OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL PHYSICS

PH05 Paper 5

Report on the examination

June 2018

REPORT ON EXAMINATION: INTERNATIONAL A-LEVEL PHYSICS PH05 UNIT 5 JUNE 2018

This was the first sitting of this examination and the cohort for it was small. The cohort represented the full ability range.

The paper as a whole seemed to be accessible to the students and there was no indication of timing being an issue. In general, students found the practical and data analysis section to be slightly easier than the synoptic questions. It was pleasing to see the improved level of comfort with practical and data analysis questions as these had been relatively poorly answered in the first two sessions of the AS level papers. The most challenging practical question was question 4. Students were not good at selecting which details it was important to give when describing how to perform an experiment and analyse the results.

Mathematical questions were answered better than written explanations. Good students set out their mathematical work in a systematic way that was easy to follow. Students should be advised to organise their mathematical work. Those who do tend to be more successful and, if not completely successful tend to access more compensatory marks as it is clear when they have done some meaningful work. It is particularly import to organise work properly in “show that” questions since, for these questions, marks are not given for finding the correct answer but for clearly demonstrating the steps needed to get to the correct answer. In general, students used significant figures well but there are some areas in which judgements about significant figures are difficult. For example, when estimating errors and uncertainties, the estimates themselves are imprecise and this should be reflected in the use of few significant figures when quoting values for percentage and absolute uncertainties. When finding the logarithms of experimental values it is often necessary to use rather more significant. Students should be guided by the numbers of significant figures that may realistically be used in the graphs that they draw.

Some calculations were found to be challenging. This is not unexpected as, in a synoptic question, the calculations may arise from any area of the specification.

Written explanations were sometimes good but at other times lacking in relevant detail. Selecting appropriate ideas is the first step in a successful answer. Once again, in a synoptic paper, this is always going to be more difficult as the whole range of ideas from the specification is available. Students could be advised that careful reading of the question is needed – there are always details within the stem of questions which are germane to the answers.

QUESTION 01

In part 1, although most of the students could find the gradient of the graph, few gained full credit because they did not show their data extraction on the graph. Students should be advised that they ought to draw a large triangle or other appropriate reference marks onto their graph to show how they are finding their data.

Part 2 was generally well done. A few students gave their final answer to an inappropriate number of significant figures. In this question, students were instructed to use their answer from the previous part to calculate a value for *g*. Students who used alternative methods were unable to gain the marks here.

Some students adopted the correct approach to part 3 but they were in the minority. Students were expected to use the extent of the error bars to draw lines representing maximum and minimum gradients. They were then expected to use their new gradients to find maximum and minimum values for *g*. Students could usefully be advised that it is not necessary for graphs of this type to go through the origin – experimental procedures may include systematic errors that result in the best fit line not going through the origin.

QUESTION 02

Part 1 was well done.

In part 2, students were uncertain about the reason for making multiple measurements. The most common acceptable comment was that it was necessary to confirm the uniformity of the wire.

Students were fairly successful with part 3. The most common error was to give the mean value to too many significant figures. Students should appreciate that the act of taking a mean does not increase the appropriate number of significant figures. They should also know that, for the purposes of these examinations, the absolute error is identified as half of the range of values.

In part 4, students showed that they were not confident in finding percentage uncertainties. There were also a lot of powers of ten errors in the calculation of the area.

There were a good number of successful answers to part 5. Students usually knew that they had to add percentage uncertainties. Once again, well organised work tended to be correct but it was difficult to find any credit-worthy responses in less well explained work. Students found the final part of the question to be difficult. Some students recognised that the percentage uncertainty in the area would become smaller. Few quantified this to say that the percentage uncertainty in area would be a quarter of the original value. Very few recognised that doubling the diameter would reduce the resistance by a factor of 4 and thus increase the percentage uncertainty by the same factor.

QUESTION 03

Students tended to calculate the logarithm of h correctly but again, a few used inappropriate numbers of significant figures. In this case, 3 or 4 significant figures were expected.

When drawing the graph in part 2, many students chose inappropriate scales resulting in lines that were difficult to extract a sensible gradient from. Students should be advised that their plotted points should cover at least half of the available space on each axis. The gradients were correctly determined by most of the students. A few omitted the negative sign and some got gradients outside the permitted range or used inappropriate numbers of significant figures.

In part 4, very few students got the unit correct. Clearly, many failed to recognise that the exponent in the equation must be dimensionless. Although most got the magnitude of the answer correct, a significant number of students performed new calculations, not realising that the magnitude of the answer was the same as the magnitude of the gradient.

In part 5, students were clearly unsure of what is meant by a systematic error. Those who identified the ruler often gave the unlikely answer that the ruler was badly calibrated rather than the far more likely answer that the zero mark was not positioned correctly.

Part 6 was poorly answered. A common misconception was that systematic errors would have no effect as they would affect all results equally.

QUESTION 04

There were some very good answers to this question but they were in the minority. Students should be advised that they are expected to give details of, for example how many oscillations would be timed and how many different values of length would be used over which range. They should also be specific about the calculations they would perform on their data and the graph that would be drawn. It is almost universally expected that a graphical technique would be used. To verify the formula, it is necessary that their graph of T^2 against l^3 goes through the origin, in addition to it being a straight line.

QUESTION 05

In the first part of this question, most students understood that the particles would lose electrons leaving them with a net positive charge.

Part 2 was often correctly done. Students should be advised that, in “show that” they are explicit about what equations they are using. Random arrangements of numbers ending in a correct answer are not sufficient.

Part 3 was done correctly by most students although some did not show an algebraic equation before using numbers. The purpose of “show that” questions is to make students be explicit and complete in their mathematical work.

Very few students managed to complete part 4 successfully. Few saw that they only had to calculate the size of the force on the particle and then to use the appropriate equation of motion to determine whether or not the particle would move through a vertical distance of 56 mm during the passage between the plates.

There were some reasonable answers to part 5. Some students had not noticed that the particles had been described as electrically conducting. These students assumed that the build up of particles reduced the field strength. It is important for students to read all of the details in contextualised questions. Some students made statements about effectiveness without backing them up with any physics argument.

QUESTION 06

Part 1 was well done by nearly all of the students.

Many also did part 2 correctly. Of those who did not manage the calculation, some wrote down a lot of figures without explanation. Such students risk losing marks that they may have gained for partly correct solutions. Such marks can only be given when it is reasonably clear what students are trying to do.

Part 3 was poorly answered. Few students realised that high pressure gases are likely to breach the volume and/or intermolecular force stipulations of the kinetic theory of gases.

In part 4, students did not appreciate that the steam releases latent heat as it condenses. Once again, students could usefully be encouraged to read the contextual information carefully as it will contain information that may be helpful in stimulating correct responses.

The calculation in part 5 was well done by most students.

There were many correct responses to part 6. A relatively common mistake was to ignore the fact that the generator had 3 coils - the current in only 1 coil was needed. Again, this is an example of an instance where it important to extract important information from the text of the question. The other common mistake was to give a lot of unsupported numbers without any guidance about what the student was attempting. In the final part of the question, despite being asked to use the ideas of electromagnetic induction in their explanation, a significant number of students did not. Having established that an emf is induced in the rotating coils and that emf causes a current to flow, students should have gone on to describe the force on a current carrying conductor in a magnetic field.

QUESTION 07

Most of the students seemed to know something about resonance. Some mentioned either the large amplitudes or the fact that the driving oscillation has the same frequency as the driven oscillation but rarely both. Students should use the mark allocation to guide them into giving answers with the appropriate level of detail. Student’s sketch graphs in the second part were generally not detailed or careful enough to gain full marks but most students gained part credit for this question. Students are reminded that, where axes for a sketch graph are presented with a scale, they are likely to be expected to give relevant detail – in this case, the frequency at which the maximum oscillation occurs.

In part 3, many students appreciated that damping reduces the amplitude of oscillations, few mentioned the removal of energy from oscillating systems and “slowing down” of oscillations was a common idea.

In part 4, the calculation was generally well done. The most common mistake was to use a distance of 3.5 cm instead of the full distance of 7.0 cm.

In part 5, few students got much beyond substituting data into the given equation. Many also continued to use the 3.5 cm rather than the full distance travelled by the microwaves. Few realised how to use the fraction of the energy absorbed on reflection. In the final part, most students thought that the selection of frequency was to do with ionisation causing damage to children rather than to do with the greater attenuation experienced at higher frequencies and the greater distances involved in scanning adults.

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