

GCSE Examiners' Report

Physics

GCSE

Summer 2025

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Introduction

Our Principal examiners' report provides valuable feedback on the recent assessment series. It has been written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and details how candidates have performed in each unit.

This report opens with a summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It then looks in detail at each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.¹

The information found in this report provides valuable insight for practitioners to support their teaching and learning activity. We would also encourage practitioners to share this document – in its entirety or in part – with their learners to help with exam preparation, to understand how to avoid pitfalls and to add to their revision toolbox.

Further support

Document	Description	Link
Professional Learning / CPD	WJEC offers an extensive programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.wjec.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 12 months after the examination.	Portal by WJEC or on the WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.co.uk)

¹ Please note that where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

Exam Results Analysis	WJEC provides information to examination centres via the WJEC Portal. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	Portal by WJEC
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Executive Summary

The GCSE Physics qualification remains very popular with centres. However, there has been a decrease in entries which is a result of some centres starting to move away from the qualification with the advent of the new Made in Wales GCSEs starting in 2026. The majority of the cohort sit the higher tier. Some very able candidates sit this qualification. It is noticeable that some higher tier candidates would have benefitted from sitting the foundation tier paper.

Candidates exhibit much better quantitative skills than qualitative skills. There were many examples of candidates not reading the questions carefully and / or taking note of information and instructions. Also question parts without answer lines were missed out even though they were in bold. Recall of knowledge (AO1 questions) continues to be an issue for many candidates.

The mathematical skills of candidates were generally good, some particularly good performances were seen on the higher tier papers. Some incorrect substitutions were seen and this highlighted that units hadn't been considered or converted properly. Rearranging of equations proved to be more problematic than in previous series.

When information is presented to candidates for AO2 and AO3 candidates, only the more able were able to interact with all the information provided and then use it in their answers.

The literacy skills of the candidates highlighted a number of issues, frequent spelling, punctuation and grammar errors were seen. Also the inability of candidates to communicate clearly and effectively was often seen e.g. incorrect terminology, vague responses. The presentation of responses often caused problems to examiners. When candidates were asked to give a qualitative response and to include data, often they didn't include the data. The clear writing of numbers proved to be problematic e.g. 4 often looked like a 7 or 9.

QER questions continue to cause issues for many of the reasons listed above, namely the recall of knowledge and the literacy skills of candidates. However, some excellent responses were seen for the QER on the unit 2 higher tier paper. The topic area obviously appealed to many candidates.

Often in GCSE Physics only content areas candidates tended to perform less well in than the common double award physics content.

Performance in the practical assessment unit was very good. The impact craters task proved to be very popular and this had the highest mean out of all nine tasks. In all tasks, candidates found scaling graphs and plotting points with accuracy very challenging, lines of best fit were often very poor too. Candidates are familiar with the key practical terms but it is the application to a situation they tend to struggle with. Identifying inaccuracies and corresponding improvements were poorly done this summer, however the writing of plans was better than in previous years.

Performance in practical questions on the theory written papers was not as good at times as in the Unit 3 assessment. Interestingly if these questions had appeared in the practical task it is likely they would have coped with them well, e.g. variables, anomaly, repeatability etc. It is the transfer of skills which is the issue.

Our digital resources website offers blended learning lessons and knowledge organisers, among other materials. Please ensure you are accessing the correct site with legacy resources (link [here](#)) and not the sister site for the new Made-for-Wales qualification.

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UNIT 1 – FOUNDATION TIER

Overview of the Unit

The exam paper included questions based on all three assessment objectives so tested recall of knowledge, (40%), application and understanding of knowledge, (40%), and analysis, interpretation and evaluation of information (20%).

There was an increase in objective style questions this year. The remainder of the paper was comparable with previous series. The degree of difficulty of questions increased throughout the paper, with questions in the common section providing the most challenge. Only two parts of the common questions had facility factors over 50%.

The objective style question parts were generally well attempted but performance in these questions was mixed. Many candidates lacked the basic knowledge and understanding of the topics assessed through some of these questions and probably made random guesses.

Candidates need to take more care when reading all the information, take note of it and act on it, especially when information is provided in tables and graphs. One question part required candidates to complete a cut away diagram of the Earth. As a result, it did not have dotted lines to write an answer on. Too frequently, question parts such as this are not attempted. This has been commented on in previous reports.

Some questions that assessed mathematical skills were not well answered. Equations are given in the appropriate form in the question part. However, too many candidates substitute incorrectly into given equations. Sometimes this is due to incorrectly selecting data from the wrong option or by not consider units. It is emphasised that workings should be shown in the provided spaces when answering calculation questions. Marks are often provided for selection of values and substitution. These marks cannot be awarded if all that is shown is an incorrect answer on the answer line.

The performance of candidates in recall questions was weaker than in non-recall questions. This is evident in questions that required descriptions and/or explanations. This is nothing new and has been commented on in exam reports for several series. This was particularly evident in questions relating to practical work. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked. This should cause concern since 40% of the questions are based on recall.

Responses to the QER question were poor. It should be noted it depended on recall. Too many responses were difficult to read. Not one question part had a 100% attempt rate. Non-attempt rates varied from 10% to 40%.

Comments on individual questions/sections

- Q.1 There were five single mark questions that either required extracting information from graphs or underlining / circling choices. Only the first part was answered correctly by most candidates. The success rate declined in subsequent parts. Candidates could not recognise how the output voltage of a generator would be affected by making changes to the coil. Surprisingly, the non-attempt rate was at least 10% for every part.
- Q.2 These question parts on transformers were similar in style to those in question 1. They were answered more successfully with all facility factors within the range 52% to 71%. However, the non-attempt rate was slightly higher at 11% or greater.
- Q.3 (a) Candidates were more successful in recognising which experiment demonstrated radiation than convection.
- (b) (i) Less than half of candidates could arrange the metals in order.
- (ii) Even less could evaluate whether the results in table 1 agreed with the data in table 2. About 20% of candidates failed to attempt this part.
- (c) About a third of candidates completed the sentence with an acceptable word. The non-attempt rate was just over 22%.
- Q.4 (a) Less than half of candidates knew the rules that apply when current divides at a parallel combination to earn both marks. Some candidates decided correctly that L_1 and L_4 are the same but incorrectly that L_2 and L_3 are the same.
- (b) A similar proportion of candidates knew the rules about voltages in series and parallel circuits to achieve both marks. Some candidates thought both unlabelled voltages were 24 V.
- (c) This was a straightforward calculation using a given equation. Candidates were required to use the values of voltage and current for lamp L_1 shown in the circuit diagrams. Less than half of candidates arrived at the expected answer. The remaining candidates either substituted incorrect values or did not attempt the question.
- (d) (i) The same comments as made in part (c) apply here.
- (ii) It was very rare to award a mark here. Most candidates agreed with Owain. The non-attempt rate was about 25%.
- Q.5 This question was based on a specified practical.
- (a) It was very rare to award a mark in both parts of this question. Answers 'to improve accuracy' were not accepted since this is the wording in the question. Many candidates still think that taking repeat readings stops anomalies.
- (b) (i) Less than half of candidates calculated the distance correctly.
- (ii) More candidates were able to calculate the speed correctly after applying an ecf.

- Q.6 This question about optical fibres required recall of knowledge. Answers were very poor with a mean mark of less than 1. Explanations did not include the terms critical angle and total internal reflection. The non-attempt rate was 34%.
- Q.7 (a) A minority of candidates earned credit for adding the path from X to D. Even less for the path X to A. Just over 25% of candidates failed to attempt the question.
- (b) The non-attempt rate for both question parts was over 30%. Both parts required recall of knowledge and were answered very poorly.
- Q.8 (a) (i) Mostly correct answers seen.
- (ii) Less than half of candidates made the required subtraction.
- (b) (i) The correct area was calculated in the majority of instances.
- (ii) Less than half of candidates substituted correctly and determined the expected answer.
- (c) Few creditworthy answers seen. The non-attempt rate was about 40%.
- Q.9 (a) Few correct responses seen.
- (b) (i) More candidates successfully calculated the energy transfer than the efficiency.
- (ii) Few candidates converted minutes to hours correctly and few were able to calculate the cost. It was common to see an incorrect substitution.
- (iii) Correct explanations seen in the minority of responses.
- Q.10 (a) Few correct descriptions seen. Candidates did not know the processes involved.
- (b) It was rare to award a mark here.
- (c) (i) Mostly acceptable suggestions were seen.
- (ii) Correct determinations seen in less than half of instances. The non-attempt rate was about 33%.

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UNIT 1 – HIGHER TIER

Overview of the Unit

The paper gave candidates the opportunity to demonstrate their skills and understanding of the subject in all three of the assessment objectives. The paper was of comparable standard with previous series.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, rearranging equations, analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question that required knowledge of the properties of P and S waves and how seismic records lead to a model of the structure of the Earth. Many good responses were seen, commonly in the middle band.

Rearranging equations was one area of the paper that was often poorly done, with substitutions into incorrect equations costing candidates marks. Knowledge of convection and the link between pressure, volume and temperature were particularly poor.

Comments on individual questions/sections

- Q.1 This common question explored the efficiency and cost of using two different kettles. Higher tier candidates performed better than foundation tier candidates. Many correct responses were seen in (a) and (b)(i). It is worth noting that it was not uncommon to see efficiencies of over 100% calculated in (b)(i)II, which should have led to candidates checking their response to look for their error. In (b)(ii) the conversion from minutes to hours was problematic for a significant number of candidates. Similarly, the simple cost calculation proved trickier than expected, with many candidates multiplying time by cost. Only around half of candidates were successful in this calculation. Most gained credit in (iii) realising that kettle Y had a greater power and therefore a higher cost.
- Q.2 There was a mixed performance on this second common question, with the latter parts proving far more accessible. The description of the processes involved in producing electrical power from a fuel was often poorly expressed, with the role of steam in the process being missed by weaker candidates. Knowledge of biomass was very poor, part (b) was one of the worst performing sections on the paper. Many candidates incorrectly stated that biomass would reduce global warming. The numerical work in (c) was done well, with most candidates attaining 2 or 3 marks here.

- Q.3 The first higher tier only question was about convection, a topic that has been highlighted previously as something that candidates find challenging. Most candidates were able to gain a mark in (a) for recognising the process of convection. The explanation was deliberately split into two sections to make the question more accessible. The explanation of what happens to water particles when heated, in (b)(i) was very poorly answered. Few candidates were able to describe the motion or separation of the particles. A common response was that they become less dense. Part (b)(ii) was answered better, with many able to describe changes to the density of the water, although a common error was to refer to water particles becoming less dense.
- Q.4 This QER question required knowledge of the properties of P and S waves and how seismic records lead to a model of the structure of the Earth. There were many good responses seen, and where candidates had learnt the properties of P and S waves, they usually attained at least a middle band mark. Many responses discussed the solid mantle and liquid outer core but did not include any discussion of the Earth's crust. Weaker responses were because candidates had not learnt the required material.
- Q.5 Circuits is an area of the specification that recent reports have commented on due to very poor attainment from candidates. It was pleasing that the structure of this question did allow for many candidates to score well, with many gaining almost all of the marks available in (a) through to (d). In the parallel resistance calculation in (a) many candidates forgot to invert their value and gained the rest of the marks with error carried forward. In line with other papers in this series, poor rearranging often cost candidates marks in (d). Part (e) was the lowest performing section of the whole paper. This required knowledge of voltage in series and parallel circuits and only the most able were able to produce a clear explanation here.
- Q.6 This question was about waves and began with some work on electromagnetic waves. In (a) candidates were required to determine the wavelength of a wave from a diagram and use it to determine the frequency of the wave. Many candidates attained 2 or 3 marks here out of the 3 available, with ecf allowed on an incorrect wavelength. The number of candidates who could not determine the wavelength from the diagram was a surprise. Incorrect rearranging and poor handling of standard form caused issues for weaker candidates. Part (b) was surprisingly poor, with only around a quarter of candidates able to identify the type of em radiation from the diagram provided. To be successful candidates needed to be confident with standard form and know the order of the waves in the em spectrum. The rest of the question was set in a practical context, examining the speed of water waves. The comparison between transverse and longitudinal waves in (c) was often poorly expressed and it was clear that many had not learnt this. In (d)(i) it was rare to award 2 marks, very few candidates could coherently explain why it is better to time three lengths rather than one. All candidates should have undertaken this specified practical and had opportunities to discuss the nature of random errors along with improvements to methods.

The calculation work in (d)(ii) required candidates to determine the speed of the waves from the graph and use this to determine the time to travel one length of the tray. Common errors here included using the depth given in the stem in place of the distance travelled, failure to convert from cm to m and incorrect rearranging, with many candidates gaining 2 or 3 marks out of 4. In the next part of this question candidates examined the factor by which the speed increased when doubling the depth. It was common here to only award 1 mark for the speeds correctly identified. Many candidates subtracted their answers rather than dividing. The calculation in (iii) was usually done correctly, and many were able to compare their calculated and graphical values to make sensible comments about accuracy.

- Q.7 This question required candidates to use experimental data to determine the specific heat capacity of aluminium. Most could successfully determine the heat energy transferred to the block, but many candidates in (ii) only attained credit for calculating the change in temperature. Handling of the specific heat capacity equation was often poor, with rearranging proving particularly challenging here. Responses to (b) were often poorly expressed, a common error being to not discuss density at all.
- Q.8 This question was about an a.c. generator. It is unsurprising given the position on the paper and the subject content, that this was one of the worst performing questions. In (a)(i) few candidates could explain how a current is produced, with many describing a transformer. Part (ii) was structured to aid candidates but few attained both marks here, not recognising that they needed to use Fleming's right-hand rule. The sketch graph of the output current in (b)(i) was very poor. Few candidates could sketch an a.c. output with the correct period. Where candidates gained marks, it was often for the correct maximum current shown. Few related the position of the coil in the diagram to the position of the maximum current. Explanations in (b)(ii), of the effect of changing both the magnetic field strength and the speed of rotation were usually poorly expressed. Many candidates failed to clearly discuss the effect of each factor on the output current.
- Q.9 The last question on the paper proved to be one of the most challenging. The explanation in (a) required candidates to link temperature and particle motion to explain the change in volume of a balloon. It was rare to see any sensible discussion of collisions between the particles and the walls of the balloon. Confused responses often referred to particles starting to vibrate or discussed the role of successful collisions. The calculation of pressure in (b)(i) was one of the worst performing sections of the paper. Few candidates could successfully substitute the values, and it was rare to see a correct response here. Many were successful in (ii) with ecf, reading an altitude correctly from the graph.

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UNIT 2 – FOUNDATION TIER

Overview of the Unit

The paper gave candidates the opportunity to demonstrate their skills and understanding of the subject in all three of the assessment objectives. Most candidates attempted the more straightforward questions, but as the level of difficulty increased throughout the paper it was evident that a significant proportion of candidates were not attempting some question parts. Questions that assessed mathematical skills were generally well attempted with candidates gaining full marks in some calculations. This contrasted with recall questions that required candidates to express their subject knowledge which was usually poor. The quality of writing in a significant number of cases was poor, causing examiners to spend some considerable time in deciphering the wording. The quality of extended response was assessed in a question about a nuclear fission reactor and answers lacked both knowledge and clarity, so most responses seen were in the bottom band.

Comments on individual questions/sections

- Q.1 This question on Newton's laws proved to be a reasonably accessible introduction to the paper. The structured calculation questions in (ii) and (iv) were usually done correctly and most candidates were able to identify that a gravitational force would decrease the height of an object moving through the air. Fewer candidates were able to identify the direction of a Newton's third law force.
- Q.2 Most candidates were able to extract information from a distance time graph and complete simple calculations, with many correct responses in (a). In (b) very few candidates could articulate that the gradient of the line indicated the region with the highest speed on the graph.
- Q.3 This question required candidates to interact with a table of data about the solar system. The simple calculations of weight and work done in (b) were usually correct, however it was unusual for candidates to recognise that the work done that they had calculated in (b)(ii) was equal to the gain in potential energy that they were asked to state in (iii). It was rare to see correct responses here. The data evaluation question in (c) elicited some pleasing responses but generally poor use of language and a lack of numerical analysis restricted the marks attained.
- Q.4 This question was about nuclear fission and included the QER. It was surprising for examiners that in (b)(i) very few candidates were able to state the number of neutrons produced in the fission reaction that was given. The QER was very poorly attempted, with mainly weak bottom band responses. Very few candidates could recall the role of the labelled features of a fission reactor. Poor handwriting along with poor punctuation, spelling and grammar was characteristic of many responses seen.

- Q.5 This question was about cosmological red shift, which is a demanding and conceptually difficult topic, especially for foundation tier candidates. The graph plotting in (a) was usually handled well, with many candidates attaining all 3 marks here. Most candidates could state a simple link between the variables plotted but it was rare to award 2 marks in (b) with most not recognising that the increase was at a constant rate. This has been commented on in many previous reports. Part (c) of this question was demanding. The explanation in (i) was beyond the ability of almost all foundation tier candidates. The data analysis in (iii) was accessible to many, and good responses were often seen although a lack of data and poorly expressed answers were common.
- Q.6 The last foundation tier only question was about velocity-time graphs. Many candidates attained well in (a) where they were required to compare two velocity-time graphs and in (b) where they had to select an equation and use it to calculate an acceleration. Whilst the calculation of acceleration was often correct, few candidates knew the unit for acceleration.
- Part (c) was a demanding end to this question and required the use of the provided equation of motion, along with an evaluation. This was not done well by many.
- Q.7 This common question examined data on thinking and braking distance. It was rare to award three marks in (a)(i) but most candidates were able to attain one or two marks here, often with ecf. Many simply halved all three distances not recognising that the braking distance would be unchanged. The explanation of how seatbelts reduce injury was often poorly written and lacked a physics-based explanation that was required to achieve both marks.
- Q.8 It is pleasing that many candidates were able to balance the alpha decay equation given in (a)(i). Candidates were much less successful on the rest of this question. Very few could identify the number of protons, neutrons and electrons in a nucleus of americium-241. Better foundation tier candidates could handle the simple numerical data in (b) to determine the mass required for a given activity of americium. Whilst many could show how to determine half-life from a graph, few candidates were successful in (c)(ii) or (iii) which required an understanding of half-life.

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UNIT 2 – HIGHER TIER

Overview of the Unit

This examination paper was based on the Unit 2 of the Physics qualification and provided the appropriate demand at a higher tier level. Some questions were set in a practical context and the assessment provided opportunity for candidates to demonstrate their skills across all three assessment objectives giving opportunity for the candidates to demonstrate their knowledge and understanding, application of that knowledge and the analysis of data, along with handling information and evidence in the A* to D range of GCSE grades. The paper provided opportunities for the candidates to undertake calculations of increasing complexity as they progressed through it, to analyse information that was presented graphically, pictorially, in written form and numerically and to manipulate and solve equations that were either presented to them and other cases where that they had to choose from the list on page 2.

Many candidates were well prepared for the examination and there were many very good answers to many of the questions, including a good number of superb answers on the QER question that was set on the life cycle of giant stars. This topic seems to have caught the imagination of this year's physics students and it is a pleasure to report that a QER question was so well attempted by a significant part of the candidature. There was and always will be a percentage of the entry where the candidates avoid answering this question. Numerical work was largely well done, apart from question 8 on the topic of moments. The exchange of energies between potential and kinetic was well done by many of the entrants in the last question on the paper. Graphical work was good on the whole but it is still worth noting that the standard of handwriting remains, in a significant number of cases, to be a problem as there were a number of illegible responses.

Comments on individual questions/sections

- Q.1 (a) The underlying aim of the first part of this question was to find whether candidates could differentiate between the effect of reaction time on thinking and braking distances when a car driver has to come to a stop. The unwary failed in halving the braking distance as well as the thinking distance when completing the table for a formula 1 driver compared to an average driver. The overall stopping distance answer mark was usually awarded by applying the "error-carried-forward" rule. Part (ii) was well answered by many.
- (b) Either of two approaches could have been taken to answer this part of the question, one based on Newton's first law of motion, the other based on the kinematics of motion with Newton's second law or work, increased distance or time to stop resulting in a smaller force exerted on the body.
- Q.2 This question based on alpha particle decay and nuclear structure was very well answered in parts (a)(i) and (b). However, as so often has happened in the past, candidates were caught out by failing to take the emboldened hint that the question was about the **nucleus** of an atom of americium in which, of course, there are no electrons.

Part (c) was straightforward, requiring that candidates did little more than take some care in using a ruler and pencil to show construction lines on a pre-drawn graph of the decay of americium. Some thought and care needed to be taken in answering part (iii) of (c), where some scaffolding was made available for candidates to structure the decay of the substance with time. A significant percentage fell into the trap of continually doubling the half-life along with repeated halving of the activity.

- Q.3 This was the first of the higher tier – only questions. Some data was presented about three different planets in our solar system, Earth Mars, Jupiter and Saturn, along with four question parts that sought to test understanding of the meaning of and the relationships between items of the data. The first part was, as expected, best answered with part (b) having been found to be most testing and on which the attainment was significantly poorer.

Part (c) involved finding the highest common factor of the four orbital periods and was largely well answered, along with completion of the planetary diagram in the final part.

- Q.4 As was stated in the overview, there were many very good answers to this year's QER question but still too many pithy and illegible answers were seen. Most candidates who gave answers could describe well the origin of stars (which is common to all types) and could generally describe the finality of large stars, going through supernova ending in a neutron star or black hole. A significant number of answers failed to identify the expansion and contraction phases correctly and to associate them with the forces and fusion processes correctly. The best responses were well structured from start to end and told the story in detail.
- Q.5 Without doing revision of this topic, candidates confused the roles of the moderator and control rods in a nuclear reactor. Some very poor answers were seen, claiming that they controlled the radiation from the reactor or that they moderated the fuel in some way. This was one of the poorest answered questions on the paper.
- Q.6 A velocity-time graph was presented at the start of the question with a straightforward part (a) requiring the interval between two points on the graph. Often just the time for the first point was quoted or the time values of the two points without finding the interval between them were given as the answer. These answers were awarded no marks. The weaker candidates for this paper gave poor answers when describing the motion in each region of the graph in part (b), though there were again some very good answers, even when describing the meaning of the curved line during the deceleration period. Part (c) required that the area under the graph be calculated between 0 s and 17 s but too many failed to read that the test described in the question ended at point C on the graph. Those candidates attempted to calculate the whole of the area under the graph and consequently lost the marks.
- Q.7 Answers to part (a) required that an equation was chosen from page 2 of the exam paper and used correctly. This part of the question was answered really well as was part (b) on the whole, though some candidates made the mistake of doubling the extension given in the early part of the question instead of doubling their answer from part (a) for getting the new extension.

The main loss of marks in part (c) was in the answers showing a failure to compare, in words, the energies stored in the two springs. One stored double that of the other and the second mark available in this part included the need for that comparison and was often lost.

- Q.8 Basic bookwork about the principle of moments and the unit in which moment of a force is expressed were not well known.

The main source of error in this question involved calculations involving the **positions** on the ruler instead of the distances from the pivot. Candidates are reluctant to write down expressions or values for the clockwise moment and for the anticlockwise moment separately before equating them. Such structured steps are paramount in the success in solving moments problems. The final demand was in showing that a weight of 1 N related to a mass of 100 g (on Earth). Even though a good number of candidates knew it to be the case, they had difficulty in showing it, based on the $W = mg$ equation.

- Q.9 Loose, poor use of language in answering the source of the black lines on an absorption spectrum cost marks for many candidates. Phrases such as the “galaxies move to the red end of the spectrum” and “blue shift” still abound. Three considered, well-structured points in an answer were all that was required to get full marks. Part (b) was pure bookwork also, requiring that the lines all showed red shift, galaxies are receding, so the Universe has expanded and once started at one point hence the Big Bang. This question was poorly answered by most candidates.

- Q.10 The final question involved calculations on potential and kinetic energies, work and air resistance force, culminating in the construction of an air resistance – distance graph. Overall the question was answered very successfully by many candidates, earning good numbers of marks.

Part (a) required that the potential energy equation was chosen and used for the sky diver in falling 2000 m. This was done very successfully by most candidates.

Part (b) required that the kinetic energy of the skydiver moving at 50 m/s be calculated, with the data having to be found from the diagram in the question. Again, this was answered very well by most of the candidates.

Part (c)(i) was where mistakes began to creep in, that, despite the hint in the question, many did not find the **difference** between their previous two answers. In part (i) II of (c), however the candidates who had made mistakes previously did use the given equation to find the mean force on the skydiver over the given distance, which for the weaker candidates involved a reversal of a calculation that they made in (c)(i) I. The given equation was often manipulated correctly to obtain an answer.

In answer to part (c)(ii), the question was designed for the candidates to present the argument that at terminal speed, the forces are balanced but a good number of the candidates chose to show that the weight of the 90 kg diver, given at the start of the question, would dictate their route to the answer. Perfectly acceptable and full credit was given but some could not construct a coherent approach to an answer using this method.

Part (c)(iii) demanded that all the information and ideas presented in the question be brought together and presented in graphical form, the line being horizontal between 500 m and 2000 m, at a value of 900 N and the early part being correctly curved from the origin to the line. Many good answers were seen but many others were poor or confused as to what they were presenting.

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UNIT 3 – PRACTICAL ASSESSMENT

Overview of the Unit

In this unit candidates are assessed on their practical skills including, forming hypotheses, recognising and preventing hazards and risks, recording and presenting data, understanding the variables that are involved in experiments, evaluating the success of the experiment and planning improvements. There was evidence that candidates are familiar with practical work and the analysis of practical results, although in some areas candidates' skills were not as well-developed as in previous series, this was particularly evident in graph plotting.

The nature of experimental work means that, on occasions, centres may feel the need to provide candidates with unformatted results to us in section B for graph plotting. This happens in a small number of cases each year. This year it was notable that many centres who gave their candidates results did not explain that they had done so and did not include a copy with the scripts. It is imperative that in such circumstances centres provide a copy of the original results to ensure that markers can accurately evaluate and award credit for correct data plotting.

The tasks all proved to be accessible for most candidates who usually attempted all sections. As in previous series, candidates were largely successful in making hypotheses and in identifying variables. Notable areas that candidates found challenging were scaling graphs and plotting points with accuracy. Lines of best fit were often very poor.

Comments on individual questions/sections

Section A – Hypotheses and risk assessments

Most candidates were able to make a sensible hypothesis in each of the 9 tasks, which linked the independent and dependent variables. The exception to this was in the investigating the effect of glucose concentration task where many candidates failed to link the independent and dependent variables and instead just predicted that a colour change would occur. In producing risk assessments, the most successful candidates linked the risk with a particular action in the method, such as burning your hand if you touch a hot beaker and were able to suggest a sensible control measure for that risk. Less successful candidates often did not link the risk to an action, for example, stating simply that apparatus can burn you with no reference to either the action of touching or the affected body part. It was also very common for candidates to create a risk for experiments when there were no significant risks such as in the impact craters task.

Section A - Tables of results

Most candidates produced well-structured tables with all the data recorded. Whilst most candidates only include units in the table headings it was more common than in previous series to see units in the body of the table. The unit for hydrogen peroxide concentration (vol) did cause issues in one task. In the glucose task many candidates confused the heading, concentration, with the unit, percentage. Incorrect abbreviations of units (e.g. secs for s / seconds) was commonly seen. Candidates should be reminded that they should always calculate a mean from their repeats as they will not be prompted to do this. The conversion of time from minutes to seconds in the glucose task posed issues for a significant minority of candidates which then led to errors in graph plotting.

Section B – Variables

Each of the 9 tasks included a section on variables. Candidates were usually able to identify the independent and dependent variables, and most were able to state the range of these variables when required. Many of the tasks explored how certain variables were controlled, and in common with previous series this was not well answered, with no clear indication of the apparatus used or the required measurement of that variable. For example, in the glucose task candidates needed to identify that the volume of Benedict's solution was measured to be 2 cm³ with a pipette. In the impact craters task candidates were asked to explain why an identified controlled variable was controlled. This was poorly answered with many responses referring to making it fair, rather than focussing on the effect that this would have on the diameter of the impact crater.

Section B – Graphs

The most successful candidates obtained most of the available marks in this section. However, a significant number of candidates displayed very weak graph plotting skills, more so than in previous series.

Even where suitable scales were chosen, many candidates struggled with the accuracy of their plotting. Scales were also often poor with multiples of 3 commonly seen, these are not accepted. In tasks where the data range was narrow, candidates often did not truncate and this made plotting the data difficult and the drawing of a suitable line of best fit. Whilst candidates were not penalised for not truncating scales, there were numerous candidates who incorrectly truncated by not starting the scale with a suitable number and either omitted a zero on the *y*-axis or did not indicate truncation had taken place.

Lines of best fit continued to be problematic as many candidates simply joined the first and last point with no consideration of the spread of data above and below the line. Joining point-to-point is only usually acceptable in Biology tasks but this was seen commonly in all tasks.

In all tasks candidates are often asked to identify the relationship between the plotted variables and this was usually done well. Whilst most candidates were able to describe a relationship between the independent and dependent variables in the graph, a description of the shape of the graph, where it was required for the second mark, was poor.

Section B – Evaluation of results

In many of the tasks, candidates were asked to evaluate accuracy, validity of the experiment, closeness to the true value, repeatability and / or reproducibility of their results of given data. Whilst it is evident that the terminology is familiar and broadly understood, the clarity of candidates' responses often limited the marks attained. When considering repeatability candidates should make clear reference to the closeness of repeat readings; it was common to see vague responses referring to all the results being close which gained no credit. Of the candidates correctly referring to repeats, few went on to use the data to support their judgment.

When evaluating the reproducibility of given data in the glucose experiment, many candidates were able to recognise that the reproducibility was poor because the results were different between groups. Very few recognised that all groups had the same pattern in their results.

Section B - Improvements

Identifying inaccuracies and corresponding improvements was poorly done by many this year. Candidates should be encouraged to consider what they found difficult in carrying out an experiment and base their responses around this. In the glucose task, many suggested that the timing was inaccurate and considering using a stopwatch with a better resolution as an improvement, rather than describing how difficult it was to judge when the endpoint had been reached. Similarly, in the craters task many discussed the levelness of the sand which gained no credit.

Section B – Plans

Where tasks included a plan at the end, these were generally better answered than in previous years. In the electrolysis task most candidates attained marks for stating that the current would be measured and describing how the solution would be heated. In common with other plans, candidates did not always state at least 4 values of the independent variable or list at least two controlled variables.

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WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk