OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A LEVEL PHYSICS

(9630) PH04

Report on the examination

January 2020

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REPORT ON EXAMINATION: INTERNATIONAL A LEVEL PHYSICS 9630 PH01 JANUARY 2020

General Comments

This paper had a wide range of question styles that gave students many opportunities to demonstrate their knowledge and understanding over a range of topics. Generally, calculations were the most accessible questions, with those requiring developed arguments or detailed explanations being more challenging.

Question 1

1.1

Very few students obtained both marks for this question. Answers that omitted the mass of the helium or that added, rather than subtracted, the weight were commonly seen. The use of 9.8 for *g* was not condoned given its impact on the final answer; the value given in the Data and Formulae booklet should always be used.

1.2

This question was poorly answered by most students. To gain one mark, answers needed to make a clear link between the factor and its effect on the speed of the balloon. Vague answers were therefore not rewarded, and many answers lacked necessary detail.

1.3

Many students found the calculation of the quantity of helium to be a major challenge, possibly because the value for the helium mass was in the stem of the question. Consequently, very few were awarded full marks, although most gained at least two marks for partial responses. Students should be encouraged to read the stem carefully as information contained there may be required in any part of the question.

1.4

This was generally well answered with many students gaining all three marks. The best answers stated the first law of thermodynamics and made clear statements linking the work done and heat transfer to the processes in the balloon Some students argued that the internal energy increased; this may have been due to them obtaining a positive value for the change in internal energy in part 1.3. The sign convention is an important aspect of the first law, and it was clear that students who understood this had little difficulty with the question.

1.5

Most students realised that a discussion of heat transfer by conduction was required. Although examiners expected to see the conduction equation, students using the *U*-value equation were not penalised on this occasion unless they then argued that the rate of heat transfer increased as the balloon got thinner. Correct responses were most commonly related to the increase in surface area.

Question 2

2.1

This proved to be a challenging question with very few students gaining more than one out of the three marks available. It may be that few are familiar with cooling due to evaporation when latent heat is removed from the surroundings. Many students focused on the idea that the liquid was cool without any reference to the change of state.

2.2

Most students were able to gain all three marks for this question. Those who made an error along the way were more likely to be awarded some partial credit if their answers were set out clearly. Several

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methods for estimating the average temperature of the room were seen. The most successful determined the area under the curve and divided it by the time.

2.3

This question provided little challenge for almost all students. Occasional errors were seen if students attempted to convert the temperature into kelvin. Partial credit was still awarded when it was clear what the student was trying to do.

2.4

Here, students were expected to bring together ideas developed in previous parts of the question to obtain the answer. It was common to see one aspect of the energy transfer being missed, despite the question setting out clearly what had to be considered. The most common contribution omitted was the power of 28 W from the food: the answer to part 2.3.

2.5

This was the most challenging question on the paper. It was clear that most students could not make the link between the reversed-refrigerator system and the ideas behind the calculation in part 2.4. A common misconception was that the aim of the system was to heat the ground rather than the house. The best answers identified the ground being equivalent to the refrigerator contents, with the inside of the house being equivalent to the back of the refrigerator. These students could then successfully show that the extra energy transferred from the ground made the system more efficient.

Question 3

3.1

Only answers that presented a clear step-by-step approach to the energy transfers were able to gain full credit. Commonly the processes inside the Sun, or between the Sun and the Earth, were missed. It was common to see answers with an unnecessary intermediate step using solar panels to provide the electrical energy to operate a pump-storage system. Many students also suggested incorrectly that turbines generate electricity without referring to the generator in the power station.

3.2

The main reasons for students failing to gain all three marks for this question included lack of detail and use of incorrect terminology. This question can be answered on many levels. Examiners were looking for clear statements appropriate to an A-level standard; these were rarely seen. Vague references to radiation did not gain credit and there was evidence that some students confuse fission and fusion.

Question 4

4.1

This proved to be one of the most accessible questions on the paper, with most students obtaining full marks. Students should be reminded that for a ‘show that’ problem, they should give their answer to at least one more significant figure than the value given in the question.

4.2

This calculation question was also well answered. The unit proved to be a problem for some students, with N m being the most common incorrect answer.

4.3

The arguments here were poorly developed. Conservation of angular momentum was often seen as the underlying principle, but few students could then apply it successfully to this context. It appeared that many students felt intuitively that the speed should decrease and attempted to argue for this even when the conservation of angular momentum showed that the speed must increase.

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Question 5

5.1

This proved to be straightforward for most students. Occasionally a mark was lost when students did not recognise that two neutrons were released during this fission process.

5.2

This calculation also presented little challenge to most although some unnecessarily complicated solutions were seen. Students who calculated the total mass before and after, subtracted them to get the mass defect, and then converted this mass to energy were less likely to make a mathematical error in the calculation.

5.3

This question was also answered correctly by many. Occasional problems with powers of ten were seen but these were rare. Again, solutions that were set out clearly were much more likely to gain partial credit when an error had been made.

5.4

Most students were able to apply the conservation of momentum in this context. No reference had been made in the question to the collision being elastic, so the use of conservation of kinetic energy was inappropriate and was not rewarded.

5.5

This proved to be more challenging than the earlier calculations. Many students thought that the range was due to multiple collisions, despite having been told that only one collision had occurred. With two marks available, examiners expected to see two points made successfully in the answer. Students should be encouraged to use the number of marks available for a question to indicate the level of detail required in the answer.

Section B

Most of the objective test questions were correctly answered by the majority of students. Only two questions, B29 and B30, proved to be more demanding.

B29

The correct answer is C and this was given by just under half of the students. The most common distractor was A, probably due to students not realising that the mass of the incident neutron must be included when considering induced fission. It may be that, as this was the first alternative, some students gave this as an answer without reading further.

B30

Fewer than 25% of students gave the correct answer which was A. The most common distractor was D.

This may have been due to confusion between fission and fusion. Alternatively, some students may have put D as they had ruled out all the previous answers. In situations like this, students should be encouraged to discount clearly incorrect answers before choosing between those remaining.

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