Grade 8 guarantees

Premium video tutorials exam-style questions and revision resources for the **9-1 Science GCSE**

GCSE Physics

Summary of Examiners Reports

The large amount of content in the 9-1 Science GCSEs was already a challenging experience for both students and teachers, even before the pandemic caused widespread disruption to education. This year's GCSE Science exams will be the first since 2019 where the full content set will be assessed.

Ofqual is managing a return to normal this summer. It has confirmed that there will be no advance information for GCSE students and expects that GCSE results this summer will be much closer to the pre-pandemic years than those since 2020. Grade boundaries are expected to move back towards levels last seen in 2019. The links below provide tables of grade boundaries that year:

- Grade Boundaries – Combined Science
- Grade Boundaries – Separate Sciences

As this summer's GCSE Science exams will be the first since 2019 where the full content set will be assessed, examiners' reports from that time will be especially useful as a diagnostic tool to help teachers provide targeted guidance to students.

This blog provides a summary of the examiners' reports for both the 2018 and 2019 **Physics** papers. Next to each point, we highlight the relevant year. It covers both combined science and the separate sciences, foundation tier and higher tier. We have used the examiner reports prepared for the AQA exam board, but the same lessons apply to students taking Edexcel and OCR exams.

Overview

In 2019 it was necessary to learn all of the ‘recall and apply’ equations on the physics equation sheet (available directly from a student’s video dashboard on My GCSE Science). For 2023 only, however, an equations sheet will be provided for all GCSE Physics papers.

For comprehensive advice on equations, read this blog: Blog: Equations in GCSE Physics.

Below, we’ve split the examiners’ comments into four broad (and overlapping) categories: Key exam skills, Maths and graph skills, Required practicals and Subject areas for development.

Key exam skills

- Students should be reminded that they *must* give both similarities and differences when the command word is ‘compare’. [2019]

- Students lost marks because they simply restated the question, without adding any value. For example, when asked to suggest reasons why particular data was collected, many students simply rephrased the stem to state that the reason was the data was needed, rather than answering the question. [2019]

- Students must use the information given in questions. For example, some students used a commonly remembered value of 50 Hz to carry out calculations and lost marks because the question stated the frequency was 55 Hz. [2019]

- In order for students to be awarded compensation marks on extended calculations they must show their working out, and it must be clear. No credit will be given for manipulating numbers with no evidence of an understanding of the underlying physics. [2019] On many occasions, students would have gained some marks for showing their working, even if they arrived at the wrong answer. [2018]

- Examiners noted that students must be made more aware of mark allocation when answering questions. In a one-mark question, a single statement (sometimes a single word) will be adequate. If six marks are available, evidently much more information is required. [2018]

- Examiners reported that students lost marks by failing to follow basic instructions: Students must tick two boxes if asked (they must not stop at ticking one box); If students are asked to complete a diagram, they must do so. Redrawing the diagram can result in lost marks. [2018]

- When asked in a question to use data from a table or graph or to refer to a diagram, students must follow the instructions. Failure to do may result in lost marks. [2018]

- Students found questions requiring longer answers especially difficult to handle. Longer, extended response questions need more practice. [2018]

- Examiners reported that students lost marks by writing contradictory statements, or by adding responses which negated those written previously. [2018]

- In a three-mark list question, two correct responses (only) would result in two marks being awarded. But two correct responses and a third incorrect response would result in losing one mark for the incorrect response, leaving the student with only one mark in total. [2018]

The errors above can be addressed by using My GCSE Science to help improve students' exam technique. My GCSE Science long-form exam-style questions and corresponding mark schemes help students build an in-depth understanding of each topic while at the same time developing exam technique.

Our teachers have also written blogs that deal directly with exam skills. They cover all of the issues raised by the examiners and are free to access on www.my-GCSEscience.com.

- Blog: Command words in GCSE Physics
- Blog: Multi-topic questions in GCSE Physics

Maths and graph skills

- Some students attempted to use significant figures, truncated values or attempted to convert units when they didn't need to. [2019]

- Students should be encouraged to sense-check their answers: for example, they could consider whether it is likely that someone can jump a height of 4.92m, a commonly seen answer to one calculation question. [2019]

- Descriptions of graphs were too simplistic, not accounting for changes in the shape of the curve. A question that asked for comparisons of data from a graph was typically answered with isolated descriptions rather than similarities or differences. A large number of misreads from the graph caused lost marks. [2019] Students need to practice reading from graphs with more complex scales and should pay close attention to axes labels, scales, and units. This was an issue across many questions on the papers. [2018]

- Examiners noted that students lost marks for using a formula triangle, when asked to write down an equation. If students are asked to write an equation, they must… write an equation. [2018]

- Students lost marks for using incorrect symbols. Credit is given for writing out symbol equations only if the correct symbols are used. [2018]

- Examiners recommended that students practise interpreting numerical information in questions that are based on unfamiliar situations. [2018]

- Students are not required to recall equations in the order that terms are given in the question (terms are given alphabetically). Students do not need to write their equation in this particular order – many attempted to do so and made mistakes with the rearrangement. Any correct re-arrangement of the variables will score credit for recall. [2019]

- The use of an incorrect equation scores zero. The substitution mark is only credited when the correct equation has been used. The second mark is for the rearrangement, the third mark is for the correct answer. [2019]

- Conversion of units with prefixes such as tera- and milli- were not done well. Many students could not convert milliseconds to seconds. A significant minority thought 180ms were equal to 3 seconds. [2019]

- Answering a question on radioactive decay, a majority of students identified that three half-lives had occurred. But only half of students could then correctly calculate the initial mass. [2019]

- Using ratios is a mathematical skill in the specification. Only 40% of students made a good attempt at a question to calculate the size of a nucleus using the ratio to the size of the atom. [2019]

Our teachers have written blogs that deal directly with maths and graph skills. They cover all of the issues raised by the examiners and are available free on www.my-GCSEscience.com.

- Blog: Maths skills in GCSE Physics
- Blog: Mathematical relationships in GCSE Physics

Required practicals

- Examiners identified student knowledge of required practicals as a key area for development. Students were often unable to state the correct names for pieces of laboratory equipment. Many students were unable to draw the relevant diagrams and many did not have a good grasp on the methods to use in practicals, or the detail needed to describe them. [2018]

- Students who clearly had experience of the Required Practical Activities had a material advantage over those without this experience. Many students described methods for different Required Practical Activities than those requested in the question, meaning they were unable to gain any credit. Students often gave precautions instead of identifying risks. [2019]

- When asked to describe only part of a practical, some students explained the entire practical, thereby wasting time in the exam. [2018]

- Some foundation tier students had issues with understanding units of measure, thinking cm^3 meant that the value had to be cubed. [2018]

- Over half of students were unable to use a protractor to measure the angle of incidence. [2019]

- Students need to practise using data from multiple sources (such as tables, graphs and diagrams) to answer questions and to understand how to draw conclusions from the correct data sets. [2018]

- There was confusion regarding key practical vocabulary such as the difference between random and systematic errors and between independent, dependent and control variables. [2018]

- Students were unsure of the meaning of the resolution of an instrument, or the interval between readings. [2018] Many students showed confusion over the difference between high and low resolution and some stated that higher resolution was worse than lower resolution. [2019]

- The term precision was confused with accuracy or resolution. There were vague statements about accuracy, repeatability and reliability. [2019]

- Methods given for an investigation into the emission of infrared radiation and for an investigation into wave speed on a string were fairly weak. [2019]
    - Properties of waves
    - Electromagnetic waves 2

- There was a weak response to a question based on the Required Practical Activity, “Investigating resistance in circuits”. Fewer than 5% of students could suggest how to give negative readings on both meters. A small proportion stated that the direction of the current needed to be reversed but did not describe how the circuit could be changed to achieve this. [2019]
    - Investigating resistance in circuits

It’s clear that, in preparing students for the 2023 exams, a focus on the teaching and learning of required practicals continues to be essential for all schools.

My GCSE Science complements lab demonstrations with learning videos on each of the required practicals. These videos are useful as preparation ahead of a class demonstrations and can also be used for revision. Our exam-style questions on practicals thoroughly test students’ knowledge and help prepare them for the exams. All videos on required practicals are available by clicking on the PRACTICALS button at the top of the video dashboard, or by using the SEARCH function.

In addition, our teachers have prepared a number of blogs that deal directly with the issues raised by examiners and summarised above. The blogs are invaluable sources of advice on required practicals and graph skills, for teachers and students alike. They are available free on www.my-GCSEscience.com:

- Practicals: key vocabulary
- Practicals: measurements and data
- Describing, explaining and comparing graphs

Subject areas for development

- Fewer than 30% of students knew the formula ($P = I^2 R$) relating power, current and resistance. [2019]

- Fewer than 25% of students knew that increasing the resistance would cause the current to decrease. Current “slowing down” was not an acceptable alternative but a reduced rate of flow of charge was accepted. [2019]

- Students were often unable to recall that ammeters must always be connected in series and that voltmeters must always be connected in parallel. [2018]

- Students found it difficult to explain why the resistance of two resistors which have been connected in parallel is smaller than their combined resistance when connected in series. [2018]
    - Investigating resistance in circuits

- The equation linking current, potential difference and resistance (V = I R) was correctly described by around 35% of students in words or symbols. Many students used lower case letters i, v and r to represent current, potential difference and resistance, which was allowed. Also acceptable was a correct combination of symbols and words. [2019]
    - Resistors

- Many students were unsure about how static charge builds up on an object. Static charge builds up due to a flow of (negative) electrons and not due to a flow of positive charge. The object which gains electrons becomes negatively charged, and the object which loses electrons becomes positively charged. [2018]
    - Static electricity

- The term 'frequency' was well known but there was some confusion between period and frequency. [2019]
    - Properties of waves

- Many students knew water waves were transverse and that transverse waves were perpendicular but could not say what they were perpendicular to, often missing out the direction or travel/transfer part of the definition. [2019]
    - Transverse and longitudinal waves

- Many students correctly identified violet light as having the shortest wavelength but did not go on to make the link between refraction and change of speed. [2019]

- Only 40% of the students knew that infrared is used for electrical heating. Many students incorrectly described bones as reflecting X-rays rather than absorbing them. Some students appeared to confuse X-rays with gamma rays or even alpha particles. [2019]
    - Electromagnetic waves 2

- Understanding of lenses and features of ray diagrams was poor with most accessing only the calculation marks on this topic. [2019]
    - Lenses

- A common misconception was that particles cease to move at all in the solid state. Few students managed to link change of states to energy changes or forces between particles. [2019]
    - Solids, liquids and gases

- Many students were unable to recall the equation for the gravitational potential energy of an object (mass × gravitational field strength × height). [2018]

- Just over half of the students understood that balanced forces result in terminal velocity. Many students gave answers in terms of the resultant force being zero and many failed to explicitly link increasing air resistance to acceleration. Many stated the incorrect idea that there was a much larger value for gravity closer to the Earth's surface than at the height of a plane. [2019]
    - Falling objects

- Many students could not recall the equation F = ke. Most students who recalled the correct equation successfully rearranged it, but a sizeable number could not give the unit N/m for the spring constant. [2019]
    - Forces and elasticity

- Students experienced difficulty with the concept of the internal energy of an object. The internal energy of an object is equal to the total amount of kinetic and potential energy of the particles which it contains. It can be increased by heating or when work is done by the action of a force (such as friction) or the flow of an electric current through a resistor. [2018]
    - Conservation and dissipation of energy

- Students found it difficult to explain why it's important that the radioactive source inside a smoke alarm has a long half-life. [2018]
    - Half-life

- Only about 30% of students could describe alpha particles as deflecting or rebounding from a gold atom. Many described the alpha particles as not going through, which was insufficient as it was given in the question. Some students thought alpha particles would be absorbed or destroyed. [2019]
    - The development model of the atom

- Electromagnetism was not well understood, with students missing detail in explanations of why two induced like magnets would repel. Many students spent too long discussing the interaction of the magnetic fields so ran out of space for other points. A number incorrectly stated that increasing, decreasing or changing the field strength or current would have the effect of changing the direction of the force. The majority of field patterns drawn showed a lack of precision. Lines joining and crossing at the ends were common. Confusion of arrow direction was very common and some students did not appear to understand the term 'solenoid'. [2019]
    - Magnetism
    - Induced potential
    - The motor effect

- Students struggled with explanations of factors affecting stopping distances, mainly because they did not use ideas from the specification. Factors given often related to alcohol or drugs but rarely to the effect on reaction time. Many students confused reaction time and thinking distance. A significant number of students seemed to think that slower reactions meant a shorter reaction time and a shorter thinking distance. When giving condition of tyres/road surface as a factor, students often referred to grip/traction/sliding rather than using friction as a scientific term. Where speed was a factor, an explanation in terms of 'greater distance travelled in the reaction time' was seen occasionally, but the 'in the reaction time' part was generally missing. [2019]

- Very few students linked kinetic energy and work done, most getting the idea of increased kinetic energy but then not linking it to work done. Even students that had an idea about work done being force × distance seemed to think that a larger force would be required from the brakes to stop in a certain distance, rather than the idea that the distance for a fixed braking force would be longer. [2019]
    - Forces and braking