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Grade Boundaries

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General

The paper WPH06 used to be called 6PH08 and remains the International Alternative to Internal Assessment unit 6PH06. It assesses the skills associated with practical work in physics and addresses the skills of planning, data analysis and evaluation. Set in a wide variety of contexts the questions will be more accessible to those candidates who have, themselves, carried out a range of practicals in the laboratory and a plan at this level will consist of several stages. There are questions concerning choice of apparatus, and the use of that apparatus, that will be immediately familiar to those with the practice behind them.

The paper for January 2014 was in the same format as previous years and with much the same content although this appeared in different questions. The topics and contexts are new each time and it is this aspect that causes difficulties to candidates who do little practical work for themselves.

Generally the candidates were well prepared and seemed familiar with all that was asked of them, it was the planning question, question 2 this year that they found difficult although question 4 also spreads out the candidates.

Specific

Question 1 was about two methods of measuring the circumference of a cylindrical object.

1a(i) The precaution required was expected to be specific to the micrometer screw gauge and not a general one such as ‘measuring at different places’ which would have applied to any instrument. Some candidates write down a number of precautions hoping to hit upon the right one, this is not a good approach. Parallax is one such option yet this is never awarded a mark by itself and indeed does not apply to the micrometer.

1a(ii) This question was answered well by most candidates who used an appropriate number of significant figures and units. Oddly many of those converting to metres used only 2 SF and lost a mark.

1a(iii) A mark was not awarded for candidates who said 4/10 = 0.4. They were expected to identify that the uncertainty in x was 4 mm and this was divided by 10 because of the method used. The real point is that the percentage uncertainty remains the same yet this was mentioned by very few candidates.

1a(iv) This was a straightforward substitution but as a ‘show that’ question candidates must quote one significant figure more than is in the question – so here 3 SF was required. There were some rounding errors leaving the answer as 0.125.

1a(v) Very few candidates knew that when quantities are added or subtracted it is the actual uncertainties that are added. Some candidates tried to calculate the maximum and minimum values and this is a method that will always gain the mark in a question about uncertainties.

1a(vi) This was done well by many candidates who realised the answer to (ii) and (v) were needed here.

1b(i) Candidates were to use their answer to 1a(ii) in a simple substitution and most did this successfully although a number got the unit wrong or used too many SF.

1b(ii) Most candidates doubled their answer in a(v) and were awarded the mark.

1c(i) Candidates are expected to relate the instrument to the measurement in terms of precision and range. The expected response is that the percentage uncertainty is small – not ‘less’ or ‘smaller’ as there is no comparison. ‘Human error’ is never a correct answer, candidates must say what the human might be doing wrong.

1c(ii) This was generally done well, marks were awarded if the candidate used the range or the half range but not the precision of the instrument – the table shows it is smaller than the spread.

Question 2 asks the candidates to plan an experiment in the context of heating. Once again general answers attract no marks as all responses must be in the context of the practical described. The best candidates thought their way through the experiment as if they were actually doing it and used the marking points to guide their answer. The term ‘error’ should not be translated as mistake. Here the method used allows much thermal energy to be lost thus causing the equation to be wrong – the error is in the method not the mistake of the experimenter.

(a) All four measurements were expected, better candidates gave these. The temperature difference cannot be measured, rather the initial and final temperatures must both be measured.

(b) The accuracy relies on minimising the heat loss. A large number of candidates simply said ‘parallax when reading the thermometer’ which did not get a mark; a diagram would help.

(c) The errors in a thermal experiment will always be thermal energy loss and at this level it is important to state what is losing the energy and where it is going; so the screw loses energy to the air as it is transferred to the water. There was much confusion about the thermometer touching the side of the test tube or the screw but little stirring or shaking of the water which transports the thermal energy around achieving equilibrium.

(d) The clue here is ‘percentage’ as it is the temperature rise that is small and thermometers have a precision of 1°C usually so the percentage uncertainty in this is very high, credit was given for just temperature as this is the actual measurement made.

(e) Candidates are expected to identify a hazard and the precaution taken to avoid it. Many candidates described using tongs or wearing gloves without saying why and merely ‘taking care’ will not get the mark either without identifying the hazard.

Candidates had to draw a curve of best fit in Question 3 and this is a skill that is difficult but many candidates seemed to have had little practice as curves were rather disappointing.

(a) Some candidates seemed to ignore some plots and drew straight lines which scored zero. A lot of lines appeared to be very thick, candidates will always need to draw a line o best fit in this paper so a sharp HB pencil is an essential tool. Data for a graph is always to 3 SF and many candidates made a mistake on the scale reading or quotes their answer to 2 SF, thus losing the second mark.

(b) This was done well by few candidates, plotting a combination of variables on one axis was an idea that many shied away from. The mark for the unit for C was given if it was correct for the graph the candidate had described but this was also often incorrect.

Question 4 concerns data handling and candidates find this difficult although the good ones did well few managed to get through to the end successfully.

(a) This piece of theory seemed to catch candidates by surprise and quite a few talked about the photoelectric effect which was disappointing. Candidates most commonly scored one mark but failed to identify an energy transition as causing the emission.

(b) This quite standard question scored one mark usually as candidates were expected to identify the fact that n is constant as the reason the line was straight, the gradient is n which is constant.

(c) Graph plotting continues to trouble the candidates and remarkably few scores all four marks. The log values should be t 3 SF as that is the precision required for graph plotting, most candidates did this although there was a high number of rounding errors this year. The way to label a log axis is as log or ln(quantity/unit), thus ln(f / Hz) is what is required, this should be in the table as well. This year a very large number of candidates tried to spread out their axes by using multiples of 3 or 6, this loses the scale mark but usually also results in the candidate making a mistake in the plotting or the gradient calculation by mis-reading their own scale. Spreading the plots across half of both axes is what is required. The plots should be small crosses – the sharp HB pencil is invaluable again – many candidates draw a blob which often loses the mark; simple dots get hidden by the line and are not suitable either. The line of best fit almost never joins the top and bottom plot, there should be as many plots above the line as there are below it. Gradient calculations were generally done well with large triangles drawn, the best candidates continue the line to the edges of the grid which usually makes reading two of the values much easier.

(d) Candidates were expected to find the percentage difference between their value and 2. When this was in a different question candidates did it with ease but many did not do this and those that did failed to compare their difference to reasonable experimental error.

(e) Candidates were expected to describe the use of the coordinate of a point on the LoBF and the gradient to calculate the value of the y-intercept, the ln Z = 0 line was rightly seldom on the graph. Almost no candidate did this but many correctly identified the exponential required to obtain the value of P from the

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