OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL PHYSICS

(9630) PH05

Report on the examination

January 2024

REPORT ON EXAMINATION: INTERNATIONAL A-LEVEL PHYSICS (9630) PH05 January 2024

GENERAL

The cohort for this examination was relatively small and so the following comments should be viewed in light of the size of the sample.

Numerical questions were better answered than written explanations. Graph plotting is also improving, with fewer students choosing inappropriate scales. However, they should be reminded that, when extracting data from graphs, the normal range of extraction is ±½ square. In addition, when attempting "show that" calculations their answers should be to more than the number of significant figures provided. Some students used g as 9.8 in question 06.2 and whilst it was not penalised on this occasion, they should not make this a common practice.

QUESTION 01

In 01.1, more than a third of the students were not aware that random errors could be reduced by repeating and averaging. Many answers stated that just repeating measurements was sufficient without mentioning the averaging process. The meanings of precision and accuracy were the cause of much confusion in 01.3 and 01.4. Students should be made aware of the subject-specific vocabulary that is available in the resources section of the website.

Although many students were able to determine a value of $9.28\ \mathrm{m\ s^{-2}}$ and to work out a percentage uncertainty, they often failed to gain the second mark by failing to comment on how this related to the accuracy.

QUESTION 02

Although the question required students to state reasons, there were some clear and concise numerical responses in 02.1. Some students failed to gain marks through carelessness, for example by referring to uncertainty in the count rate rather than in the count.

The majority of students were able to access at least three of the five marks available. Marking point (mp) 5 was the least commonly awarded mark because students failed to state a reason as to why the same sources could have been used. For mp4, creditworthy alternative analyses were rewarded.

QUESTION 03

The responses to question 03 were disappointing. It was clear that many students had not attempted this practical activity, which is required in the specification. There was much confusion between the diffraction grating and double-slit experiments and their equations. Whilst those making some progress had recognised that an angle of diffraction needed to be determined, they often referred to measuring the angle directly rather than using the relevant lengths and appropriate trigonometry. It appears that many were providing information from their theoretical perspective rather than practical knowledge.

QUESTION 04

Question 04 was generally well attempted by most students. A small minority continue to use a poor choice of scales making plotting of points difficult and not subsequently readable. These students need to show their plots, as marks for a best-fit line cannot be credited when no plotted points are seen. It is also advisable that students label their axes at least every ten small squares. There were some students who only labelled a couple of points on the y-axis, perhaps every 50 small squares. Students are also advised to use a large triangle which they should mark on their graph when determining gradients. The gradients should also be found from points that lie on their best-fit line and not from individual data points provided in the table.

QUESTION 05

Almost 70% were able to take logs and correctly manipulate the equation to show the required intercept relationship.

Those who did not score a mark in 05.2 simply stated that the gradient was constant or positive as it was a straight line.

In 05.3 a large number found the intercept as 10.66 but were then unable to use it correctly by using it in the equation of a straight line. Instead, they simply substituted into the value in the equation in 05.1. This gave them a value of around $5.9\ \mathrm{kg}$ for the mass of the star which students did not seem to question. They should be advised to recognise such improbable answers and check their method and calculations.

QUESTION 06

Many responses in 06.1 failed to link the rise in internal energy of the system to the equation and then to the rise in temperature. Some students used g as 9.8 which in this instance was not penalised. However, they are told to use 9.81 and should therefore make sure that they use it to avoid being penalised in future examinations.

In 06.3 there were many students who thought that five was the appropriate number of significant figures (sf) required for 06.2 as this was the largest number to which the data had been provided. Simply stating 3 without giving an explanation was not credited.

06.4 clearly stated that the explanation required for P and Q reaching constant speed should be in terms of the forces acting on the paddles. However, there were many answers which ignored this and concentrated on forces acting on P and Q, with references to tensions in the string and air resistance. The fact that the opposing forces are negligible when the paddles were moving slowly was rarely mentioned. For marking point 3 the response that the resistive forces were equal to the weight was not credited. Equal *and opposite* were both necessary.

Whilst 06.7 was generally well attempted, a significant number of students used 0.06 for $\Delta\varphi$, or 8240 for Q, or added both temperatures. Nevertheless, they were still able to gain a mark for the use of the equation as long as it had been correctly rearranged with C as the subject.

Students should be advised to give answers to more than the number of sf provided when giving the final answer to "show that" questions, such as $0.9\ \mathrm{N\ m}$ in 06.8, or 9.0×10^{-5} in 07.1, or 9.5 in 08.3.

Equating torques to find the torque applied by the drum was a more popular route than using the gearing ratio.

QUESTION 07

Almost a fifth of the students used the discharge equation in 07.2. Some of those who used the correct equation were unable to manipulate it correctly hence only gaining one of the two marks available.

In 07.3, the first alternative on the mark scheme was rarely seen. In the second alternative the fact that the time constant was much larger than the periodic time was recognised by many. However, the idea of the movement of charge being very small was seen less frequently.

Many students simply wrote down a few equations and numbers for 07.4, without providing any comment or explanation. Answers such as " $C = \frac{20}{19}$ and so $V = \frac{19}{20}$ " were often seen. Students need to be made aware that the examiners cannot be expected to deduce what they mean. The students should be more specific in their responses.

Sinusoidal graphs were poorly attempted in 07.5. Students would benefit from practising drawing sinusoidal graphs.

QUESTION 08

There were many incorrect and out of range values of λ_{peak} . Students should be made aware that the normal range of extraction of data expected from a graph is $\pm$ ½ square.

In 08.2 the students needed to recognise that dips in intensity were a result of changes in energy levels. A significant number limited their answer to "*the photon being equal to the difference in energy level*". Most were familiar with the fact that energy levels were characteristic of atoms of particular atoms.

The most common mistake in 08.4 was to miss out 550 when substituting the distance for Antares.

The most commonly credited mark in 08.5 was for using the equation $F = G\frac{Mm}{R^2}$. Not squaring R^2 or not adding the two distances was seen many times.

A small number of students simply wrote down equations and a final answer without showing substitutions. This should be discouraged and the students advised that in such cases an incorrect answer would disqualify them from gaining any intermediate credit. With substitutions, an error in the intermediate steps might still be creditworthy.

In 08.6 the most popular response was the need for the two stars to have the same angular velocity.

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FAIR ASSESSMENT PROMISE

In line with OxfordAQA's Fair Assessment promise, the assessment design, marking and awarding of this examination focused on performance in the subject, rather than English language ability.

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