GCSE
ADDITIONAL SCIENCE / PHYSICS

PH2HP
Report on the Examination

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General

Questions 1 to 3 were standard demand, targeting grades C and D. Questions 4 to 6 were high demand, targeting grades A and B.

The paper was well attempted by the majority of students who were able to complete the examination within the specified time. There were perhaps more items not attempted by students than previously, with an average of 2.5% across all items.

Question 1 (Standard Demand)

(a) Students seem to find forces conceptually difficult and that was reflected in the standard of the qualitative answers to this question. Few students seemed confident in their understanding of Newton's Laws of Motion; most failed to recognise that this was the clue to providing clear answers. Whilst a significant number of students were able to access a general statement about equal and opposite forces, few could apply that knowledge. A very small minority of students recognised that because the boat pushed on the water the water would push back on the boat and too many failed to say that the forward motion was the consequence of a forward force.

(b) (i) Over half of students earned full marks and a further 40% were able to complete the calculation but incorrectly gave the unit as m/s. A few students threw away marks by either writing the equation or their substitution carelessly or by poor use of a calculator.

(b) (ii) The vast majority of students gained both marks here, either by giving the correct answer or by using the correct method with an incorrect answer from part (b)(i).

(b) (iii) Almost half the candidates circled the 'greater than' box but few then recognised that the driving force had to overcome resistive forces. The most common reason given was the need to move the mass of the boat. There was also a lack of understanding as to what was meant by a resultant force, a term used in many answers.

Question 2 (Standard Demand)

(a) (i) Only one third of students answered this correctly. The most common error was for students to simply name the component J rather than explain why it was included in the circuit and various names were offered for the component, such as diode, alternator, LDR, thermistor and transformer. There were various mistakes and misconceptions, including the idea that the component was a measuring device, or had some safety function to protect the bulb/circuit, or to change the resistance of the bulb, or to control current by keeping it the same. Those students who provided correct answers tended to gain the mark by referring to the need to change or "control" the resistance (not often the current or the p.d.). A worrying number of students want to slow down the current or allow the resistor to stop the current.

(a) (ii) Less than one quarter of students gained the mark for this part question. Most answers referred in some way to the "non-ohmic" characteristics of the component, without explaining that this was due to the increase in temperature. There were some excellent answers in terms of collisions between free / delocalised electrons and the vibrating ions. Very few students gave the simple response that the bulb gets hotter.

(a) (iii) The numerical part of the question was very well answered by the vast majority of students, although a few wrote 12/3 instead of 12 × 3. However the unit mark was only awarded about half of the time. Common unit errors involved the use of (k)joules, ohms, pascals, coulombs, newtons, N/m, dioptre and hertz. Those who used the correct symbol for watt took care, in the main, to ensure that it was upper case.

(b) Many students exceeded the space available for this answer. Two common reasons for this were that they often repeated figures from the table without any comparison (before maybe going on to make some comparison) and secondly they often gave comparisons in terms of one bulb before repeating the same comparisons in reverse for the second bulb. A lot of students reached the end of the space and stopped in midsentence, without any indication that the answer continued elsewhere. Most students were at least Level 2 (3 or 4 marks) with over three quarters scoring 4 or more marks. Students were often able to make good clear comparisons in terms of cost, with higher level answers using the figures to make comparisons of costs for equal lifetimes or showing that, for the same cost as 1 LED, the 6 halogens that could be bought would still not last as long. Answers in terms of efficiency were much less detailed, with many students writing little more than that LEDs were (22%) more efficient. Better answers referred to LEDs being over 3 times as efficient or giving some comment on how this extra efficiency would affect electricity bills or the use of resources to generate electricity and expanding on environmental issues. Good candidates also went beyond the information in the table e.g. the lower maintenance costs for LED to be replaced as they lasted 18 times as long as the halogens. There were several students under the impression that 3 halogens bulbs, at 10% efficiency were nearly as good as 1 LED at 32%, and some tried to do calculations using costs and efficiency together.

Question 3 (Standard Demand)

(a) (i) Nearly two thirds of students scored this mark with the main incorrect answer being uranium; a very few candidates gave thorium instead of plutonium.

(a) (ii) Despite the instruction to the contrary, too many students simply described the fission process. Marks scored tended to be 0 or 3. A significant minority of students did not attempt the question. The most common error in the good attempts tended to be to replace the turbine with the generator, although propellers and rotators were also erroneously mentioned. Those students who answered successfully demonstrated a clear and detailed knowledge of the process, by describing the whole process, including the turbine driving the generator.

(b) The students who knew how to approach this diagram did well. Unfortunately a significant minority of students did not even attempt the diagram. The most frequent error was showing the process as continuing from the two daughter nuclei shown. Often candidates seemed to have an idea of the process but either failed to show it clearly, or did not use labels to support poor diagrams.

(c) Most students who scored at least one mark did so by knowing neutrons were absorbed by the boron, although they often failed to make this absolutely clear. The descriptions for the third marking point too often failed to earn credit, by simply writing as a result “less energy released”.

Question 4 (High Demand)

(a) (i) Only one quarter of students gained this mark, the majority of students starting their answer with 'The time it takes for the driver …'

(a) (ii) A majority of students gained both marks, with most mentioning use of a mobile phone causing distractions as one of their answers. A number of students confused thinking and braking distance, giving weather or road conditions as an effect on thinking distance.

(b) (i) This was well answered with the vast majority of students scoring both marks. A common error was failing to square the speed. This was surprising as the students had usually quoted the correct equation.

(b) (ii) Many students completed another operation despite the question being worth only one mark, as a consequence only half of students scored this mark.

(b) (iii) Some students were let down by the inability to rearrange a simple equation or to divide correctly by 8000. However over half of students were able to score both marks.

(b) (iv) The vast majority of students scored this mark. Those who did not usually gave speed, despite the stem of the question asking for one *other* factor. There were also a number of students who responded with factors affecting the reaction time and thinking distance.

(b) (v) The majority of students scored one mark on this item for either of the two marking points. Unfortunately a number of students did not read the question carefully and gave answers including 'friction is caused between the road and the car', scoring zero. There was little appreciation of work being done to stop the car even though this had been introduced in part (b)(ii).

(c) Very few of students scored all three marks. A number of students did not really read the question carefully enough and wrote an answer describing the effects on braking distance and thinking distance. Many students seemed to think the car would go slower so as not to need to brake so much, and related this to increased road safety. There were many confused answers and students should be encouraged to plan answers to focus on one aspect at a time.

Question 5 (High Demand)

(a) A majority of students scored this mark.

(b) Again, a majority of students scored this mark.

(c) (i) Over half of students scored zero, the most common error being an attempt to change mass and proton numbers in accordance with alpha decay. Students who got the proton number correct almost always scored full marks. The most common mistake made with the mass number was subtracting 1 rather than adding 1.

(c) (ii) Under half of students correctly answered this for both marks. A minority of students scored one mark for correctly identifying four half-lives sufficiently well to gain credit. The most common mistake amongst students scoring one mark was to neglect to

multiply 4 by 8, leaving 4 as the answer. Of the students who failed to score any marks 1200/75 to give 16 days was one common misconception, another was in counting five half-lives, i.e. 1200 as 1 half-life, 600 as 2 half-lives etc. resulting in an answer of 40. A disappointing number of students could not multiply 4 × 8 correctly, giving answers of 24 or 36.

(c) (iii) Only 10% of students scored both marks for this question. Some students scored one mark for correctly stating that the tablets inhibit the absorption of I-131 but not stating the link to a reduced chance of developing cancer. Some students scored one mark for indicating that the tablets did reduce the chance of developing cancer but with incorrect reasoning. Two common misconceptions were that the tablet acted like a vaccination to prepare the body to deal with the radioactive iodine using anti-bodies, or that the non-radioactive iodine would in some way neutralise the radioactivity of I-131.

Question 6 (High Demand)

(a) The correct answer of 35 was rarely given; 8.8 as the resistance for all 4 heating elements was the most common answer. A number of students then incorrectly divided by 4 to find the resistance of a single heating element. These students usually gained a single mark for dividing the p.d. of 230 V by the current of 26 A. The concept of significant figures is still not well understood with very few students scoring full marks.

(b) (i) Very few students scored both marks, however half of students did score one mark. Most answers lacked detail and some made reference to potential difference rather than current. Several students confused current and p.d, writing that 230 V was too high for the wire. Surprisingly few students scored the mark for overheating with many references to plugs/things blowing up and fuses melting rather than the wire.

(b) (ii) A significant minority of students did not attempt this part question. Many students referred to a plug rather than the cable. Some answers suggested that students were not familiar with what a cable was, except in the context of a 'cable grip' in the plug, which made them believe it was the plug that they needed to describe. Very few students scored all three marks, and half of students only scored one mark. The idea of the wires connecting to the pins of a plug was quite common, as were a variety of colours.

(c) Nearly half of students gained both marks. For direct current, frequent incorrect answers included: 'the current goes straight to the device', or 'straight to the source with no wires', 'direct current travels in straight lines'. With regard to alternating current incorrect answers seen frequently included 'alternating current goes up and down', 'only flows in a parallel circuit' or 'goes in many directions.'

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.
UMS conversion calculator