aspects of the work so the marks are awarded for how well the student fulfils the criteria and not for simply carrying out the task.

Examiner Tip

Ensure your students understand what is required by each criterion statement. Use the exemplar material in the Tutor Support Materials to help with this. Try getting your students to mark one of the exemplars and go through the marking in class to see if you agree.

General Comments

There are two assessment routes for this unit; the work can be marked by the centre and a sample moderated by Edexcel (paper 1A) or the work can be submitted in its entirety for marking by Edexcel (paper 1B). Candidates fared equally well along either paper.

There are three distinct aspects to this unit; planning, measuring and analysing. The standard of practical work in all three aspects is generally good but often candidates missed marks because they did not address the criteria specifically enough. The criteria are necessarily very short since they must be used for a wide variety of work but they need to be applied in quite specific ways.

Planning is an activity not currently assessed at GCSE so it is a new activity for AS. At A2 candidates are expected to use the AS skills and develop them with a fuller description of the apparatus they need and how it will be used – this year diagrams were generally satisfactory. They are expected to be able to employ a wider range of measuring techniques and to think more thoroughly about how they will gather reliable data.

Implementing and measuring requires candidates to use the appropriate number of significant figures and to show that they are considering uncertainty during their readings. They must refer to the plan; they cannot be awarded the mark M4 unless they do. If they are not going to alter their plan they must say why they think it is working well; one candidate said

'my results showed clearly that as the temperature increased the current went up by more than proportionally, the trend I was expecting, so I did not need to change my plan'.

Similarly the candidate might have said that repeat readings showed only a small variation.

Analysing falls into two parts, there are 8 marks for the graph work and the other 10 refer to the analysis and evaluation. Generally the graph work is very good and the legacy practical papers from unit 5 (available for download from the Edexcel physics website) will give useful tips on the standard expected. Candidates are then expected to use their results in discussing the uncertainties and their final conclusion. One candidate, having drawn a conclusion said

'since my plots all lie near the best fit line which is straight and the uncertainties for my readings are small I think my conclusion that the time constant is 15 seconds is valid'

This is worth the A17 mark since it refers to the quality of the data and the original aim.

Examiner Tip

Candidates who scored high marks on this unit had clearly practised on similar tasks. Just as with a theory paper candidates do better when they rehearse the 'real thing'. Use the tasks in the Tutor Support Materials to give your students some practice.

The Criteria
A: Planning

Ref	Criterion	
P1	Identifies the most appropriate apparatus required for the practical in advance	This is usually a list
P2	Provides clear details of apparatus required including approximate dimensions and/or component values (for example, dimensions of items such as card or string, value of resistor)	Meter ranges, range and size of masses, dimensions of card and mass for damped pendulum are expected – this is an extension of P1
P3	Draws an appropriately labelled diagram of the apparatus to be used	Diagrams should be dimensioned and labelled and represetational, for example, rulers should be drawn close to the measured length. The diagram can help score P2.
P4	States how to measure one quantity using the most appropriate instrument	Any quantity
P5	Explains the choice of the measuring instrument with reference to the scale of the instrument as appropriate and/or the number of measurements to be taken	It is not enough to quote either the range or the precision, or both, without reference to the experiment. A good student said '*the stopclock has a precision of 0.01 s which is less than the uncertainty of the manual operator which is likely to be 0.1 s*'. Another '*the uncertainty of 0.005 V in a meter gives a % uncertainty of 0.7% in a typical measurement of 0.7 V as in the forward bias voltage of the diode in this experiment*'
P6	States how to measure a second quantity using the most appropriate instrument	Again, any quantity, it does NOT have to be one of the variables
P7	Explains the choice of the second measuring instrument with reference to the scale of the instrument as appropriate and/or the number of measurements to be taken	As for P5
P8	Demonstrates knowledge of correct measuring techniques	Good candidates drew on their own experiences when planning the readings. A timing marker at the centre is one technique. Another is using the laptimer to record the time when the voltage reaches a certain value - this is much more precise than trying to read 2 meters simultaneously. The technique should improve the measurement.
P9	Identifies and states how to control all other relevant quantities to make it a fair test	'All the variables' is the key here. If there are none to control the candidate should explain why. A_0 in the pendulum and 'supply voltage' in the capacitor experiment should be recorded and checked
P10	Comments on whether repeat readings are appropriate for this experiment	Repeats are appropriate if they improve the reliability and accuracy of the data. Candidates should explain why this is the case, it is not enough to say that repeats will be taken. Candidates must say that a mean value is obtained

P11	Comments on all relevant safety aspects of the experiment	Only sensible remarks were read. If there are no safety concerns then that should be explained – 12 V electricity is safe *because* it will not give the careless user a shock. The power supply unit might need more thought
P12	Discusses how the data collected will be used	In effect a comparison with the equation of a straight line is expected. Deriving the experimental equation will help with A10 too.
P13	Identifies the main sources of uncertainty and/or systematic error	This refers to the method as well as the measurements
P14	Plan contains few grammatical or spelling errors	This refers only to the plan
P15	Plan is structured using appropriate subheadings	Many good candidates followed the marking grid – which is fine but some headings are still needed.
P16	Plan is clear on first reading	Is the written communication clear? This implies the correct use of technical terms. Clarity in describing the actual method is what is looked for.

B: Implementation and measurements

Ref	Criterion	
M1	Records all measurements with appropriate precision, using a table where appropriate	The numbers should show the precision of the measuring instrument, P5 & P7 should concur. A common mistake is to record time in seconds as 10, 20 instead of 10.0, 20.0. The latter suggests a precision ten times better and which is probably true.
M2	Readings show appreciation of uncertainty	Best is ± at top or bottom of table since candidates are expected to appreciate the uncertainty in what they are reading.
M3	Uses correct units throughout *measurement*	This is for using correct units throughout *measurement*
M4	Refers to initial plan while working and modifies if appropriate	Candidates must say why no modification was needed if none was done, it is not enough to award the mark for 'what was seen'
M5	Obtains an appropriate number of measurements	Usually at least 6 to plot a linear graph
M6	Obtains measurements over an appropriate range	Are the points evenly spaced or bunched near a sharp change? Is the candidate thinking about the measurements as the work proceeds?

C: Analysis

Ref	Criterion	
A1	Produces a graph with appropriate axes (including units)	The quantity plotted determines the units of the gradient, so logarithmic quantities must be dimensionless. The plot is thus ln (x/m) for example.

A2	Produces a graph using appropriate scales	Data must occupy half of *page* on both axes and scales and must be simple so that gradient calculations and interpolation are easy. The origin need not be shown
A3	Plots points accurately	Two plots are checked, these should be underscored, misplots circled. Choose the two most off the line.
A4	Draws line of best fit (either a straight line or a smooth curve)	Lines must have points on both sides.
A5	Derives relation between two variables or determines constant	This is for the gradient calculation and the link to the constant in the briefing with negative signs where appropriate
A6	Processes and displays data appropriately to obtain a straight line where possible, for example, using a log/log graph	The evidence is the appropriate graph
A7	Determines gradient using large triangle	At least half of the drawn line
A8	Uses gradient with correct units	There might be no unit, as in a log-log graph
A9	Uses appropriate number of significant figures throughout *calculations*	This is for using appropriate number of significant figures throughout *calculations*
A10	Uses relevant physics principles correctly	This mark is for the use of good physics seen anywhere, use of mathematics in showing why the chosen line is straight is one way of doing this. A relevant description of the physical change that explains the results is another. One candidate said '*the temperature rise releases more charge carriers meaning that the current rose at constant voltage'*
A11	Uses the terms precision and either accuracy or sensitivity appropriately	These can be seen anywhere, some candidates discussed them in the plan
A12	Discusses more than one source of error qualitatively	This is a *review* of the uncertainty in the light of P13 and experience of doing the experiment and must be based on the evidence from the method/results/graph
A13	Calculates errors quantitatively	A % uncertainty is expected on every measurement
A14	Compounds errors correctly	This can be gained by *using* error bars, it is not enough just to draw them.
A15	Discusses realistic modifications to reduce error/improve experiment	Good candidates explained how the modification improved the readings. Candidates who said '*use a datalogger*' without explanation did not get the mark.
A16	States a valid conclusion clearly	This should refer to the aim
A17	Discusses final conclusion in relation to original aim of experiment	This should refer to the quality of the data. The best candidates compared the % uncertainty and the % difference to back up their conclusion
A18	Suggests relevant further work	Further work should be both relevant and realistic. It should aim to be the non-trivial follow-up experiment that could be performed by the same student in the same laboratory.

Examiner Tip

When your students have carried out one of the exemplar tasks ask them to mark each others' work and use the resulting discussions as a training exercise.

Administration points

It was difficult to give some candidates credit because the briefing sheets were not included. Each candidate's work should have the briefing paper attached along with the Candidate Record Form; for route 1A the mark sheet should be with these. It is a good idea to check that the marking grid agrees with the mark on the script. There should be a line ruled under the completed plan and no planning marks can be awarded after this.
It is a great help to all if the candidates can write on only one side of the paper in black ink. Each sheet should be named and numbered in order and all the sheets connected with a treasury tag. Since the work is all carried out in examination-style conditions this should be easy to achieve.

EXAMINER'S TOP TIPS

Most candidates could improve easily by looking closely at
P5, P7, P13, M1, M4, A1, A9, A13 and A15

Statistics

Grade	Max mark	A*	A	B	C	D	E	N
Raw boundary mark	40	35	32	29	26	24	22	20
Uniform boundary Mark	60	54	48	42	3 6	30	24	18

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code UA024552 Summer 2010

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH