Teacher Resource Bank

GCE Physics A

General Advice on Marking the ISA

General Advice on Marking the Investigative Skills Assignment (ISA)

Overview

The mark schemes for each ISA have been devised by a team of experienced examiners. They have tried to anticipate all possible responses worthy of credit. For consistency, it is essential that all centres mark exactly to this scheme.

For ease of use the mark scheme has been presented in tabular form. Concise answers are given in the middle column. More detailed explanatory notes for some questions are included in the third column.

Marking of Stage 1 of the ISA – student data and graph – should ideally be completed before the ISA written test to ensure that candidates do not change any data (alternatively, centres would have to take other steps to ensure that candidates did not change any information on their data script/graph). The marking of this section should be annotated with a red tick or cross on either the script or graph paper at the point where the mark has been awarded. The reference letter for this mark point from the mark scheme should be written at the side of the tick, eg '✓b' or '×b'. If a particular mark point is allocated two marks or more, an equivalent number of ticks or crosses should be shown, eg '✓✓d'. No other comments or feedback should be written on the candidates' script. The total mark for this section should be written at the top of the paper. This will be transferred to the grid on the front page of the ISA test booklet.

Marking of the ISA test should be done using a red tick to represent each mark awarded. Further annotated comments can be added where necessary as an explanation as to why a particular point has been awarded. This will be useful in the moderation process. For questions relating to the graph, the ticks or crosses should be written on the graph. The total marks for each question should be entered on the grid on the front cover of the ISA booklet, and the total mark calculated.

More information regarding marking will be given at the Teacher Standardising meetings held in the autumn term. Assessment Advisers are allocated to each centre and they can also advise on the marking process.

Confidentiality

To ensure confidentiality, mark schemes or detailed verbal feedback on any marking points must not be given to candidates after completion of their ISA test. The two sample ISAs provided by AQA can be used by centres to give formative feedback to their candidates in preparation for future ISA tests.

Centres can, at their discretion, give candidates details of the raw mark achieved on a particular ISA test. It should be made clear that this mark could change after the moderation process.

Abbreviations Used in ISA Mark Schemes

ecf
Error carried forward - this means that a candidate can be awarded credit for a numerical calculation where they have used incorrect data from a calculation in a previous part of the question.

3 marks max
This means that from a list of 4 or more alternative answers a maximum of 3 marks only may be awarded, even if the candidate states 4 or more of the correct responses.

/
The slash symbol, /, is used to separate alternative correct responses. This is usually followed by a tick symbol (✓) indicating one mark for either of the alternative correct responses.

sf
Significant figures.

bod
Benefit of doubt. Often annotated to indicate that the marker acknowledges the response is 'only just' worthy of credit.

ne
Not enough. Often used to indicate that the response contains some relevant information but not enough to award a mark.

Marking of Tabulated Results and Graphs

Tabulation of results, plotting graphs and measuring gradients feature in all AS ISA tests. The following guidance outlines the general principles in marking these features.

Tabulation

In part 1 of the ISA, candidates have to design their own table in which to present the experimental data collected (in some situations, credit may be awarded where the data is displayed in neat vertical columns, but without vertical rulings. Although this practice would normally be discouraged, the essential requirement is that the data is recorded in a clear and unambiguous manner). The table must include column headings labelled with the appropriate physical quantity and units. This should be in the form, in line with the ASE convention, of quantity/unit, eg current/amps or I/A. Either words or standard symbols for both quantity and unit are acceptable. All centres should encourage their students to use this format since examination papers and modern textbooks all use this format.

Credit can also be awarded for units quoted in other formats; eg height (metres), h (m), height in metres, h in m, (do not allow h, m **or** h/m^{-1}).

If no unit is given the column heading then credit may also be given where the unit is written after every result in the table (without exception).

Significant figures for raw data recorded should be compatible with the precision of the instrument used, eg an ammeter which reads to precision of 0.01 A. A typical small reading on this instrument might be 0.30 A (quoted to 2 significant figures). A larger reading should be recorded as 1.40 A (quoted to 3 significant figures but still compatible with the precision of the instrument).

Where appropriate, tables should also include columns for repeat readings and processed data together with column headings and units. As a general guide, significant figures for processed data should be consistent with the raw data.

Graphs

Graphs should be plotted on A4 graph paper with either 1 mm or 2 mm squares. Graph scales should have sensible divisions on which points can be easily plotted and read (ie not generally in multiples of 3, 4, 6, 7, 9 etc). Axes should be labelled with the plotted quantity and unit. This should be in the same form as column headings in line with the ASE convention, ie quantity/unit. The scale should be chosen so that the plotted points occupy as large an area of the paper as possible. As a general guide, a scale would be deemed too small if the plotted points do not occupy at least half the length of each axis. Such a scale could easily have been doubled. In some cases this will require starting either or both axes at a suitable non-zero value.

It is good practice to ensure that all graphs have an appropriate title.

The plotted points should ideally be represented as a small horizontal cross '+' or a small diagonal cross '×'. Other forms of representing the plotted point will also be accepted provided they clearly show the precise position of the plotted point eg a small but well defined dot. Error bars will not be required at AS level. When marking plotted points, a point would be deemed as correctly plotted if it is a distance of 1 mm or less from the correct position.

Where the plotted points suggest a straight line, the line should be drawn with approximately equal numbers of points on either side of the line. A ruler or straight edge should be used.

Points which are obviously anomalous should not unduly influence the line (candidates should indicate that an anomalous point has been ignored when drawing the line of best fit). If the plotted points suggest a curve, a smooth curve should be drawn.

Where a gradient is to be calculated, a suitably large triangle should be used. Candidates should be encouraged to draw as large a triangle as possible to ensure accuracy of the calculated value. As a general guide, candidates should be instructed that the minimum size of triangle is where both the x-step and y-step are at least 8 cm (this is approximately half the size of the smallest axis). However, on occasions, in some ISAs, we may suggest that a slightly smaller triangle is allowed dependent on the data collected.

Where a gradient is taken from two points on the graph, the points must be sufficiently far apart to be equivalent to a 'large' triangle as defined above. The gradient should not be taken from plotted points which do not lie on the line of best fit.

Where an intercept is required this can either be read directly from the axis or, in the case of axes not starting from zero, a suitable calculation may be required.

Sample marking of derived data and graph points

In Stage 1 of the ISA
It is necessary to check a sample of derived/processed data values or graph points when marking candidates' work.

A minimum of two graph points or two data samples (in each column) should be checked, focusing on any suspect data. It is essential that the samples checked are indicated by drawing a red square around the data value or graph point. Moderators will usually then check the points/data indicated when remarking samples of work from centres.

For processed or derived data (eg mean value, sine etc) all samples must be correct for the mark to be awarded. If one of the initial two samples is incorrect then no mark should be awarded.

For graph points one misplot is allowed in a typical sample of 6 or more points plotted (for a graph with double this number of points, two misplots can be condoned). If on checking the initial sample of two points, one of these is found to be incorrect, it will be necessary to check the remaining points to establish that there are no further misplots.

In the ISA test paper
All derived or processed data values and graph points must be checked to award the marks indicated in the mark scheme.

Error carried forward (ecf) in relation to tables and graphs

Where graph points are plotted from processed data, the mark(s) can still be awarded for correctly plotting the incorrect data values recorded. The mark should be indicated with a red tick and an indication of 'ecf' from data values (candidates will have already incurred a penalty for incorrect derived data values).

Where a line of best fit has been drawn through incorrectly plotted points the line can still be awarded credit, provided it is appropriate for the points plotted. Again indicate 'ecf' when awarding the mark.

Questions in the ISA test paper relating to the graph
These can still be awarded credit as an 'ecf' mark where the line shows a different relationship to that expected, eg where a line was expected to be a straight line through the origin, mark(s) might be awarded for describing this and explaining that this indicates direct proportionality. Where a line does not go through the origin, candidates might be awarded credit as 'ecf' for some statement which acknowledges that the line does not go through the origin, and indicates an understanding that the relationship is not directly proportional/or is of the form $y = mx + c$ etc.

Ecf marks are not allowed on gradient calculations where incorrect reading of data from the graph leads to a gradient value outside the tolerance quoted in the mark scheme.