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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics

PHA3/B3/T Investigative and Practical Skills in AS Physics

Report on the Examination

2010 examination - June series

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GCE Physics, PHA3/B3/T, Investigative and Practical Skills in AS Physics

General Points

In both ISA tests candidates were able to follow instructions on the task sheet and successfully take appropriate results. Feedback from centres suggested that the experiments worked well and no specific problems were reported.

In samples remarked by moderators both ISA P and ISA Q were present in approximately equal numbers as candidates' 'best mark', suggesting equivalence in standard of the two ISAs.

Administration Procedures

The vast majority of centres followed administration procedures efficiently, and ensured that sample scripts and Centre Mark Forms arrived at the moderator by the prescribed deadline. There were problems with a few centres with scripts arriving well beyond the deadline and Centre Declaration Forms and Candidate Record Forms missing or unsigned.

Marking

A tolerance of ± 3 is allowed on the ISA test before centre marks are adjusted. The majority of centres marked the scripts accurately in accordance with the marking guidelines. Most centres were within the allowed tolerance, and only a small number of centres had marks adjusted. It should be noted that just one script out of tolerance in the preliminary sample remarked by moderators will automatically mean that further samples will be remarked and an adjustment to all the centre marks is then likely.

Overall there was an improvement in the marking of graphs in line with the issues covered at the Teacher Standardisation Meetings last autumn. There are still problems with some centres, however, where marks were again awarded for unsuitable scales, incorrectly plotted points and inappropriate lines of best fit.

Advice is available from the Teacher Resource Bank on the AQA website and from the allocated Assessment Advisers. Further details of marking errors in specific questions are mentioned later in the detailed report on each ISA.

PSA

As expected, most middle and higher grade candidates achieved full marks (nine) on this component. Less able candidates typically did not gain one or two marks out of the nine available.

ISA P – Refraction through a glass block

Stage 1

Most candidates scored well on this section with a large proportion achieving nine or ten marks. Virtually all candidates were able to set up the equipment and take appropriate readings of angles of incidence and refraction successfully. A few candidates lost marks for not taking repeat readings. Some candidates chose a fairly restricted range of angles of incidence, and this usually required plotting the scales on both graph axes from non-zero values in order to achieve marking point 'g' (suitably large graph scale). The most common error on graphs was inappropriate line of best fit, usually caused by trying to 'force' the line through the origin. The line of best fit should have an approximately equal distribution of points around the line.

Section A

Question 1

Part (a) was an easy question for most candidates. The uncertainty should be equal to the protractor precision.

Part (b) (i) should be based on the spread of repeat readings. Where repeat readings are identical the uncertainty is the protractor precision.

'Error carried forward' was allowed from an incorrect answer in part (b) (i). It is important that teachers check the candidates' calculation where ecf is applied.

Only the more able candidates giving two correct reasons to part (c).

The answer to part (d) must relate to the candidates own graph for this experiment. The first mark requires reference to whether or not the graph is a straight line **and** if it goes through the origin. Reference to both the line and origin are required for the mark. The second mark is for the relationship between the plotted quantities.

Many candidates referred to the relationship being directly proportional when the line did not go through the origin, and this should be penalised. Where candidates have plotted a graph with non zero origin they cannot conclude direct proportionality. The first mark should be awarded for stating that the graph is a straight line but it is not possible to say whether or not it goes through the origin. The second mark should be awarded for a 'linear relationship' or 'proportionality'. The second mark could also be awarded for suggesting the relationship is of the form $y = mx + c$.

Although some candidates were confused as to what was required in part (e), most candidates were able to perform this simple rearrangement.

In part (f), many candidates stated either refractive index or 1/refractive index. It is essential that the answer refers to the appropriate media or materials.

For part (g), it is essential that candidates show the distances measured in relation to the light rays or normal. No marks should be awarded where candidates have simply drawn a triangle and referred to the trigonometric relationships, but made no link to actual experimental situation with either the light rays or normal.

Section B

Question 2

Parts (a), (b) and (c) were straightforward and accessible to all but the least able candidates.

Again, part (d) an easy question for most candidates, although there were many scripts where marks were lost due to 'triangles' being too small (should be minimum 8 cm × 8 cm). Other common errors included incorrect reading of data from graph and too many significant figures on the final answer. In some cases these errors were missed by markers.

Parts (e) and (f) were answered well by more able candidates, but less able candidates were unsure of the appropriate relationships and theory.

Question 3

This was the most discriminating question.

Although part (a)(i) was very straightforward, many candidates did not understand what was required in this part of the question.

Many candidates were unsure what was meant by the term 'range' in part (a)(ii).

In part (b), only the most able candidates correctly related uncertainty to '0.5 × range' from part (a)(ii).

Only the more able candidates were able to recognise that the key point in parts (c) and (d) was the difference in angles of 2.5°, and the fact that this could be measured with a protractor with precision of ± 0.5°.

Question 4

Most candidates could give one advantage in part (a), but only the more able could give the two advantages given in the mark scheme.

In part (b), most candidates referred to the danger in using lasers. To achieve the mark the actual danger must be specified, eg reference to eyes.

ISA Q – Cylinder rolling down incline

Stage 1

Most candidates scored well on this section with the vast majority achieving nine or ten marks. Virtually all candidates were able to take appropriate readings following instructions in the task sheet. Many candidates lost the mark for marking point (c) by quoting distances to the nearest cm rather than to the nearest mm. Frequently, less able candidates did not give the correct unit for t^2 (as s^2). This incurs a one mark a penalty in either marking point (b) or (h). Some candidates did not gain marks on graphs, usually due to inappropriate scales or lines of best fit.

Section A

Question 1

Part (a), was answered correctly by all but the least able candidates.

Part (b) discriminated quite well, with only the more able candidates able to give two appropriate reasons. The following responses were not allowed; 'human error' without reference to 'reaction time', 'random error' without specifying exactly what the random error is and 'air resistance'.

Part (c) should be calculated from '0.5 × spread of repeats'. In the very unlikely event of identical repeat timings, the uncertainty would be the stopclock precision (typically, ± 0.01 s).

The answer to part (d) must refer to the candidates graph from stage 1. Where candidates plotted a graph with non zero origin, they can still achieve the full three marks for this question. Their answer must refer to the fact that it is not possible to say whether the prediction is supported because it is not possible to say whether or not the line will pass through the origin.

Likewise, full credit can be awarded if the candidates graph is a curve as explained in the mark scheme.

Part (e) (i) was a good discriminator, with more able candidates usually referring to the steeper slope giving shorter times and corresponding greater percentage uncertainty in timings.

For part (e) (ii), many candidates referred to carrying out the experiment in a vacuum. This was not allowed as such an arrangement would be impossible in a school or college laboratory.

Section B

Question 2

Parts (a) and (b) were accessible for most candidates.

Only the more able candidates achieving the maximum three marks to part (c). Many candidates incorrectly squared (rather than doubled) the percentage uncertainty in v to achieve the percentage uncertainty in v^2.

Part (d) also discriminated well. Many candidates described a method to measure the 'average velocity' down the slope rather than the 'final velocity' of the cylinder. The mark scheme gives full details as to how the three marks should be allocated. Many candidates did not achieve full credit by omitting to state precisely what distance was measured and/or how the final velocity should be calculated.

Inappropriate lines of best fit were evident on a significant number of scripts in part (e), although this part was accessible for most candidates.

Question 3

As in ISA P, part (a) should be an easy question for most candidates. Many candidates again did not achieve full marks mainly due to 'triangles' which were too small (should be a minimum of 8 cm × 8 cm), misreading data from the graph and too many significant figures on the final gradient value.

Although relatively straightforward, only the more able candidates were able to identify the gradient from the equation given in part (b).

Question 4

This question discriminated well, with only the more able candidates achieving full marks. Many variations were possible, but the same marking points could be applied to each variation.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.