



GCSE Examiners' Report SCIENCE (Double Award)

Summer 2024

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
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.wjec.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	Portal by WJEC or on the WJEC subject page.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with valuable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner WJEC

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Executive Summary

This is the most popular qualification in the GCSE Science suite. There has been a decrease in entries in recent series and the Foundation Tier is the most popular tier of entry. Some candidates sitting the Higher Tier papers would have benefitted from sitting the Foundation Tier papers instead.

The easing of the Foundation Tier papers which has occurred for a number of series continued to have an effect on the means and it is pleasing to see the majority of candidates attempting most of the paper. It is particularly noticeable in the performance in the first few questions. The performance on the Higher Tier papers was encouraging too.

There were many examples of candidates not reading the questions carefully and / or taking note of information and instructions. Also some candidates missed out question parts without answer lines even though they were in bold. At times it was apparent that candidates did not understand the different command words being used.

Recall of knowledge (AO1 questions) continues to be an issue for many candidates.

Candidates exhibit much better quantitative skills than qualitative skills.

The mathematical skills of candidates were good. Some incorrect substitutions were seen and this highlighted that units hadn't been considered or converted properly. Incorrect rounding was often seen. Candidates should be encouraged to show their workings, if incorrect answers are given they may be able to attain some method marks. Only a small number of candidates were able to cope with more demanding maths, such as, percentage changes and rearranging equations.

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. The legibility of the numbers 1, 2, 4 and 7 in candidate responses were very difficult at times to read. The writing of chemical symbols was often not clear. When candidates were asked to give a qualitative response and to include data, often they didn't include data.

QER questions continue to cause issues for many of the reasons listed above, namely the recall of knowledge and the literacy skills of candidates. Scaffolding in these questions does increase the attempt rate. QER questions based on practical methods were not successfully answered, it was questionable if the candidates had actually done the practical. However, a small number of excellent responses were seen.

Candidates continue to have difficulty in writing chemical formulae and balancing symbol equations. Many candidates were unable to recall basic knowledge and skills from the Year 10 Chemistry unit. Drawings of the structure of cells provided problematic for many and the topic of electric circuits was poorly understood by many.

Performance in the practical unit was good. The areas for development are very similar to those listed above – qualitative responses weren't clear, issues with units and incorrect rounding. Candidates are familiar with the key practical terms but it is the application to a situation they tend to struggle with.

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 between units which is the issue.

Areas for improvement	Classroom resources	Brief description of resource
Qualitative responses	<u>TEXT TOOLS</u>	A bank of tools that allow teachers to use their own piece of text to generate a range of activities.
Topic of electric circuits	<u>ELECTRIC CIRCUITS</u>	Blended learning resource contains interactive self-study on the topic.
Improving recall and AO1 skills in Biology	<u>KNOWLEDGE ORGANISERS</u>	A collection of sample knowledge organisers to support the learning of GCSE Biology
Improve understanding and application of eutrophication	<u>ECOSYSTEMS, NUTRIENT CYCLES AND HUMAN IMPACT ON THE ENVIRONMENT</u>	This blended learning resource contains interactive self-study content covering human impact on the environment. Candidates may find this useful either as a recap or in flipped learning
Electronic structure	<u>ATOMIC STRUCTURE AND THE PERIODIC TABLE</u>	This blended learning resource is a good refresher for all content relating to atoms, electronic structure and the Periodic Table. It includes a section on testing for ions
Testing for ions		
Chemical calculations	<u>CHEMICAL CALCULATIONS</u>	PowerPoint resource on the Tanio website covering all aspects of calculations based on masses of elements and compounds

SCIENC (DOUBLE AWARD)

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UNIT 1: BIOLOGY 1 – FOUNDATION TIER

Overview of the Unit

Topics included:

- circulation of blood and aerobic respiration
- enzymes
- cell structure, biological stains and use of the microscope
- thoracic structure and function
- effects of smoking on the lungs
- principles of survey design (QER)
- photosynthesis
- eutrophication

Skills tested included:

- mathematical skills including graphical work
- practical skills

The first four questions on Low Demand, were split into short sections calling for mostly short answers, simple arithmetic, or data plotting on a grid. Questions calling for specification knowledge (AO1) were generally supplied with prompts to facilitate recall, such as Cloze comprehension style word selection from a limited list of options, or a True/False exercise. Question five (QER) and those on Standard Demand were somewhat more challenging.

Once again, many candidates seemed to be underprepared to take the paper. Basic literacy was often very limited. Many appeared not to comprehend the questions, and there was widespread failure to act on the cues provided, even though they were often emboldened. Therefore, many answers were irrelevant or confused. Candidates often struggled to distinguish between the command words 'Describe' and 'Explain', 'State' and 'Suggest'. Spelling was often far off the mark. Limited vocabulary hindered many candidates, who appeared to struggle to express their ideas.

Lack of even basic specification knowledge limited many candidates.

Illegible handwriting, excessively small writing or the use of pale colours, rather than black biro as instructed was an issue for a number of candidates.

Skills in basic numeracy, were patchy, although most candidates coped well at low demand. Candidates would be well advised to avoid using the term 'amount' when answers require reference to a specific measurable quantity, such as volume, concentration or mass.

Comments on individual questions/sections

- Q.1** (a) Knowledge of the basics of the circulatory system was very patchy. Given the limited number of multiple choice options from which to select, it was disappointing that many candidates failed to score at all.
- (b) Construction of the bar chart was generally well done by the vast majority of candidates, although many failed to add the units to the vertical axis. A number of line graphs were seen, indicating a failure to read the question properly. Most candidates scored the mark for correct arithmetic in part (ii) and were able to access most of the marks available in part (iii).

- Q.2** (a) The function of platelets in the clotting of blood was unknown to many - the 'red blood cells' option was commonly selected.
- (b) The two comprehension questions in part (i) were quite well done by most candidates. A common error, however, was to write 'faster' instead of 'fastest' (as given in the preceding bullet points).

The true/false exercise in part (ii) contained three statements referenced in the comprehension passage and two requiring recall. Many candidates scored on three or four of the five statements. A few scored all five. In 2023, it was reported that most candidates asserted that enzymes are made of lipids. This misconception persisted in 2024.

- Q.3** (a) Some candidates were able to recall this specified investigation and gave pleasingly detailed accounts. Many others, however, appeared to have no knowledge of this practical and often gave inaccurate accounts.
- (b) The correct answer of x400 for the highest magnification was seen in a small majority of cases, indicating familiarity with microscopy. Erroneous answers, which were common, ranged from x1 to x80 000.
- (c) An acceptable answer to the function of the nucleus was seen in a number of answers. Most candidates correctly selected the cytoplasm from a choice of two options.
- (d) The purpose of biological stains was not well known. A common error in those who had some idea, was to state that stains made them (cells/structures) visible or clear. As so often the case, failure to use a comparative answer ('more') resulted in no score.
- (e) A common error in part (i) was again a failure to use the comparative. All microscopic structures are small. Mitochondria are too small (to be seen under the highest magnification of this microscope).

In part (ii), most candidates selected the term '*electronic*' or '*electric*' rather than the correct option of '*electron*' microscope.

- Q.4** (a) Knowledge of thoracic structures was very patchy. Most candidates correctly labelled a rib and many correctly identified the diaphragm but suggestions for bronchus and alveolus often appeared to be at random.

- (b) Knowledge of the functioning of mucus and cilia in the trachea, together with the effect of smoking on these components was very patchy, despite the heavily cued diagrams. Answers were often confounded by confusion and poor expression of ideas.
- (c) Most candidates scored the mark for naming a lung disease caused by smoking, usually 'cancer'.

In part (ii), many candidates were aware of the idea of passive/ secondhand smoking. However, many answers were too vague, such as (smoking in confined spaces having) 'harmful effects on others', without explaining why this should be.

Q.5 (a) Almost all candidates gained credit for the calculation. Most also scored at least one mark for a correct reference to a health problem from eating too much fat, most usually 'obesity' and many scored both marks.

- (b) The extended writing question (QER) was given extensive structuring and clear instructions, with key words written in bold. Reference to these key words alone would put candidates into middle band. It was disappointing therefore that many candidates ignored the instructions, and gave an account, which was mostly irrelevant.

The importance of a large sample size or involving different ages/ sexes/ ethnicities/ languages was very rarely expressed.

It was gratifying however that several well-structured and logically sequenced accounts were also seen, with some achieving top band.

Once again, several promising accounts were limited to the lesser of the two marks available in each band due to poor grammar and/or poor spelling.

Q.6 (a) Very few candidates were able to state the function of chlorophyll.

- (b) In part (i), only a minority of candidates could explain the results of the investigation into photosynthesis. Commonly seen answers were centred around the assertion that the brown colour of Leaf A (the result of a negative test for starch) was, rather, due to the leaf being dead.

Answers to part (i)II were also generally confused, although often, one mark was scored for a reference to lack of light.

In a very few cases, some candidates had clearly studied the diagrams and methods and made correct deductions, based on a knowledge of photosynthesis, for both parts I and II.

Identifying the control leaf proved problematic in part (ii). Just a few candidates pointed out that the control was leaf C, which had not been deprived of either carbon dioxide or light, or the idea that the leaf had not been tampered with.

Q.7 (a) A number of candidates scored the mark here, usually for the idea of rainwater washing the fertiliser into the lake. Vague accounts such as the fertiliser moving through the soil did not score.

- (b) The percentage calculation was beyond all but a very small minority. This was disappointing, as the figures chosen for the calculation ($3.5 - 1.0 = 2.5$ and therefore an increase of 250%) could have been done without a calculator for those who understood the idea of percentage change, which very few did.

In part (ii), the concept of eutrophication appeared to be unknown to almost all candidates. When asked to explain trends in graphs, candidates should, at the very least, first describe those changes (here, the bacteria increase in number and the dissolved oxygen content decreases). Such an answer would receive two marks.

In part (iii), when asked to suggest a reason for the slow growth in the number of bacteria during January and February, several candidates pointed out, rightly, that it might be due to low temperatures (usually expressed as 'its cold') or not enough oxygen. Often answers were just too vague, as in 'its winter' or 'the weather'.

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UNIT 1: BIOLOGY 1 – HIGHER TIER

Overview of the Unit

Topics included:

- photosynthesis
- eutrophication
- cell structure, biological stains and calculation of magnification
- digestive system, digestive enzyme and food tests
- mechanism of inspiration (QER)
- osmosis
- aerobic and anaerobic respiration

Skills tested included:

- mathematical skills including graphical work
- practical skills

Performance on AO1 questions involving pure recall was disappointing. This particularly applied to the questions on photosynthesis, osmosis and eutrophication. The detailed knowledge required to answer questions on these topics just was not evident. Performance on these topics in previous years has usually been satisfactory to good. Although some excellent answers were seen in the QER question, many of the candidates' responses were very disappointing.

Not reading the question carefully and failing to follow precise, often emboldened, instructions, given in the question, lost candidates marks. In question 3 detailed instructions were given on the drawing of a plant cell. In many instances these instructions were not followed, and marks were lost. Also, in this question, candidates had a calculation to perform where they were instructed to give their answer to two significant figures. More often than not this instruction was not followed, and marks were lost. It seems, in many instances, that candidates lacked understanding of significant figures. Again, it seems, that when reading the introduction to a question the information provided is often 'skimmed' through in order to get on with answering the question. This is not good exam technique. The information and instructions given in a question must be carefully read before, during and after answering the question, this is good exam technique.

Performance in maths skills was often disappointing. If a line graph is given with more than one line drawn on it, then a key will be given. Failure to study this key will result in answers being given which are incorrect. Many candidates struggle when asked to calculate a percentage increase in given data. In question 3, candidates were given data in both μm and in mm. In order to perform the calculation, they first of all had to either convert μm to mm or mm to μm (information was provided in order to perform the conversion). Many candidates didn't or couldn't perform this conversion and worked in both units in the same calculation which resulted in incorrect answers and lost marks.

The practical skills demonstrated in questions on photosynthesis, microscopy (cells) and osmosis were often very disappointing.

The quality of handwriting is an issue with many candidates. More so this year than in previous years. Handwriting is often almost, or in some cases, completely indecipherable. Online marking helps in this respect in that the written answer can be magnified many times on screen. In some cases, even then, the answer cannot be read. If an answer cannot be read, then it cannot be marked. Centre staff entering students for exams need to be aware of this.

Only a minority of candidates failed to attempt the questions.

Comments on individual questions/sections

Q.1 (a) There were many incorrect answers here. The three most commonly seen answers, probably in equal numbers, were 'to absorb light', 'to give the leaf its green colour' and 'to carry out photosynthesis'. The last two answers are, of course, incorrect.

(b) There were many really good answers seen in part(i). The lack of starch was linked with there being no carbon dioxide and therefore photosynthesis could not take place. The most common error related to the fact that the plant had been destarched and this was the cause of the negative starch test. Also, some answers related to the fact that the plant did not have any light because light couldn't pass through the wall of the clear glass bell jar.

In part(ii) most candidates realised that the black card across the middle of the leaf would block light from that part of the leaf. Better answers went on to state that there would be no photosynthesis or no starch in that section of the leaf. Some candidates stated that the black card prevented light and carbon dioxide entering that part of the leaf. This comment led to the lack of light mark not being awarded. Blocking the sun is not an acceptable answer.

(Leaf) C was the only acceptable answer in part (ii). If the answer given was Leaf A or B then both marks for this question were lost.

The Reason was linked to (leaf) C being the answer to the first part. Answers looked for included reference to the fact that the leaf had both light and carbon dioxide or all the limiting factors. Other acceptable answers included the leaf not being experimented on, not altered or nothing being done to the leaf.

Q.2. (a) This was quite well answered. Any reference to the fertilisers entering the lake in rain was not credited. This answer implied that the fertilisers were present in falling rain. However, fertilisers being washed off by rain, washed off the plants, washed off the soil, gained the mark. Blown by the wind, run off, wash off, leaching, during flooding were all acceptable answers.

(b) Candidates found the calculation very difficult with few gaining the 2 marks for 250%. However, 1 mark was awarded if it could be seen in the calculation that they had extracted 1 and 3.5 from the graph – irrespective of how they used those two figures. This mark could also be awarded if 2.5 was seen in the calculation. The method of calculation

$(3.5 - 1) \div 1 \times 100$ with the wrong answer would also gain this 1 mark.

Part (ii) was an attempt at testing the understanding of eutrophication but very few candidates recognised it as such. Fertiliser entering fresh water should immediately clue them into the topic. Candidates needed to look at the graph, between May and September, and state what was happening to the dissolved oxygen content and the number of bacteria. Number of bacteria increased (1 mark). The reason for this change – more dead plants (1 mark) for the bacteria to break down/decompose (1 mark). More bacteria means that more oxygen is being used up (1 mark) during bacterial (aerobic) respiration (1 mark). Any 3 points 1 mark each.

Points often missed by the candidates were: the presence of dead plants, their decomposition by bacteria and bacterial respiration being the cause of the decrease in oxygen.

Common errors included describing the change in bacterial numbers and oxygen concentration between January and October. (January and December in some cases!). Also not understanding which line represented bacteria and which represented oxygen – the key wasn't studied – this error led to most marks being lost.

Many candidates related the changes in bacterial numbers and oxygen concentration directly to an increase in temperature. "Because it's warmer in summer...".

In part (iii) many of the candidates linked the slow increase in bacterial numbers in January and February to the colder temperature. It's cold, too cold gained the mark. 'It's winter' did not score.

- Q.3.** (a) Some good answers seen, but more often than not the answers were of poor quality. Candidates are very rarely asked to draw anything in this exam paper. The quality of the drawings seen was often very poor. One mark was awarded for the quality of the drawing and 2 marks for the labelling.

In order to gain the quality of drawing mark, the cell wall had to be drawn thicker or darker than the cell membrane of the given cheek cell. There should be no breaks in the wall, and it should not be drawn sketchily. The cell wall could be drawn as a single or double line.

Candidates were also told not to draw anything that could not be seen in the photograph of the plant cells. This instruction was often ignored and chloroplasts, mitochondria, vacuoles, etc. were often seen in the drawings and accompanied by labels. This resulted in all marks being lost.

Students must be encouraged to read questions carefully.

The guide arrows from the labels had to touch the structure being labelled. Even a small gap would negate the mark. Many candidates lost marks because they simply did not do this. The guide arrows often landed in 'mid-air'. It would have been nice to see the guide arrows drawn with a ruler, but this was a rarity.

Part (ii) was quite well answered. To see them more clearly, to make them more visible are examples of answers that scored. See the image clearer gained the mark. Answers that didn't score included to see the cells better or easier.

Many candidates gained the mark for the measurement in part (iii). Acceptable answers here were 38, 39 or 40 mm. Many candidates were unable to measure line X-X correctly. Coming up with readings such as 0.5 mm and 380 mm.

The second part of the calculation caused problems for many candidates. The mathematics was often very poor. They often found the conversion of the answer to (a)(iii) into μm difficult even though they were told that

1 mm = 1000 μm . Some candidates were using both μm and mm in their calculation. Some candidates did the calculation correctly by converting 70 μm into mm (0.07 mm).

The next problem experienced by the candidates was the rounding of their answer to two significant figures. Many candidates either missed the instruction to do this or they ignored the instruction, or they didn't understand significant figures. It seems that most often it was the latter. Some candidates produced what seemed like a correct 3 digit answer only to rub out the 3rd digit thinking, it seems, that the answer to 2 sf meant an answer to 2 digits. 2 marks were given for a correct answer rounded to 2 sf. A look at the published mark scheme for this paper will show that there were many ways in which candidates could obtain 1 mark if they hadn't rounded their answer to 2 sf. Error carried forward (ecf) from an incorrect answer in (a)(iii) was also applied.

- (b) Part (i) was generally well answered. Tissue was the only acceptable answer.

Many struggled with part (ii). Increased efficiency was the correct answer. Making the cells more productive or effective were also acceptable answers.

- Q.4** (a) Well answered although often the wrong structures were labelled. Labelling guide arrows had to land on or in the structure being labelled. The guide arrow falling short, by even a small amount, lost the mark. Pancrease failed to score.

- (b) Many struggled with part (i). Candidates needed to identify **where** the glucose came from and **how** it appeared. A simple sentence stating that starch is digested into glucose by amylase/carbohydrase gained both marks. The **where** and the **how** were stand-alone marks. The other term acceptable for digested is broken down (and obviously hydrolysed if seen). Turned into, broken into, converted into and changed into were not acceptable.

The method by which the glucose moves was not required here but some candidates referred to it moving by osmosis.

Part (ii) was quite well answered. Diffusion or active transport were credited in I. Osmosis and digestion were the most commonly seen incorrect answers.

Blood or (blood) plasma the only correct answers in II. Both water and bile were seen as answers.

Most candidates were able to gain credit for the first section of part (iii). Amino acid(s) was the only acceptable answer. Many candidates struggled to gain both marks for the second section of this question. Again, a simple sentence stating that protein is digested into amino acids by protease gained both marks. Reference to amino acids was not needed here if amino acids was the answer given to (b)(iii) 1. The same unacceptable terms for digestion were applied as in (b)(i) above.

- (c) This question really tested knowledge of food tests. Performance was not good with most candidates getting less than the 2 marks available.

One mark was awarded for each correct row. Very often Benedict's appeared in the top row and Biuret in the bottom row even though the positive results of each of these reagents was given in column 3. For some reason, iodine appeared as a very common answer in the Name of Reagent column. Disappointing performance on a topic that is usually well answered.

- Q.5** There were some excellent answers seen on this QER question with candidates gaining 5 or 6 marks (max = 6). However, many of the answers were low scoring and of poor quality. Inspiration is a topic that lends itself to good sequencing and candidates should be able to get things in the correct order.

High scoring accounts started with the action of the intercostal muscles and diaphragm and the changes their actions bring about in the body. Volume and pressure changes in the thoracic cavity should be next in the written account. These changes result in the lungs inflating and air rushing into them.

The problems, amongst many, seen in accounts were:

- Failure to refer to the diaphragm and intercostal muscles contracting.
- No or incorrect reference to the volume and pressure changes in the thorax eg volume decreases pressure increases.
- Lungs inflated and causing the diaphragm and intercostal muscles to contract

- Q.6** (a) Almost every candidate got the basic mathematics in this table correct. A problem, which often arose, was a failure to indicate that the calculated values in columns C, D and E were negative values. This omission lost the 1 mark available.

- (b) Most candidates struggled with this fairly straightforward osmosis question. The potato in Tube B increases in length by 1 mm. Why?

The first common error was not to state that the concentration of water outside the potato cylinder was greater than the concentration of water inside the potato. Without this fundamental statement it is difficult to move on. (This could be stated in terms of the reverse argument or in terms of solution strength or tonicity). 1 mark.

Next we have WATER moving, from high to low concentration of water, into the potato. Very often in incorrect answers it was glucose, glucose solution or solution that was moving. 1 mark.

Finally, the potato increases in length. Why did so many candidates refer to a change in mass?

A straightforward definition of osmosis gains no marks. The information within the definition must be applied to this novel situation in order to gain marks.

- (c) Part (i) was generally well answered. Any value within the range $>1\%$ but $<2\%$ gained the mark. Most answered 0.5% .

Part (ii) was again quite well answered. Many referred to using a narrower range of solutions such as 0.5 , 1.0 , 1.5 , 2.0% and gained the mark. Very few candidates precisely narrowed the range to between 1.0% - 2.0% i.e. 1.1 , 1.2 , 1.3% etc. for the 2nd mark.

- (d) This was not well answered. The only acceptable answers were temperature or type/variety/age of potato.

Q.7 (a) Generally well answered. 1 mark was awarded for the correct reactants and 1 mark for the correct products. Reference to energy or ATP in the products was not credited. The use of chemical symbols was accepted. Errors included reversing the reaction and giving the equation for anaerobiosis.

- (b) Many struggled to correctly read the figures from the graph. Both needed to be correct for 1 mark. The acceptable range of answers was I. $3.5 - 4.5$ minutes. II. $14.5 - 15.5$ minutes.

In part (ii), the first marking point was for a statement that said – ‘As the heart rate increases the breathing rate increases’ or vice versa. Most candidates gained this mark.

The second marking point was for finding some fine detail difference between heart and breathing rates that was shown in the graph. Such as recognising that the breathing rate took longer to get back to normal than the heart rate did– in fact the breathing rate did not get back to normal within the time scale given. Most candidates failed to get this second marking point.

The first section of part (iii) was well answered. An answer of 119 beats per minute gained 2 marks. 1 mark was awarded for the correct mathematical method with the incorrect answer.

In the second section, candidates were asked to draw a horizontal line, on the graph, to indicate their value in (b)(iii) I. A tolerance of $\pm < 1$ small square in either direction was allowed. Error Carried Forward was applied. Many struggled with this and far too many, for some reason, didn't attempt the question.

Many found part (iv) difficult. Most candidates recognised a question on oxygen debt. 1 mark. The 2nd mark was awarded for an answer referring to oxygen being required to breakdown lactic acid.

- (c) Many failed to gain the mark here. Some of the candidates referred to the incomplete breakdown of glucose during anaerobic respiration. Others knew that less ATP was produced in anaerobic respiration or more ATP in aerobic respiration. Some candidates gave the values - 2 ATP v 38 ATP.

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UNIT 2: CHEMISTRY 1 – FOUNDATION TIER

Overview of the Unit

The demand of questions in this paper was broadly comparable to that seen last year. It was set at a suitable level for foundation tier candidates. The difficulty of questions increased throughout the paper from the lower demand section to the to the common section.

The foundation tier only section of the paper was generally well attempted. The questions in this section usually gave a choice of answers. This has been done over the past three summers with the intention of making questions more accessible for foundation tier candidates. Unfortunately, there is evidence that many candidates lack some of the basic knowledge and understanding needed to gain credit even in these questions. Some failed to follow question instructions correctly e.g. by not selecting the appropriate number of answers from choices given.

Extended answers requiring descriptions were fairly answered in some cases but those requiring explanation were more poorly done. In questions assessing recall as well as understanding, answers that were often unclear or vague.

Few candidates at foundation level showed an understanding of chemical reactions and skills in writing chemical equations were generally poor. These are key skills in chemistry and therefore have a significant number of marks allocated to them in each paper. They are most often tested separately on the foundation tier paper e.g. in questions requiring candidates to give the chemical formula of a named compound or to complete a partially written symbol equation.

The quality of graph work was generally good and most candidates were able to successfully plot points onto an axis with a given scale and draw a straight line of best fit. No credit was awarded for lines simply joining all the points.

The common section proved more difficult for candidates at this level to access. Again extended written answers, typically for 2 marks, were generally poorly attempted and answers lacked the clarity needed to gain the marks.

The QER question was attempted by five out of every six candidates but answers were generally weak with a mean mark of 1.3 out of 6 awarded. Many gave a simple description of the stages of water treatment at lower band standard. Few were able to describe each stage clearly using appropriate terminology to get a middle or top band mark.

Comments on individual questions/sections

Question 2

- (a) Candidates commonly mixed up a period and a group and lost simple marks here.
- (b) The term *ductile* was not well understood.

Question 4

- (b) Just under a half of candidates gave the correct formula for magnesium oxide.
- (c) Many candidates simply added the A_r values for the three elements to gain an incorrect answer of 88. No credit was awarded unless there was clear understanding that the formula contains four oxygen atoms.

Question 5

- (b) This was poorly answered. Very few gave the correct number of neutrons. Many copied the mass number as one answer and the atomic number as the other.

Question 6

- (b)
 - (i) Many circled the whole row or the mean value rather than the individual result that was not used to calculate the mean. Candidates gaining both marks gave clear reasoning using the term *anomaly* or a clear description such as *it is too far away from the other results at that concentration*. There was often poor language used in attempts to give the reason e.g. *it is an incorrect result* or *it doesn't follow the pattern*.
 - (ii) The graph was well done and most candidates could plot four of five points to gain 1 or 2 marks. The line mark was often lost. Some did not use a ruler and others joined individual points rather than drawing one straight line of best fit.
- (d) Only one in four candidates correctly identified the gas as hydrogen.

Question 7

- (a) This question was attempted by 85% of candidates. Many gave a simple basic description of the stages of water treatment at lower band standard or in some cases accessing middle band marks with a description of the purpose of each stage. Fewer were able to describe in more detail how each stage is carried out. Top band marks were very rarely awarded.
- (b)
 - (i) Only one in three gave a clear *scientific* answer here to a simple recall question. Vague answers such as *it is good for your teeth* did not gain credit. There was obvious confusion with the importance of calcium for strong and healthy bone growth. Where possible references to bones were ignored.

Question 8

- (a) Most candidates could identify the greatest difference between melting and boiling points from the table and could follow the trend in part (ii). Only around half of candidates could use the information to give the correct answer in part (iii).

- (b) Surprisingly few candidates could state that potassium ignites or gives a lilac flame when put in water. Fewer still could give the reason for the difference in terms of reactivity increasing down Group 1.
- (c) Barely any marks were awarded with only around one in 20 being able to give the formula for lithium oxide.

Question 9

- (b) Many candidates could not link the number of electrons to the atomic number here. From those who did, most could then give the correct name for the element calcium.

Question 10

- (a) About one in six candidates correctly stated that **J** has a lower boiling point than **K** and gained 1 mark here. Very few candidates realised that **J** has a boiling point of 56°C (and not lower) from the statement that the temperature stays at 56°C even though the mixture is still being heated.
- (b) This quite simple calculation had a low facility factor of 20%. Many candidates did not multiply the mass of carbon by 4 and rounding errors were very common.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 2: CHEMISTRY 1 – HIGHER TIER

Overview of the Unit

The demand of questions in this paper was comparable to those of previous series and the paper was set at a suitable level for higher tier candidates. The difficulty of the questions increased throughout the paper from the common section to the higher tier-only section.

Most questions in the first half of the paper were attempted by almost all candidates and attempt rates were generally high apart from question 7(c). Many candidates have good knowledge and understanding and can demonstrate the skills necessary to achieve credit in many areas. It is pleasing that there was some evidence of improvement in candidates' skills in writing simple formulae and balancing equations. There is plenty more room for improvement but it is worth investing time in this. There were 9 marks for formulae and equations in this paper.

Chemical calculations were usually attempted by most with the usual common errors seen. Many candidates are unable to complete percentage calculations. Understanding of both reacting mass and simplest formula calculations was poor overall.

Extended answers requiring descriptions were well answered in many cases, with answers requiring explanation more poorly done. In questions assessing recall as well as understanding, answers often lacked clarity or were too vague to be credited.

The quality of graph work demonstrated by candidates was good and most were able to successfully plot points and draw a suitable curve. Some were caught out by the vertical axis having a scale where one small square represents 0.5 cm^3 . Some lost a mark for a poorly drawn curve or for joining the points with a ruler.

Comments on individual questions/sections

Question 1

- (a) Most candidates could identify the greatest difference between melting and boiling points from the table and could follow the trend in part (ii). More than three in four candidates used the information correctly to give the correct answer in part (iii).
- (b) Many candidates could state that potassium ignites on adding to water but fewer could give the reason for the difference in terms of reactivity increasing down Group 1.
- (c) Very few gained both marks for completing the equation but a good number of higher tier candidates managed to give the formula for lithium oxide.

Question 2

- (b) This was very well answered with the majority gaining both marks.

Question 3

- (a) Many candidates correctly stated that **J** has a lower boiling point than **K** and gained 1 mark here. Fewer realised that **J** has a boiling point of 56°C (and not lower) from the statement that the temperature stays at 56°C even though the mixture is still being heated.
- (b) This was better done by higher tier candidates but rounding errors were again common.

Question 4

- (a)
 - (i) Few candidates could give the correct formula for magnesium nitrate so most gained no marks. More difficult formulae involving compounds ions and therefore the use of brackets clearly require more work.
 - (iii) Most candidates gained 1 mark for stating that the rate decreases over time. Most who gained a second mark referred to fewer collisions over time. Few candidates stated that reactant particles are used up and fewer still referred to the significance of the graph levelling off at 25 s with the reaction having stopped. Many answers incorrectly referenced the energy and/or speed of particles which was irrelevant here.
- (b) Most candidates gave the reason for adding a catalyst but not many explained that a catalyst lowers the activation energy or provides an alternative reaction path.

Question 5

This PISA-style question was reasonably well answered but many responses in part (a)(ii) were too vague to be credited. The equation in part (b) again caused problems.

Question 6

The QER question was attempted by more than 90% of candidates. Many could give a fair description of ion exchange and some could give advantages of both methods. Good descriptions of how boiling softens water in terms of removing hydrogencarbonate ions and forming a precipitate were not often seen. Many candidates incorrectly stated that boiling is a cheap method to soften hard water. This question requires detailed recall and it is not surprising that the mean mark equates to a lower band answer. Despite that some exceptional top band answers were seen.

Question 7

- (a) Knowledge of ion tests was poor and the mean mark for part (a) was less than 1 out of 3. In many cases candidates either gained no marks or did well. These are easy marks for those who have learnt these simple tests and observations. They are also needed for the year 11 unit so are worth revisiting regularly during teaching.
- (b) Some candidates gained 1 mark for stating both numbers of protons correctly. The number of electrons in positive and negative ions was very poorly understood and a fully correct answer for 2 marks was rarely seen.
- (c) This was amongst the most poorly answered questions on the paper. Many incorrectly included all ions rather than only those involved in the precipitate formation. Many seemed not to have used the ion table at the back of the paper.

Question 8

- (a) (i) Many candidates gained the first mark for the trend of reactivity within Group 7 but lost the second mark due to a lack of understanding that Group 7 elements need to gain electrons. Confusion with Group 1 elements losing electrons was often apparent.
- (a) (ii) The first mark for identification of the three elements was often awarded. Unfortunately the reasoning was generally poor. Very few candidates used the observations correctly so the second mark was rarely awarded. This is a difficult area requiring good understanding of several concepts and is really only accessible for A/A* grade candidates.
- (b) This was poorly answered with a facility factor of 18%. The majority didn't really know where to start.
- (c) It is pleasing that almost half the candidates correctly balanced this unfamiliar equation.

Question 9

- (a) (i)&(ii) These questions, although attempted by most candidates, were very poorly understood. There was some confusion with global warming and levels of carbon dioxide. Answers to part (ii) were usually vague and lacked the detail needed for credit in a higher tier question. Very few marks were awarded for either part.
- (b) The facility factor here was 30% which is slightly disappointing for a question type which should be familiar. The steps to find a simplest formula are straightforward given some understanding and practice. Candidates were penalised one mark only for the common errors so often gained a mark for one correct step in the method. They should be reminded that showing their working in a clear and logical way can often gain credit even though the final answer is not correct. This applies to all calculations in chemistry papers.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 3: PHYSICS 1 – 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 all sections of the paper.

Questions that required recall of knowledge were very poorly done with few correct responses in some cases. The quality of writing in a significant number of cases was poor, causing examiners to spend some considerable time in deciphering the wording. Spelling, punctuation and grammar were often poor and where this was examined many candidates lost marks for a basic lack of capital letters and full stops in their writing. Whilst equation work was often good some numerical work was hampered by candidates not reading questions carefully. Knowledge of units was frequently weak.

Questions allowed candidates to: apply their knowledge and understanding of scientific ideas; analyse, interpret and evaluate data; use equations to solve questions; and apply their knowledge of practical techniques. The quality of extended response was assessed in a question about household insulation.

Comments on individual questions/sections

Question 1

This proved to be an accessible introduction to the paper with many correct responses seen and a good attempt rate. Despite this it was evident that many candidates were unaware of the units for power and voltage. It was noted that it was surprisingly common for candidates to choose different values for power and voltage in the calculation section than those they had stated in (a)(i), despite the instruction to use their previous answers. Reading even simple questions is a challenge for many of the Foundation Tier entry. In part (b), many could successfully choose the correct fuse rating, but the recall required in the remaining parts on safety features was very poor.

Question 2

This was a straightforward question on electricity generation, and many correct responses were seen. Despite this, some candidates did not realise that the whole pie chart must add up to 100% and many had evidently not read the question as they mixed up the required sections. Matching the electricity source with a statement about it in (b) was usually well done, with most attaining 2 or 3 marks here.

Question 3

This question was set in the practical context of exploring the I - V characteristic of a resistor. Most candidates knew the symbols for an ammeter and voltmeter, but many were confused as to how they should be connected in the circuit shown. The graph in (b) was relatively straightforward to plot, and many candidates scored well here, although the plots at 3 V and 5 V were sometimes incorrect. Candidates who did not complete the line with a ruler were unable to attain the line of best fit mark. A minority of candidates lost plotting marks because their plotted points were too large to allow examiners to judge if they were in the correct place on the grid. Many candidates successfully read the current off the graph for (b)(ii) and were able to use their value to determine the resistance in (b)(iii). Despite completing this calculation very few were able to give a sensible answer in (b)(iv), not realising that the straight line meant that the resistance of the resistor was constant. The most common response was to simply describe the trend of current increasing with voltage. The calculation of total resistance in series was very poorly handled in (b)(v) with few correct responses.

Question 4

This question tested knowledge of the em spectrum. Part (a) required candidates to recall the missing regions. Few had learnt the regions of the spectrum and many simply picked regions that were already present on the diagram or gave responses relating to the frequency the missing regions. In part (b) many candidates were able to select one or two correct responses. In part (c) many picked up a mark here for a reference to ionising radiation causing cancer but few mentioned damage to cells.

Question 5

This question was set in a practical context and explored the speed of water waves. Part (a) was very disappointing, with very few candidates able to read the value of wavelength from the wave diagram given. Whilst many gained credit in the frequency calculation in (a)(ii) with error carried forward, it was rare to award a mark for the unit of frequency. Part (b) tested knowledge of practical techniques, and this was poorly done by most candidates. Many could not identify an anomaly in the table of results and instead of a time value selected mean values or depth values or circled whole rows of data. Even where candidates were able to select an anomaly very few were able to explain why it was anomalous and could not calculate a more accurate mean. These are basic practical techniques which were not well-known. In (b)(v) candidates were required to make a conclusion by examining the data in the table. This was successfully done by many, where candidates were not correct it was usually because they mixed up time and speed.

Question 6

This question tested the quality of extended response with a question about household insulation, based around a table of data. Many candidates were able to successfully select the best two types of insulation to fit given the budget within the question. They were often less successful in explaining why they should fit these types rather than the others presented and a lack of comparative language was seen. Many poor responses stated the insulation prevents all heat loss from a house. Mainly bottom band or weak middle band responses were seen, it was rare to award marks in the top band. The quality of written communication was frequently poor, with a lack of punctuation and incorrect spelling which limited marks within the band for many candidates.

Question 7

This question was the common question, and it was poorly done by most Foundation Tier candidates, with few good responses seen. The exception to this was the simple payback time calculation in (a)(i) which was correctly done by many. Part (b) was very poorly addressed with few candidates realising that trees absorb carbon dioxide, and it was rare to award marks here. Interpreting the Sankey diagram in (c) was also poor with very few candidates recognising the useful power output from the power station was simply the input power minus the clearly labelled waste power. Many candidates could not calculate an efficiency in (c)(ii) and where marks were awarded here it was usually with error carried forward. In (d)(i) candidates had to select and use the power equation. It was rare to see conversions from minutes to seconds so 2 marks were commonly awarded out of the 3 available. The remaining questions in (d) tested candidates' ability to read and interpret given information and perform some numeracy type calculations. This was very poorly completed by Foundation Tier candidates with a common error being to only use the numbers given in a particular question part and not bring forward any previous answers.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 3: PHYSICS 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. Most candidates attempted all sections of the paper.

Questions requiring recall were poorly attempted and for most candidates their basic knowledge of Physics was not secure.

Circuits proved to be a very challenging aspect of the specification with a poor performance seen in questions based on current electricity. Responding appropriately to command words was often weak with candidates calculating rather than stating, not using data where required and not using comparative language.

Questions allowed candidates to: apply their knowledge and understanding of scientific ideas; analyse, interpret and evaluate data; use equations to solve questions; and apply their knowledge of practical techniques. The quality of extended response was assessed in a question about investigating the relationship between current and voltage for a filament lamp.

Comments on individual questions/sections

Question 1

The responses from Higher Tier candidates on this common question were much better than those attempted by Foundation Tier candidates. The calculation in (a)(i) was usually correct although some rounding errors were evident. Despite Higher Tier candidates generally handling this question well the idea of trees absorbing carbon dioxide was still not well done and it was rare to award credit in (b). The Sankey diagram in (c) was handled well, with many correct responses seen. Where candidates made mistakes in (c)(i) they were usually able to determine an efficiency in (c)(ii) and attain credit with ecf.

In common with Foundation Tier candidates, it was rare to see a totally correct response to (d)(i) with only a few candidates realising that they needed to convert from minutes to seconds in the power calculation. The remaining sections of (d) were numeracy style calculations that demanded careful reading and there were many correct responses seen, usually with ecf. However, there were still many candidates who had difficulty handling these calculations and treated each question part as separate.

Question 2

In this QER question candidates were required to describe the components they needed to add to the circuit and how they, along with the rest of the circuit, should be used to investigate the I - V characteristic for a filament lamp. Very few top band responses were seen. Most candidates were able to discuss adding ammeters and voltmeters to the circuit, but the methods presented lacked detail. The quality of the written response was often poor and limited marks within a band. Few candidates could securely describe the role of the variable resistor in obtaining pairs of readings. The question in (b) proved to be beyond the reach of all but a very small number of candidates. They showed limited understanding of what the I - V characteristic presented revealed about the relationship between voltage and resistance, with most simply describing what they saw.

Question 3

This question proved to be a challenging question on current electricity which began by exploring the total resistance of a circuit consisting of two identical resistors in parallel. In (a)(i) the equation of parallel resistance was given and most attempted to use it. The most common answer was $0.2\ \Omega$, arising from candidates failing to invert the sum of the calculation they had done. In a quite few cases fractions were poorly handled and an answer of $20\ \Omega$ was attained. The calculation of the current through the ammeter in (a)(ii) was often awarded with ecf although many did not realise that they needed either to use the total resistance or to determine the current through one resistor and double the answer. In (a)(iii) candidates were asked to state the voltage across one of the resistors and this was usually incorrect with few candidates demonstrating an understanding the behaviour of voltage in a parallel circuit. Part (b) was very poor with few correct responses. Candidates were instructed to state how the values of resistance, current and voltage would compare in a series circuit connected from the same components. Most chose to do calculations and did not compare their answers in any way obtaining no credit.

Question 4

This question tested candidates' knowledge and understanding of the em spectrum. Part (a) was surprisingly poor – many struggled to handle the negative indices and correctly match the wavelengths to the regions. Part (b)(i) tested knowledge of the names of all the regions of the spectrum and whilst many were able to attain a mark here it was common to see candidates who could not name any ionising regions of the spectrum. Few gained credit in (b)(ii) - knowledge of the meaning of the term ionising radiation was very weak and most answers presented were vague. In part (d) many candidates ignored the instruction to use data from the table and hence made no attempt to compare time delays.

Question 5

This question tested knowledge of domestic electricity and began with simple cost of electricity calculations comparing two kettles. Most candidates were unable to convert W to kW and minutes to hours in (a)(i) but could gain some credit for substituting a power and a time into the equation for energy transfer, even if they did not pick up on the kettle being used 6 times per day. Many mistakes were seen in (a)(ii) where candidates were required to use the units used that they had calculated in (a)(i) in a cost calculation. It was very common to see no value being brought from (i) into (ii). Another common mistake was to convert the cost per unit given in (ii) into pounds, even though pence was on the answer line. This unnecessary conversion did cause many to lose marks. In part (a)(iii) where comparisons between the two kettles were required was very poorly handled, despite candidates only needing to repeat their calculation from (a)(i) for the other kettle to see that the units used would be the same. In part (b)(i) candidates were asked to recall two advantages of the ring main – very few totally correct responses were seen here with vague statements about safety commonly presented. Part (b)(ii) was slightly better attempted although again many answers were vague. In the final question part candidates were usually correct as all they were required to do was check that the power did not exceed the value stated. A few candidates did not show the result of the sum and hence attained no marks.

Question 6

This question tested knowledge and understanding of the National Grid. Many good responses were seen in (a)(i) about the role of step-up transformers. A common error here was to state that step-up transformers prevent heat loss which could not be credited. The calculation in (a)(ii) was handled well by many candidates who selected the correct equation, substituted and rearranged to get a partially correct answer. Only a few converted MW and kV so lost a mark. It was quite common to see incorrect equations selected here despite the words power and voltage appearing in the question and no other quantities being referenced. Candidates who attempted to rearrange before substituting often lost all 3 marks and in those cases, it was very common to see incorrect 'triangles' being used to support the rearranging. Part (b) was very poorly done with many unable to identify from the graph when water would be returned to the upper reservoir.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 4: BIOLOGY 2 – FOUNDATION TIER

Overview of the Unit

Topics included:

- Classification
- Adaptation
- Cell Division
- Nervous System and reaction time
- Structure of DNA and Genetic Profiling
- Diabetes
- The Skin and Temperature Control (QER)
- genetics
- antibiotics, medicines and biodiversity

Skills tested included:

- mathematical skills including graphical work
- practical skills

Only a minority of candidates failed to attempt the questions, but the quality of written communication was an issue for some candidates. If an answer cannot be read, then it cannot be marked.

Many candidates lost marks by not reading the question carefully. This caused some questions not to be attempted, probably because the candidate did not realise the question existed, e.g. labelling the y axis of the graph in question 6.

The calculation in question 9 was disappointing. The formula was given to the candidates, and they are allowed to use a calculator. Again, many candidates did not read the question carefully enough. This resulted in many not realising the answer was needed to the nearest whole number.

Basic recall continues to be an issue with many candidates. This was shown by poor quality responses to several questions, e.g. nervous system, food tests, skin and antibiotics.

The performance in practical skills was varied. Most candidates were able to state what a student could do to gain more confidence in the results of an experiment. However, there was very poor understanding of control variables.

Comments on individual questions/sections

- Q.1.** (a) Well answered by many candidates. However, marks were lost here due to not being able to copy accurately from the box of possible answers. A number wrote *quercus* instead of *Quercus*.
- (b) Well answered by many candidates. A minority did not read the question carefully and only underlined one statement.
- (c) This was well answered by most candidates.
- Q.2** (a) Very well answered. This was the most accessible question on the paper.
- (b) This type of question has been asked many times before. As always, no credit is given for the word 'spine'. It was disappointing to see many candidates use this term.
- Q.3** (a) Part (i) was well answered by most candidates. A small number did get confused between number of cells and number of chromosomes. We did see answers such as '46' and '23'. This is probably due to a lack of recall combined with not reading the question carefully.
- Responses to part (ii) were generally good but many candidates did not get full marks. The main reason would again be, not reading the information carefully, combined with only a superficial understanding of cell division.
- Q.4** (a) This was answered well by most candidates.
- (b) This proved to be the most difficult question on the paper. It was attempted by most, but it was poorly answered. Many did not know what was meant by controlled variables or a fair test. Many of those who did understand controlled variables focussed on the same computer or keyboard rather than the experimental design, such as, same time of day.
- (c) This was answered well. The idea of repeating the experiment or having a large sample size increasing confidence seems to be well understood by most.
- (d) Part (i) was poorly answered. Most candidates did not seem to understand the term 'stimulus'. There was a wide range of answers here.
- Part (ii) was again poorly answered. There seemed to be a better understanding of the concept, but literacy let many candidates down. Examples of such responses are 'electricity', 'electrical', 'electronic', 'electrical message'. 'Electrical impulse or electrical signal were the only two possibilities.
- Part (iii) was a recall question. Many candidates could recall the components of the CNS. However, some mentioned 'spine', instead of 'spinal cord'.
- Q.5** (a) This was answered well by some and poorly by others. This was a recall question. Some got mixed up with the base-pairing rules, and some wrote down random letters.

- (b) Again this was purely recall. The only answer that was creditworthy was 'double helix'. Anything else was incorrect.
- (c) Both parts of this question were very well answered by most candidates.
- Q.6** (a) The plotting of the data and the drawing of the line was done well by most candidates. It was good to see small, neat crosses joined by a thin, straight line. Unfortunately, a number of candidates did not read the question carefully and missed 1 of the 4 marks available by failing to label the y axis.
- (b) Many candidates were once again let down by their poor literacy skills. They did not mention that as the years progressed, the percentage of the Welsh population being treated for diabetes was increasing. They put this into their own words and omitted the time element or shortened the dependent variable.
- Part (iii) was an AO3 question. Many went down the wrong path, e.g. NHS does not have the money, long waiting lists, patients do not have the money.
- (c) This was pure recall. Some could do it, others could not. Some interesting spellings of insulin. Phonetic spellings were credited.
- (d) Part (i) was a combination of recall and practical work. It is a question that has been asked many times in the past. It was poorly answered by most. This was disappointing.
- In part (ii), it was curious that most candidates could not recall the method of doing the Benedict's Test, but they could recall the result. There were four possible correct answers, and they were told that the answer was a colour, so there may be a significant number of guesses that gained credit.
- Q.7** The mean score for the QER question was disappointing. Many candidates were only able to recall 'sweating' as a means to cool down. Many answers lacked detail. Again, literacy let many candidates down. Many failed to describe the blood vessels in the skin getting wider or vasodilating. Instead, they gave much more vague descriptions like 'they increased in size' or 'got bigger'. Some are still claiming that the blood vessels move closer to the surface. Very few mentioned evaporation of sweat from the skin.
- Q.8** (a) Very few candidates picked up this mark. The answer to this question required reference to both a characteristic/feature and gene/ allele/ genotype/ DNA for 1 mark. Most candidates stated characteristic or feature but far fewer mentioned the genetic link. Many did not attempt this question.
- (b) Part (i) was poorly answered by most candidates even though most attempted it. It was disappointing to see so many answers with single allele genotypes.
- Part (ii) was well answered by some candidates. Although many seemed to have the idea of both parents being heterozygous, possibly due to doing past papers where that was the case.

It is difficult to understand why some candidates used letters other than **T** and **t**. The instruction to use these letters is clearly written on the question paper. Candidates must read the question carefully and follow instructions. This error lost marks but this loss was limited by allowing ECF. The use of **X** and **Y** was also occasionally seen but their use resulted in the loss of all 4 marks for this question.

Part(b)(iii) was not well answered at foundation tier. If the answers to 1(b)(i) & (ii) were correct then the ratio was 0 : 2 : 2. It would have been nice to see this ratio reduced to 0 : 1 : 1 but either answer would have gained the mark.

Many candidates were not sure what the word ratio meant. This was evidenced by many answers containing genotypes or phenotypes here instead of numbers.

- (c) In order to gain the mark reference had to be made to the 7 pairs of identical twins. Many candidates got the idea but found it difficult to express themselves and therefore lost this mark.

- Q.9**
- (a) Many candidates lost marks in part (i). There were several reasons for this. Some were unable to get the data from the stem of the question. Many were unable to plug the data into the given formula. Some forgot to multiply by 100. A lot of candidates struggled with the notion of rounding their answer to the nearest whole number.

Most foundation candidates also struggled with part (ii). Overuse or over prescription of antibiotics was the answer looked for. Antibiotic courses not completed (by patient) was also a correct answer. The following incorrect answers were often seen: vaccination, mutation, bacterial immunity, the bacteria are stronger than the antibiotic.

- (b) **B** was the only answer to part (i). Most of the candidates gained this mark.

The mark for part (ii) could only be awarded if the candidate got (b)(i) correct.

Most of the foundation tier candidates got confused here. Many did not know what the clear zones were or how they were formed. Unfortunately, some candidates got close with their answer stating that 'there is no clear area', but this was not enough for the mark. They needed to state that none of the bacteria were killed/destroyed/because the bacteria are unaffected by methicillin.

- (c) Part (i) was poorly answered at foundation tier. Not many stated fungus, mould or *Penicillium*. This topic appeared to be a part of the specification that had not been revised thoroughly by most.

Part (ii) was poorly answered by most candidates. Many stated that testing was required but this was not enough for the mark

The basic answer for part (iii) here was 'to find new medicines/ antibiotics/ drugs/cures. As biodiversity decreases then we could lose species that could have provided us with new medicines. Many candidates came close to getting the mark but did not due to the phrasing of their answer. Answers like 'biodiversity could give us new medicines' were not accepted. There seemed to be a lack of understanding of the word biodiversity.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 4: BIOLOGY 2 – HIGHER TIER

Overview of the Unit

Topics included:

- genetics
- antibiotics, medicines and biodiversity
- karyotype, stem cells and insulin control of blood sugar
- biological control
- reflex arc and reflexes
- variation and Natural Selection
- structure of DNA and protein synthesis (QER)
-

Skills tested included:

- mathematical skills including graphical work
- practical skills

Performance on AO1 questions involving pure recall was disappointing. This is especially so in the 3 questions involving an element of continuous prose. Performance on the questions relating to insulin and the control of blood sugar and natural selection were often very disappointing. Performance on these topics in previous assessments have always been satisfactory to good. Although excellent answers were seen in the QER question many of the candidates' responses were very disappointing.

The lack of understanding of some basic biological terms is also concerning. Candidates should be clear, at this stage, in their understanding of terms such as phenotype, genotype, antibiotic resistance, biodiversity, stem cell, biological control and natural selection. In the genetics question not knowing that a genotype has two alleles lost the candidates marks in the rest of the question.

Not reading the question carefully and following simple instructions given in the question also lost candidates marks.

Performance in maths skills and in practical skills seemed much better than the performance in AO1 questions.

Only a minority of candidates failed to attempt the questions, but the quality of written communication was an issue for some candidates. If a word or words cannot be read then positive marking becomes very difficult.

Comments on individual questions/sections

Q.1 (a) The answer to this question required reference to both a characteristic/feature and gene/allele/genotype/DNA for 1 mark. Most candidates stated characteristic or feature but far fewer mentioned the genetic link.

(b) Both parental genotypes were required for one mark in part (i). It was disappointing to see so many answers with single allele genotypes. This error would have seriously affected the number of marks obtained if Error Carried Forward (ECF) had not been applied in later parts of the question.

Part (ii) was well answered. However, it is difficult to understand why some candidates used letters other than **T** and **t**. The instruction to use these letters is clearly written on the question paper. Candidates must read the question carefully and follow instructions. The use of **X** and **Y** was also occasionally seen but their use resulted in the loss of all 4 marks for this question.

One mark was awarded for a correct ratio in part (iii) and this was well answered by most. If the answers to 1(b)(i) & (ii) were correct then the ratio was 0 : 2 : 2. It would have been nice to see this ratio reduced to 0 : 1 : 1 but either answer would have gained the mark.

The answers seen here evidenced the fact that quite a number of candidates are unsure of the meaning of the word ratio. Some answered by writing in words, some answered using fractions and some gave ratios that bore no relationship to the genotypes in the Punnett Square.

(c) This was quite well answered. In order to gain the mark reference had to be made to the 7 pairs of identical twins.

Q.2 (a) The maths question in part (i) was very well answered with the majority of candidates gaining 2 or all 3 marks. Again, marks were lost for not following a clearly written and emboldened instruction on the question paper – Give your answer to **the nearest whole number**.

A better performance on part (ii) was expected. Overuse or over prescription of antibiotics was the answer looked for. Antibiotic courses not completed (by patient) was also a correct answer. The following incorrect answers were often seen: vaccination, mutation, bacterial immunity, the bacteria are stronger than the antibiotic.

(b) **B** was the only answer to part (i). Nearly all of the candidates gained this mark.

2 (b)(i) & (ii) were linked marks meaning that candidates could only get a mark for (ii) if **B** was the answer to part (i).

Answers here were often confused. Many of the candidates didn't understand what the clear area around the methicillin discs represented – areas where the bacteria have been killed. Neither did many of the candidates understand that a methicillin disc was placed in each of the 3 compartments.

An answer stating that 'there is no clear area' is not enough for the mark. Why isn't there a clear area? – because none of the bacteria have been killed/destroyed/because the bacteria are unaffected by methicillin.

- (c) Part (i) was fairly well answered. Many stated fungus or mould. A few answered *Penicillium*.

Many candidates were given credit for their answers to part (ii), but it would have been nice to see some reference to **time** in the answer. Eg To test if they are safe – and this takes a very long time to collect and analyse the results.

Performance on part (iii) was disappointing. The clue to answering this question is that penicillin is obtained from a fungus.

It was very surprising to see how unsure many candidates were about the word biodiversity; and how many seemed to think that biodiversity was a living thing. "We get drugs from biodiversity". "Without biodiversity we wouldn't have animals". "We get medicines from biodiversity". "If biodiversity died we wouldn't have medicines".

To get the 1 mark awarded here the word biodiversity does not need to be mentioned in the answer. However, an understanding of what the word means is essential.

This is all about the loss/extinction of living organisms before there has been an opportunity to test them for new medicines.

- Q.3** (a) Part (i) was quite well answered. Candidates answered 46 or 23 pairs of chromosomes and gained the mark. There are 23 **sets** of chromosomes is incorrect.

Far too many candidates failed to gain the mark for part (ii). Some candidates realised that there must be other organisms with the same **number** of chromosomes as humans and gained the mark. They have to be careful with certain types of answers "Because chimpanzees have 46 chromosomes" is probably a guessed answer and incorrect.

The answers to part (iii) were very hit and miss. Every chromosome, pair/s of chromosomes, groups of pairs of chromosomes were circled – probably in equal numbers to the circling of the sex chromosomes. More wrong than right answers. The second part also saw male and female in equal numbers.

Performance on part (iv) was also disappointing. Care was needed with the answer here – "would have 23 chromosomes/half the **number** of chromosomes/ one chromosome from each pair of chromosomes/ the haploid number of chromosomes" all gained the mark. However, "would have half the chromosomes" was incorrect.

Some candidates' answers went into the detailed number of cells produce in the two types of cell division – no marks here.

- (b) Cancer – very well known.

- (c) Some good answers were seen in part (i) referring to stem cells being undifferentiated or unspecialised cells and being able to turn into differentiated or specialised cells – with examples given.

Answering that stems cell are undifferentiated cells was insufficient for the mark.

Candidates found part (ii) difficult. It was the first question with a little continuous prose. The control of blood glucose levels by insulin was poorly understood. Blood glucose control is a topic which candidates have responded favourably to in the past.

There were a few good answers seen where reference was made to blood glucose falling too low and glucose being converted into glycogen and stored in the liver.

The attempt to put the answer into continuous prose was very often poorly written and often very confused.

Reference to Type 1 and Type 2 diabetes was not needed.

- Q.4** (a) Most candidates underlined at least one correct statement and many underlined both.
- (b) In part (i) candidates seemed to have a poor understanding of biological control, both its function and the general principle of how it works. A misconception here was that because the biological control agent is a bacterium which is being sprayed onto human food crops then the food crops will be inedible or will just rot away.

There were some very confused answers here. Candidates didn't understand/realise that if a biological agent, on human crops, is already in use in some countries then it is unlikely to damage the crop or make it unfit to eat. "Spraying the bacteria on food would kill the food" was, an often seen, incorrect statement. Candidates often correctly answered that the crop yield would increase but few stated that this is because the insect pests are killed by the bacteria.

Some candidates had difficulty with the term yield.

Most candidates could give an acceptable reason for field testing Xentari WG/or another biological control agent in part (ii).

- Q.5** (a) Many candidates got 2 marks but many also lost both marks for the way they drew labelling guide lines. Lines should be drawn with a ruler (no mark for this but it makes for greater accuracy). The line should end on or in the structure being labelled. Where the line ends must not be ambiguous. Often with the effector label it was difficult to decide whether the muscle was being labelled or a dendrite.
- (b) Fairly well answered. Instant is not acceptable for rapid. Examples of reflexes as answers – no marks.
- (c) Part (i) was well answered, many gained all 3 marks.

Parts (ii) and (iii) were also generally well answered. Distraction was the commonest correct answer. Some answers here related to why they had selected 27 cm as the anomalous reading.

There was however a disappointing performance seen in part (iv). Correct answers referred to the speed of reactions increasing/getting faster.

Improves accuracy/reliability was a frequently seen incorrect answer.

- (d) Quite well answered. Answers referring to amount/concentration of coffee/caffeine; type/brand of coffee; time of drinking usually gained marks. Answers referring to experimental method were not credited e.g. same catcher, same stop watch, etc.

- Q.6** (a) Often the wording in the answers was very confused. The answer must relate to differences within a species; between members of the same species; intraspecific differences.

Some candidates found difficulty in expressing this detail sufficiently well enough to be credited – “differences in different species”; “species differ”; “different ways species look”.

The two main causes of variation were well known.

- (b) Continuous was often seen in part (i), although there were very many incorrect answers here.

Candidates found part (ii) very difficult. If the candidates referred to the giraffes moving south then it must be made clear, in their answer, which giraffes are moving south. That is, the giraffes in the north/nearest to the southern extension of the Sahara Desert move south.

If they state that the distribution will decrease, they must specify where this decrease will be. If the answer states that there will be an increase/decrease in giraffes, then they must state where this increase/decrease will be. This level of precision was often absent from the candidates' answers.

It seems that some candidates did not understand the term distribution.

6(b)(ii) It was the second question with a little continuous prose. Answers were generally of poor quality. Natural Selection is a topic which candidates have responded favourably to in the past.

An important omission from almost all the accounts was that neck length/height in giraffes is determined by a gene. If this statement is left out of the answer, then Natural Selection becomes a difficult topic to explain.

Very many answers related to Lamarckism in that candidates thought that the giraffes could alter their height/neck length, develop a mutation, at will. “So that the short-necked giraffes develop long necks by stretching to reach the leaves on the top of the tree”.

Candidates often included the Survival of the Fittest statement without specifying which organisms are the fittest or how this survival contributes to Natural Selection.

One mark was available for a correct statement relating to how Graph 6.2 would change. It would shift to the right; fewer height ranges on the left. The answer to this question was often omitted.

- (c) Part (i) was generally well answered, but candidates experienced difficulty with part (ii). The answer must relate to the modern classification of the giraffe. That is, there are 4 species as shown in Table 6.5. The validity of the graph is affected because it gives no indication of which species of giraffe the data in the graph came from.

Q.7 Some excellent answers were seen but the majority of candidates' answers fell into the 2 – 4 mark range. There were also quite a few answers which were at the bottom of the lower band.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 5: CHEMISTRY 2 – FOUNDATION TIER

Overview of the Unit

The demand of the questions was comparable to that in previous series and the paper was a suitable and fair test for the candidates at foundation tier level. The degree of difficulty of the questions increased throughout the paper, with questions in the common section providing the most challenge.

The foundation tier only section of the paper was generally well attempted. The objective style questioning used in most of this section was accessible for all candidates. Despite this, many candidates lacked the basic knowledge and understanding of the topics assessed through these questions and therefore made random guesses. There were also a few candidates who, through failing to read the question properly, selected more answers than required.

Questions that required descriptions and/or explanations were poorly answered, particularly when they required direct recall of knowledge. This included questions relating to practical work.

Where candidates did demonstrate some knowledge and understanding, many gave answers that were either too vague or that did not specifically relate to the question.

As in previous years, very few candidates demonstrated the skills required to successfully answer questions relating to understanding chemical reactions and writing equations. These questions continue to be poorly answered, despite being a key part of the assessment of chemistry and therefore having a significant number of marks allocated to them in each examination paper. As a result, very few candidates were able to give the chemical formula of a named compound, insert a number into a box to balance a given equation or complete and balance a symbol equation.

Questions that assessed mathematical skills were generally well attempted. However, too many candidates still lack the basic numeracy skills required to successfully access these questions.

The quality of graph work demonstrated by candidates was generally good and most candidates were able to successfully plot points onto a given axis and draw a suitable line of best fit. However, there were still a small number of candidates who were unable to plot all points correctly and/or were unable to draw an appropriate line for the data.

As in previous years, a significant number of candidates were unable to answer questions where they are required to recall or apply the basic knowledge and skills taught in Unit 2 (year 10). For example, very few candidates were able to identify the correct method for calculating the percentage by mass of an element for a given formula.

The PISA-style question was well attempted. Most candidates were able to select information from the article to answer the accompanying questions. Furthermore, because many of these questions were again objective style questions, this made them more accessible to candidates.

The quality of extended responses was better than in previous years with far fewer candidates not attempting the QER question. It was good to see that a reasonable number were awarded top band marks.

Comments on individual questions/sections

Question 1

- (b) Many candidates were unable to calculate the mass of carbon in octane and therefore the percentage by mass of carbon. This would suggest these year 10 skills are not being revisited by centres in year 11.

Question 2

- (c) Too many candidates gave general properties of metals, e.g. malleable and strong, rather than properties that were specific to the use of aluminium in overhead power cables.

Question 3

- (a) Very few candidates were able to name ethane or draw the structure of propene. In contrast, many were able to give the chemical formula for butane.
- (b) Very few candidates were able to explain why dibromoethane is not a hydrocarbon.
- (c) Few candidates were able to complete the diagram to show how the outer shell electrons are shared in a molecule in methane, despite this type of question being asked in many previous papers.

Question 4

- (a) (ii) Although most candidates were able to identify **A** and **B** as the exothermic reactions, many gave general descriptions of exothermic reactions (releasing energy or heat) rather than referring to the experimental data i.e. temperature increase.
- (b) Many candidates were unable to complete the energy profile for an exothermic reaction, despite this knowledge being assessed many times in recent years.

Question 6

This QER question was better answered than in previous years with far fewer candidates not attempting the question. This might be because the topic choice of smart materials was well suited to the ability of the candidates and that using an example within the question provided some scaffolding. However, as in previous years, the standard of handwriting, spelling and grammar was often poor.

There were a good number of top band answers where candidates were able to describe the properties of all three smart materials and give an appropriate use of each material linked to these properties.

Middle and bottom band answers were awarded where candidates:

- described the properties and uses of only one or two of the smart materials
- did not give uses that were specifically linked to the properties of each material
- gave relevant uses for each smart material but did not link these to the relevant properties
- described the smart material given in the example or other materials not relevant to the question.

Question 7

- (a) (i) Few candidates were able to name sulfuric acid, with many candidates giving the names of other acids or other chemicals.
- (ii) II Very few candidates were able to explain that the excess was to ensure all the acid was used up. Instead responses referred to ensuring all the reactants were used up or to increasing the rate of the reaction.
- (iii) Many candidates were able to recall the process of evaporation used to remove the water from the solution. Far fewer were able to recall the need to filter the mixture to remove the excess. There were also several responses where the stages were not listed in the correct order resulting in lost marks.
- (b) (i) The graph plotting of foundation tier candidates was better than in previous years. However, there were still a significant number of candidates making fundamental mistakes such as missing out plots or not drawing a suitable straight line.
- (ii) I&II Whilst most candidates knew how to interpret the graph to answer the question, many were unable read the scale on the x-axis correctly and did not realise that each small division represents 0.5 cm^3 .
- (c) Very few candidates were able to link the volumes of the solutions to their relative concentrations. Most responses incorrectly linked a larger volume to a higher concentration.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 5: CHEMISTRY 2 – HIGHER TIER

Overview of the Unit

The demand of the questions was comparable to that in previous series and the paper was a suitable and fair test for the candidates at higher tier level. The degree of difficulty increased throughout the paper, with the most challenging questions towards the end.

All parts of the paper were generally well attempted, including the most demanding questions. Far fewer candidates left questions not attempted than in previous years.

Again, performance on questions that required descriptions and/or explanations was often poor, particularly when direct recall of knowledge was required. Where candidates did demonstrate some knowledge and understanding, many gave answers that were either too vague or that did not specifically relate to the question.

Whilst most candidates were able to give the formulae of simple compounds and insert a number into a box to balance a given equation, very few demonstrated the ability to bring all these skills together to successfully write full symbol equations. Significant teaching time should be invested in these skills as they have a significant number of marks allocated to them in each examination paper.

Questions that assessed basic mathematical skills were generally well answered. However, as in previous years, very few candidates were able to answer mathematical questions that assessed the skills taught in Unit 2 (year 10).

The quality of graph work demonstrated by candidates was generally good and most candidates were able to successfully plot points onto a given axis and draw a suitable line of best fit. As expected, the quality of graphs produced by higher tier candidates was better than that seen on the foundation tier paper.

As in previous years, very few candidates were able to answer questions where they were required to recall or apply basic skills and knowledge taught in Unit 2 (year 10). For example, very few candidates were able to give the colour of the precipitate formed by iodide ions when silver nitrate solution is added.

As in previous years, the PISA-style question was well answered. Most candidates were able to select information from the article to answer the accompanying questions. Furthermore, because many of these questions were objective style questions, this made them more accessible to all candidates.

The quality of extended responses was better than in previous years with far fewer candidates not attempting the QER question and larger numbers accessing middle and top band marks.

Comments on individual questions/sections

Question 1

- (a) (ii) II Many responses referred to ensuring all the reactants were used up or to increasing the rate of the reaction rather than specifically to using up all the acid.
- (iii) Most candidates were able to recall the process of evaporation used to remove the water from the solution. However, fewer were able to recall the need to filter the mixture to remove the excess. There were also several responses where the stages were not listed in the correct order resulting in lost marks.
- (b) (i) The graph plotting was generally good with more candidates obtaining full marks, compared to previous years. However, a small number of candidates made fundamental mistakes such as missing out plots or not drawing a suitable straight line.
- (ii) I&II These questions were better answered than by the foundation tier candidates. However, there were still a significant number of candidates who were unable read the scale on the x-axis correctly.
- (c) This was better answered than by the foundation tier candidates and many responses were awarded one mark for recognising that the alkali is more concentrated than the acid. However, very few went on to explain that the concentration of the alkali was double the concentration of the acid.

Question 2

- (a) Many candidates were awarded the mark for giving the correct formulae of the reactants. In contrast, very few were able to give the formula of carbon monoxide and balance the equation to get the second mark.
- (b) (ii) Many candidates were credited for recognising that carbon is oxidised because it gains oxygen. However, many incorrectly identified iron rather than iron oxide as being reduced. There were also many candidates who gave general descriptions of oxidation and reduction without linking to the reactants in the equation.
- (c) (i)&(ii) Very few candidates were awarded both marks for this question, despite the prompts given in the question. More gave the correct formula of calcium silicate than were able to name decomposition as the type of reaction.

Question 3

- (a) (iv) Although most candidates were able to draw a structure with the formula C_5H_{12} , few were able to draw the correct isomer. The most common error was drawing a variation on the straight chain isomer rather than the isomer containing the branched methyl group. All the bonds in the structure must be included in order to gain credit.

- (v) Many candidates were able to describe the test using bromine water to identify unsaturation. However many, despite knowing the expected observations in alkanes and alkenes, were unable to link these to compounds **C** and **D**.
- (b) Few candidates were awarded full marks for this question. Marks were mostly awarded for drawing the correct repeating unit for PVC. Accompanying explanations too often contained irrelevant information and did not specifically link to the 'double bond breaking' and the monomers being able to 'join together'.
- (c) This was very poorly answered with most responses listing general properties of plastics, rather than those that are relevant to PVC replacing iron in drainpipes. A significant number of responses referred to cost, despite being told not to in the question.

Question 4

- (a) The quality of responses varied significantly despite this being standard content assessed in nearly every previous paper. Many candidates were awarded full marks for drawing complete diagrams showing the electronic changes that take place during the formation of calcium fluoride. Marks were lost when only one of the calcium electrons was shown as being transferred, when the electronic structures of some ions formed were not given and when some of the ions were given the incorrect charge. There were a small number of candidates that attempted covalent bonding diagrams. They gained no credit.
- (b) Very few candidates were awarded both marks for this question. Whilst there were several responses that recognised the bonds in calcium oxide being stronger and needing more energy to break than the bonds in sodium chloride, very few were linked this to the size of the charges of the ions in both compounds. Many candidates referred to 'intermolecular forces' within the compounds and were therefore not given any credit.
- (c) Few candidates were awarded both marks for this question, mainly because of failing to specifically give the **differences** between the two structures. However, some credit was awarded to candidates that described two features of the one of the structures without direct comparison. Other responses that gained no credit were those that described the properties of diamond and graphite rather than the structure that explains these properties.

Question 5

- (a) (i) Very few candidates were awarded full marks for this question. Where many were given credit for either recognising that copper ions are formed or that copper salts are blue, they were not able to explain this in terms of copper displacing silver or the oxidation of copper atoms.

Question 6

- (b) Many were given some credit for partially answering the question, either by stating that iron is more reactive than copper or that a displacement reaction takes place. However far fewer candidates gave a complete answer that linked both parts.

- (c) This was poorly answered suggesting that fundamental calculations introduced in year 10 are not being practised during teaching of the year 11 content. Where candidates understood the method needed to answer the question, the most common mistakes were dividing the numbers the wrong way around in the first step, not expressing the numbers in the simplest whole number ratio and not using the numbers calculated to giving the formula of the compound.

Question 7

This QER question was better answered than those in previous years with far fewer candidates not attempting it. There were a good number of middle and top band answers, despite this question requiring recall of knowledge and many candidates gave detailed explanations of the process of fractional distillation.

Lower band marks were awarded where candidates:

- did not state where evaporation and/or condensation take place during the process
- did not correctly link where the fractions condense in the column to their different boiling points and differences in chain length
- incorrectly linked the separation to other properties of the fractions e.g. how easily they burn
- included lots of irrelevant information e.g. how crude oil is formed and the process of cracking.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 6: PHYSICS 2 – 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%).

The demand of the early questions was less than in previous series due to an increase in objective style questions and straightforward calculations. The remainder of the paper was comparable with previous series. It provided a fair test for the candidates at Foundation Tier and differentiated well. The degree of difficulty of questions increased throughout the paper.

The early question parts were generally well attempted. Candidates need to take more care in reading the questions and taking note of information such as reading graphs.

The performance of candidates in recall questions tended to be poor. This was evident not only in questions that required descriptions and / or explanations but also in those with an objective style. 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 e.g. the QER was based on a specified practical. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked.

Questions that assessed mathematical skills were generally well attempted with some candidates gaining full marks. Equations are given in the appropriate form in the question part. However, too many candidates substitute incorrectly into given equations. They do not consider units during the substitution process. Errors were seen in simple addition and subtraction. Another problematic area is the incorrect rounding of final answers especially when an ecf applies. This always attracts a penalty. 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. It must be mentioned that it is becoming increasingly difficult to differentiate between certain numbers in candidates work particularly 1, 2 and 7.

The quality of graph work was inconsistent. The majority of candidates were able to successfully plot points onto the grid but a minority were able to add a best fit curve.

Responses to the QER question were disappointing. Too many responses are very difficult to read, and too many spelling, punctuation and capitalisation errors are seen.

Comments on individual questions/sections

Question 1

The objective style question in part (a) was meant to be a straightforward start to the paper. In one sense it was since it had the highest attempt rate on the paper. However, the mean mark was less than half of the available 3 marks. The error many candidates made was in thinking this was a speed-time graph. A significant number of candidates started answering the questions about a distance-time graph then changed to a speed-time graph for the second or third parts. Candidates need to read labels on graph axes with care so they know what relationship the graph is showing.

- (b) & (c) Most candidates interpreted the graph correctly to obtain the relevant information to answer these questions well. A common error in (b)(ii) however was to divide by a time of 4 when calculating the mean speed. The only possible reason was they excluded the one hour when the car was at rest.

Question 2

- (a) Less than half of candidates knew that mass is a measure of inertia.
- (b) Candidates were expected to interpret a deceleration-time graph. Most had more success when answering both parts here since, unlike (a), they required no recall.

Question 3

- (a) Candidates were given a scenario of a rugby ball being kicked up into the air and three options to select from in relation to four different properties of the ball as it rises. It was poorly answered. It does not appear that candidates actually took the time to think about this event. Common sense would tell them that the ball slows down as it rises. This option was often not selected. Kinetic energy was not linked to speed since the options for speed and KE were frequently different. Potential energy was not linked with the fact the ball rises.
- (b) The first two parts were answered well by a majority of candidates. Others made mistakes. These include:
- Multiplication errors e.g. $0.46 \times 10 = 46$
 - Using an equation of their own making rather than the ones given in the question e.g. instead of multiplying values some candidates chose to divide
 - Squaring 10 because it was given as 10 m/s^2
 - Making rounding errors in part (ii) when an ecf was allowed from part (i)
 - Not knowing the unit of work done.

Part (iii) was very poorly answered.

Question 4

- (a) This QER was based on knowledge of a specified practical. The demands of a recall question meant that it was poorly answered with a mean mark in the lower band. Candidates were unable to describe a suitable method for this investigation. Very rarely, a top band answer was seen.

- (b) This section of questions did not require recall and as a result responses improved. The vast majority of candidates completed the table correctly and added points to the grid accurately. Rather less, but still a majority, identified the anomalous point. The requirement to draw a curve through the points proved too difficult for many so only about a third of candidates obtained this mark. The mass of each cake case could be deduced from the table of results but the majority of candidates found the terminal speed for a 1 g mass rather than a 0.5 g cake case.

Question 5

- (a) The table of decay times was completed accurately by most candidates who attempted it. The non-attempt rate was about 12%. Others made errors such as selecting data for half-life for an isotope other than technetium-99m or using numbers of their own choosing not present in the table of isotopes. These candidates need to take more care reading information presented to them.
- (b) The non-attempt rate for all parts was about 15% or more. Those that attempted the questions performed poorly. In these types of questions, it is necessary to relate the emissions and half-life to the task. This was lacking. Knowledge of radon was poor.

Question 6

Candidates performed well in the early parts of this question and attempt rates were very high. However, responses in part (b)(iii) were very poor. Candidates were asked about gas giants but often spoke about rocky planets. It's unclear if candidates misread the question or were unable to identify gas giants from the table of planets provided.

Question 7

- (a) The vast majority of candidates failed to earn a mark here. Knowledge about how to correct for background was very poor. Candidates usually talked about taking repeat readings and comparing results with others. The non-attempt rate was the highest on the paper.
- (b) Less than half of candidates were able to make sense of the information provided in both tables to identify the emissions and isotopes.
- (c) Part (c)(i) was answered better than part (ii). Sometimes answers appeared that were not included in the list of numbers in the box.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 6: PHYSICS 2 – HIGHER 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%).

The paper was comparable with previous series. It provided a fair test for the candidates at Higher Tier and differentiated well. The degree of difficulty of questions increased throughout the paper. Most question parts had very high attempt rates. Candidates need to take more care in reading the questions and taking note of information such as reading graphs.

The performance of candidates in recall questions tended to be 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 e.g. the benefits of larger sample size. 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.

Questions that assessed mathematical skills were generally well attempted with some candidates gaining full marks. Some questions required equations to be rearranged and this caused problems for some candidates. There is still a group of candidates that substitute incorrectly into given equations. They do not consider units during the substitution process. Another problematic area is the incorrect rounding of final answers especially when an ecf applies. This always attracts a penalty. 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. It must be mentioned that it is becoming increasingly difficult to differentiate between certain numbers in candidates work particularly 1, 2 and 7.

Some questions ask candidates to include data in their answers, which could be from a graph, table or in written form. Failure to do so attracts a penalty which could be as high as all the available marks. The quality of graph work was inconsistent. Two of the graphs were interpreted better than the other.

Responses to the QER question were encouraging. It should be noted it did not depend on recall. Too many responses are difficult to read.

Comments on individual questions/sections

Question 1

Candidates performed very well in the early parts of this question. However, responses in (b)(iii) were poor. Candidates were asked about gas giants but often spoke about rocky planets. It's unclear if candidates misread the question or were unable to identify gas giants from the table of planets provided.

Question 2

- (a) In part (a) most candidates failed to earn a mark. Knowledge about how to correct for background radiation was poor. Candidates usually talked about taking repeat readings and comparing results with others.
- (b) The majority of candidates were able to make sense of the information provided in both tables to identify the emissions and isotopes.
- (c) Part (c)(i) was answered better than part (ii). Occasionally answers appeared that were not included in the list of numbers in the box.

Question 3

- (a) The QER question was based on a distance-time graph. This was emphasised by writing distance-time in bold print. The description required little knowledge so responses were better compared to those that require detailed knowledge. The mean mark was in the middle band and responses covering the full range of marks were seen. Top band answers described all sections of the graph accurately. All speeds were calculated correctly and clearly compared. They recognised there was a return journey also. Middle band answers typically made errors or did not consider all sections of the graph. Sometimes the scale was misread, or the candidate's thought process suddenly changed from dealing with a distance-time graph to a speed-time graph. This was a common occurrence.

Lower band responses were usually solely based on a speed-time graph. Even then accounts were contradictory, e.g. acceleration at a constant speed of 50 km/h. The descriptions of motion were incorrect and calculations were based on misreading the graph. The question instructed candidates to use data from the graph in their answer, so even a correct description of motion without any data would score a lower band mark. Another instruction, printed in bold, to compare speeds was also often ignored.

- (b) About half of candidates read the graph correctly and doubled the maximum value of distance. They usually went on to calculate the mean speed correctly. Others were allowed an ecf from (i) to (ii) so often gained the marks in part (ii).

Question 4

- (a) It was a pleasure to see a selection of responses earning full marks for these question parts even if only in a minority of instances. Some textbook examples of how to present answers were seen. Clear workings were shown and they were well set out.

In each part that required it, the recommended order of carrying out calculations is:

- Write down the equation
- Make substitutions
- Simplify e.g. in part (ii) when dealing with $KE = \frac{1}{2}mv^2$
- Rearrange
- Complete calculation

When candidates do not adopt this style mistakes are frequently made. Too often the first step shown is an incorrect rearrangement of values which earns no credit. A common error in part (ii) was failing to find a square root. In part (iii) candidates attempted to use the work done equation and failed to substitute values of force and distance. In fact, no value of force was provided in the information leading up to this question part. These candidates did not recognise that work done is an energy value that should have been determined by subtracting the KE from the PE. Candidates made another error in part (iv) by selecting an incorrect equation. No acceleration was given in the question apart from g . Some candidates did substitute a mass and acceleration into the $F = ma$ equation, but it was not the correct acceleration. The instruction to use their answers from parts (i) and (iii) were often ignored.

- (b) Both parts required recall of knowledge and were answered poorly, and in the case of part (ii), very poorly.

Question 5

- (a) Knowledge of inertia was very poor.
- (b) This was better answered than the previous part but still the mean was less than half marks.
- (c) There was a requirement to use data from the graphs but this was usually ignored. As a result responses gained very few marks.

Question 6

- (a) Candidates usually gained some credit for stating it is the time to halve (1) 'something'. However, the 'something' is not always acceptable e.g. the radioactivity, the element, the atom and the life.
- (b) Just over half managed to describe the method here. Others failed to mention counting dice, removing them or repeating the process. A sizeable proportion of candidates could not demonstrate any knowledge of the method.
- (c) (i) Candidates did not appreciate the impact of increasing sample size on the random nature of throwing dice.
- (ii) In I most candidates were able to determine the half-life but too many ignored the instruction to add lines (in bold print) to the graph so losing 1 mark.
- (d) The majority of candidates succeeded to determine the mass after 75 hours. A sizeable minority of candidates were able to work out the number of half-lives correctly. However, they then proceeded to divide or multiply 48 by 5, instead of showing a sequence of halving. Some candidates started such a sequence at 75 or 24 (instead of 48) since these numbers also appeared in the question. It should be noted that when producing a half-life sequence, some candidates count the numbers and not the arrows / intervals so producing an error.

SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 7 – 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.

The performance of candidates across all the tasks was pleasing with good evidence that candidates are familiar with practical work and the analysis of practical results. The tasks all proved to be accessible for most candidates who usually attempted all sections. Hypotheses were usually well done. Risk assessments were not well done. Candidates were usually able to record their results logically although units were often incorrect and correct rounding was an issue for many candidates. Many produced suitable graphs although many did not produce linear scales or suitable lines of best fit. Key terms such as repeatability and reproducibility were well-known, but many candidates were not clear in their responses and consequently lost marks in explanations.

Comments on individual questions/sections

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 the exothermic reactions experiment, where many candidates simply stated that the temperature would rise when zinc was added and did not link temperature and time.

In producing risk assessments, the most successful candidates linked the risk with a particular action in the method, such as spilling chemicals onto skin whilst pouring, 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 water can burn you with no reference to either the action of pouring or the affected body part. It is still common to see reference to chemicals splashing into eyes which earns no credit. It was also very common for candidates to create a risk for experiments where there were no significant risks.

Section A - Tables of results

Most candidates produced well organised tables of results and recorded all their data. It was pleasing to see that most candidates included units in the table headings and not in the body of the table. Incorrect units such as $^{\circ}\text{C}$ or use of incorrect abbreviations of units (e.g. secs for s / seconds) was commonly seen, especially in the sweating tubes practical. In that task many candidates struggled to organise their table of results sensibly. In the exothermic reactions task, candidates were instructed to record the time every 30 seconds for 3 minutes. It was common to see the time recorded incorrectly with candidates recording 1.3 minutes for a time of 1 minute 30 seconds. Handwriting was an issue for many candidates, and particularly the legibility of numbers. In the cake cases experiment, candidates were required to determine the mean from 3 numbers. Almost all candidates knew how to calculate the mean, but errors in rounding their final answer meant that this mark was withheld.

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.

Section B – Graphs

The most successful candidates obtained most of the available marks in this section. However, a significant number of candidates made common errors that have been seen in past series. The choice of non-linear scales, particularly in the cake cases task, was commonly seen with many candidates scaling their x -axis in reverse. Many candidates also lost the scale mark as they failed to record a value at the origin. Where candidates chose sensible scales, plotting was usually accurate with errors mainly seen in plotting where multiples of values such as 0.15 were used. 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.

Description of the results was often quite limited. Whilst the majority of 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. A significant number of candidates do not understand “directly proportional” correctly. In the exothermic practical, candidates would link the temperature increase to time but not follow this with a description of the subsequent decrease or levelling off.

Section B - Calculations

Across all the tasks, where candidates were asked to use equations, calculations were answered well by most candidates; these included calculations of speeds, heat energy released and uncertainty. Some candidates did confuse units particularly in the cup case speed calculation where m/s was used for cm/s calculations and vice versa.

Section B – Explanation of results

Linking practical results to underlying theory proved again to be challenging for many candidates. In the exothermic reaction task, many candidates failed to clearly link their results to the reaction pathway. Similarly, in the cake cases task, only the most successful candidates recognised that the speed should have been consistent and could sensibly comment on their results.

Section B – Use of practical terminology

It was evident that most candidates understood practical terminology such as repeatability, reproducibility and precision and understand what an anomalous result is. The most successful candidates were able to evaluate repeatability and use data to justify their responses. However, many candidates, whilst clearly understanding the meaning of the terminology, gave answers to questions that were too vague for credit, with responses such as all the results are similar, rather than focusing on the similarity of repeats. Poorer responses were characterised by a lack of reference to the data collected or presented.

Section B – Improvements

Many candidates were able to suggest suitable improvements, for example using a lid for insulation in the exothermic reaction experiment or video recording the drop in the cake cases experiment. Where candidates were less successful, they often used vague descriptions of improvements with no suggestion of how these would be used.

There seemed to be a lack of knowledge or experience of higher precision instruments such as a burette or graduated pipette from many candidates in some centres.

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