GCSE
PHYSICS

8463/1H Paper 1
Report on the Examination

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General

Grade 4-5 calculation questions ask for students to recall an equation first before using it in a subsequent calculation, however in the 2023 series, students were given an Equations Sheet which had all the equations printed on it. Subsequently, the performance on straightforward calculations has improved on previous years.

Handwriting continues to be a problem for a large number of students, making it very difficult for examiners to read what has been written.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Question 1 (Standard Demand)

01.1 71% of students scored 2 marks on this question about transformers.

01.2 98% of students identified the correct equation. In this exam series, students were provided with all the equations on an Equations Sheet.

01.3 86% of students scored 3 marks. Many students failed to square the current so scored zero for the substitution and subsequent rearrangement.

01.4 84% of students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet. Students who quoted the version of the efficiency equation with power input and power output scored zero.

01.5 95% of students scored 3 marks. An answer of 33.9264 scored 3 marks as significant figures was not being tested in this question part. An answer given to 2 s.f. could score 3 marks with working. If the answer was rounded, the rounding needed to be correct.

Question 2 (Standard Demand)

02.1 The answer needed to refer to the iron block's temperature rather than the room temperature. 'To allow the thermometer time to reach the iron block's temperature' would be creditworthy. 'To allow the iron block to reach room temperature' was insufficient. 36% of students scored a mark for this question.

02.2 70% of students scored all 4 marks. 17% of students scored 3 marks for using a temperature change other than the correct one. An answer of 216.7 was commonly seen

using the total temperature change, which scored 3 marks. If an incorrect temperature change was used it needed to be clear from the graph and subsequent calculation why an incorrect value had been used.

02.3 72% of students scored 2 marks, while 27 % of students scored 1 mark for identifying the effect of adding insulation.

Question 3 (Standard Demand)

03.1 Very few correct answers, only 11 % of students scored a mark. Many students gave answers in terms of charge flow and current which were insufficient. The specification does not mention alternating or direct current, only alternating or direct p.d. Answers like ‘ the potential difference flows in one direction’ were insufficient to score.
. Saying the potential difference only travels/goes in one direction was insufficient, as this suggested charge flow. Saying that ‘the potential difference is always positive’ or ‘the potential difference doesn’t go negative’ were creditworthy. ‘The potential difference is in one direction’ was creditworthy. ‘The potential difference isn’t alternating’ was insufficient.

03.2 Almost all students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet.

03.3 98% of students scored 3 marks on this calculation question

03.4 95% of students scored 3 marks. A small minority of students scored 2 marks, usually due to a spurious conversion of mass from kg to g.

03.5 To score in Level 2, students needed to make comparisons of the movement and arrangement of particles in ice and liquid water. In addition to this, for students to score a Level 3 mark they needed to discuss either the change of state at constant temperature increasing the potential energy of the particles or how the warming of liquid water increased the kinetic energy of the particles. For 6 marks, both these aspects needed discussion. Students found this question difficult with only 9 % scoring 5 or 6 marks and48 % scoring 3 or 4 marks. The mean mark was 3.

Question 4 (Standard/high Demand)

04.1 In this exam series students were provided with all the equations on an Equations Sheet. 57% of students scored 4 marks, while 32 % of students scored 3 marks, usually for incorrectly or not converting the gravitational potential energy. Changing the mass to grams was counted as a Physics error on Higher Tier questions so scored zero for subsequent calculations. A student could still score the mark for the unit conversion of E_p, however.

04.2 In this exam series students were provided with all the equations on an Equations Sheet. 67% of students scored 5 marks, while 18 % of students scored 4 marks, for either not converting or incorrectly converting the power, or failing to put their answer in standard form. The standard form mark scored independently as long as the student had given a calculated value using data from the question in standard form.

04.3 6% of students scored 2 marks, while 33% of students scored 1 mark. Many students did not use technical vocabulary to express themselves, giving responses which were insufficient. Students needed to make comparison statements about both solar power and

hydroelectric, using the graph to score the first marking point. Statements repeating the questions stem 'meaning the electricity supply is more reliable' were insufficient to score the second mark.

Question 5 (Standard/high Demand)

05.1 This question discriminated well with 43 % of students scoring 3 marks, 18 % of students scoring 2 marks and 17 % of students scoring 1 mark. There is evident confusion about the significance of the mass number and the atomic number and what they represent. Lots of students 'shot themselves in the foot' by making statements about incorrect numbers of particles. e.g. 'Number of neutrons in carbon-12 is different from carbon-14, it's 12 in carbon-12 and 14 in carbon-14', would score no marks. Any numbers given as examples had to be correct to score marks.

05.2 'Time for radioactivity to halve' was insufficient to score, which was a commonly seen answer. If a student specified 'the time to halve' they needed to be clear what was halving: mass, number of nuclei, activity, etc. 47% of students scored the mark for this question.

05.3 Students struggled to realise that if ¼ remained two half-lives had passed. Subsequently, any calculation they did scored no marks. 32% of students scored 2 marks. For only 1 mark to score the words '2 half-lives' needed to be seen, it was not sufficient to see the number '2'.

05.4 Most students incorrectly chose Fluorine-18 as causing the biggest risk, believing that its long half-life would cause the most harm. Students who chose nitrogen-18 were often imprecise in their explanation and used 'more radiation emitted' without indicating the time period over which the more radiation was emitted. 'Decays the fastest' was insufficient to score the 2nd marking point. Less than 1% of students scored 3 marks, 7% scored 2 marks and 15% scored 1 mark.

05.5 Students who had learned the definitions as stated in the specification scored well, with 18% of students scoring 2 marks. Many students were unclear of the difference between the two terms and gave vague answers about 'radiation being around you versus in you', which were insufficient to score. It was evident that many students don't appreciate that radioactive materials emit radiation and gave confused answers mixing the terms 'radiation' and 'radioactive'.

05.6 90% of students answered correctly, scoring a mark. The most common correct answer was 'cancer'. 'Death' was ignored as working with nuclear radiation would cause other specific harm before death occurred. 'Damage to tissues / organs' was also creditworthy, as they are made up of cells. As ionisation occurs at an atomic level, this was not sufficient to score a mark. A commonly seen incorrect answer was 'ionises cells'.

05.7 38% of students scored 2 marks on this question, while 3% of students scored 1 mark. Students who didn't mention alpha radiation / particles would not have scored marks. Some students thought that standing close to the radiation detector would help to rule out radiation due to background radiation, which was not creditworthy.

05.8 82% of students scored 3 marks usually for using the first method given in the mark scheme. Some students calculated 144 (days) but thought they had calculated hours so divided by 24 and wrote an answer of 6. They scored 2 marks, as their final answer was treated as a unit error.

Question 6 (High Demand)

06.1 Question **06.1** was generally well attempted and students who had carried out the current-potential difference characteristics required practical would have had an advantage over those who hadn't. For this question, 14 % of students scored 5 or 6 marks and 36 % of students scored 3 or 4 marks.
A circuit diagram wasn't necessary for 6 marks, but students benefitted from drawing a circuit diagram as they didn't then need to describe the circuit, although many students still did. In their circuit diagram minor errors, like gaps between components and minor slips in circuit symbols, were ignored as long as the meaning was clear. However, a voltmeter in series means that the circuit would not work, so limited any written answer to Level 1. For Level 2 a student needed to make it clear how the p.d. and current could be varied, several methods are given in the mark scheme. For Level 3, students needed to have a method to achieve negative results. Students were often quite vague about how this was done, some thought it sufficient to reverse the connections to the ammeter or the voltmeter.. For 6 marks, students also needed to refer to the correct interval and range of readings from the graph.

06.2 91% of students scored 3 marks on this question. In this exam series students were provided with all the equations on an Equations Sheet.

06.3 77 % of students scored 5 marks on this question. 16% of students scored 4 marks, usually for mis-converting or not converting time into seconds. In this exam series, students were provided with all the equations on an Equations Sheet which improved their success at answering calculation questions.

06.4 Only 2 % of students scored 2 marks and 11 % of students scored 1 mark. This question was targeted at grade 8-9 students so required a precisely worded answer. Most students thought that the student believed that power and p.d. were directly proportional but had done the calculation incorrectly, so the power should be 2.0 W not 4.0 W. Statements like 'if power was proportional to p.d. then the power should be 2 W not 4 W' were commonly seen and scored zero.

Question 7 (Standard/high Demand)

07.1 64% of students scored the mark. 'Over extend was insufficient', but 'exceed elastic limit' was allowed as it is correct but not on the specification.

07.2 The second marking point was for the idea that the baby had kinetic energy at some point in the movement and the spring had some elastic potential energy. So, the following ways of wording this would be creditworthy:
The baby's kinetic energy is transferred to the spring's elastic potential energy.
As the baby's kinetic energy decreases, the spring's elastic potential energy increases.
For the third marking point, the mark was given for saying that at position B <u>all</u> the energy is elastic potential energy as the baby is stationary. But if a student said that all the energy is elastic potential energy, apart from some energy dissipated / transferred to the surroundings, this would still score the mark. An answer indicating that the final elastic potential energy is <u>equal</u> to the initial gravitational potential energy would be acceptable for this marking point. 'Gravitational potential energy is transferred to kinetic energy then

elastic potential energy' would score 2 marks, as the student hasn't stated that all the energy was elastic potential. 'Gravitational potential energy in position **A** is transferred to elastic potential energy in position **B**' would score 1 mark.
Abbreviations like KE, GPE and EPE were creditworthy. If types of energy were written in words, 'potential' must be included, i.e. not just 'gravitational energy' or 'elastic energy'.
3% of students scored 3 marks, while 32 % scored 2 marks and 39 % scored 1 mark.

07.3 45% of students scored 4 marks, while 36% of students scored 3 marks. Most students either mis-converted or did not convert the extension into metres.

Question 8 (Standard/high Demand)

08.1 36% of students scored 2 marks, while 32% of students scored 1 mark for getting 2 or 3 particles and their year of discovery matched correctly.

08.2 43% of students scored 2 marks, while 13% scored 1 mark. Many students thought incorrectly that the alpha particle was affected by the gold atom's electrons, while some thought the alpha particles couldn't penetrate the nucleus due to the low penetrating power of alpha particles. If a student stated that either the nucleus or the alpha particle was negatively charged, this was a physics error and no marks could be scored. Any mention of the alpha particle colliding with the nucleus was ignored as the idea of proximity to the nucleus was tested in 08.3.. Particles being 'deflected' was insufficient for a description as this refers to the path followed by the alpha particle not the force experienced.

08.3 Students who stated the alpha particle collided with the nucleus scored zero. A number of students thought that the alpha particle collided with electrons as the reason for the deflection and they also scored zero. A reference to the force or the field was needed to score the second marking point. The weakest answer that would score was 'repels more'. Mention of incorrect forces causing repulsion e.g. magnetic forces, or incorrect use of technical terms like refraction / reflection, meant the student couldn't score the second marking point. 46% scored 2 marks, while 2 % scored 1 mark.

08.4 85% of students identified the correct deduction.

08.5 Only 38% of students scored this mark. Many students thought the Bohr model didn't have a nucleus, which didn't score. Some students thought the difference between the Bohr model and the nuclear model was the structure of the nucleus, which also didn't score.

08.6 It wasn't seen often, but the answer 'photons' e was creditworthy for electromagnetic radiation. Another creditworthy answer was 'lectromagnetic waves'.. If a student stated that the emission / absorption was the wrong way round this was a hysics error and scored zero. Students who hadn't learned this small part of specification content were predictably vague about how the electron gained / lost energy. 8% of students scored 2 marks, while 4% of students scored 1 mark.

Question 9 (High Demand)

09.1 80% of students correctly stated that the particels move in random directions.

09.2 18% of students scored 2 marks, while 60% of students scored 1 mark.
If a student stated that there are a greater number of collisions with the tyre per second, but linkedthis to a spurious reason e.g .because the particles are moving faster, they did not score the score the 2nd mark. For the 2nd mark a microscopic description was needed, which is why 'greater force per m^2' was ignored.

09.3 This question was well attempted, but most students' explanations lacked the detail needed to score marks. 45% of students scored 1 mark. 26 % of students scored 2 marks. Only 10 % of students scored 3 or 4 marks.
The first 3 marking points were microscopic explanations, whereas the 4th marking point is a macroscopic explanation. Students who stated 'the particles vibrate more/faster' could not score the 1st marking point. For the 2nd marking point students needed to refer to more collisions with the tyre 'per second' or 'more frequently' or 'greater rate', the dependence on time is important. For the 3rd marking point te force referred to is the individual force experienced in a collision by a particle with the tyre wal, Students needed to state this so that it was clear whether they were talking about the total force or the individual force exerted by a particle. For the 4th marking point students needed to say both that the pressure is greater **and** why – that the force per square metre is greater. If a student said 'greater force and as pressure = force / area, greater pressure' that was just enough to score.

Mark Ranges and Award of Grades

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