GCSE EXAMINERS' REPORTS

COMBINED SCIENCE
GCSE

SUMMER 2019

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COMPONENT 1 – CONCEPTS IN BIOLOGY – FOUNDATION TIER

General Comments

Only one question was attempted by all candidates sitting foundation tier, question 2. This also had the highest facility factor. Overall, foundation tier candidates found this paper difficult. The facility factors were low for most questions, particularly question 3. Candidates found recall questions the most difficult.

Comments on individual questions/sections

Q.1 **(a)** A large number of candidates stated the tissue was phloem and that the function was transport of food. Of those candidates that correctly identified the tissue was xylem some then stated that the role of the xylem was to transport water up and down therefore only gaining one mark.

(b) Many candidates were able to correctly state what is meant by *specialised* cell in (i). Candidates are advised to avoid using the word 'specialised' in their explanation of what is meant by *specialised* cell. Many candidates correctly identified that root A takes up more water because it has {more/longer} root hairs in (ii), but very few stated that this would increase the surface area to absorb water.

Q.2. **(a)** **(i) and (ii)**

The majority of candidates correctly identified the nucleus and its function in (i) and (ii).

(iii) Although a significant number of candidates could correctly identify the role of mitochondria in (iii), there were many who stated the role was to produce energy.

(b) Answered well by most candidates.

(c) Most candidates were able to correctly describe how *C.trachomatis* is spread from person to person.

(d) It was disappointing that a large number of candidates failed to calculate two-thirds of 202 546 in (i). This is a maths skill outlined in the specification. Of those who did get the correct answer a large number failed to write the answer as a whole number.

Most candidates could suggest at least one way in which the NHS could try to reduce the spread of Chlamydia in part (ii). However, answers related to how an individual could avoid contracting the disease such as use condoms failed to gain credit.

(e) References to the disease mutating or the bacterium becoming immune did not receive credit. In order to gain both marks candidates needed to make it clear to the examiner that the bacterium has developed resistance.

(f) Very few candidates used the information provided in the question to answer it.

Q.3 This question proved to be the most challenging on the paper.

(a) **(i)** It was disappointing that there were very few correct responses to part (i). Candidates were required to apply their knowledge of digestive enzymes to this practical context. Very few were able to conclude the nature of enzyme X and explain the results.

(ii) Candidates were required to recall that enzymes are proteins in part (ii) and use this knowledge to describe the correct test for protein. This question proved to be very challenging with very few candidates answering successfully. Consequently, even fewer candidates were able to explain why the result would support the prediction made.

(iii) Many candidates correctly identified that 0.2 g of starch would be required in (iii). Some answers were completely unrealistic. Candidates are encouraged to look at the answers they obtain for calculations and consider if their values are sensible.

(iv) Very few candidates were able to suggest suitable improvements to a method provided in part (iv).

(b) Many candidates gained one mark for either stating that molecules need to be small enough to be absorbed or for reference to being taken into the blood. Very few gained both marks.

(c) A common answer was that glucose is needed to release energy. However, a reference to the process of respiration was required for credit.

Q.4 **(a)** Although a significant number of candidates did get a correct answer of 2.25, a large proportion incorrectly subtracted 1.2 from 2.7.

It was pleasing to see that a large number of candidates could compare the structure of arteries and veins in part (ii) and explain how their structure is related to function.
Comparative statements were required when discussing structure. Some candidates incorrectly referred to arteries pumping blood.

(b) A large number of responses correctly named the process by which molecules move between the blood and tissues but very few could explain how the structure of the capillaries would allow efficient exchange.

Q.5 **(a)** Many candidates correctly identified the sensory neurone and effector.

(b) Many correct answers were seen although there were also a number of incorrect references to ‘electrical pulses’.

(c) A large number of candidates gained full credit for correctly identifying three properties of reflex actions.

(d) **(i)** Common errors seen in part (i) included incorrect rounding and using diameter instead of radius when substituting into the equation provided.

(ii) Most candidates could give a correct description of how light intensity affects pupil size in (ii).

(iii) Some candidates could identify the risk or control measure in (iii) but very few were able to identify both.

(iv) Part (iv) was answered well, with most candidates gaining credit.

Q.6 **(a)** Many candidates could identify where oestrogen and progesterone are produced and name the gland that made them. Fewer were able to identify the target organ but most knew that hormones travel via the blood.

(b) Most candidates gained credit in (i) and some very good responses were seen in (ii), with many candidates identifying that an increase in oestrogen resulted in an increase in LH production.
Few candidates could describe the effect of progesterone on LH production in (iii). A common error seen was a statement that low progesterone leads to an increase in LH.

(c) Most candidates correctly identified that LH levels remained low but very few gained more than one mark as they failed to state that ovulation would be prevented. Some simply described the trend in progesterone levels.

Q.7 This QER was designed to test candidates understanding of practical procedures. Quality of written communication was poor and there were many misconceptions regarding osmosis. Common errors included descriptions of solutes or solutions moving by osmosis. In addition, a significant number of candidates stated that the sultanas would lose mass.

Q.8 **(a)** **(i)** Most candidates gained two marks for correct plotting of points. However, the line quality was poor in many cases. Despite being provided with a number at the origin some candidates made up their own scale.

(ii) Nearly all candidates correctly described the trend in (ii) with a few failing to reference 13.30, consequently gaining only 1 mark.

(iii) Very few foundation tier candidates recognised that part (iii) required an explanation of the role of insulin.

(b) Although a number of candidates correctly referred to using Benedict's reagent in (i), very few stated that it would need to be heated.
Very few candidates answered (ii) correctly.

They were required to use the information on the previous pages to see that the normal glucose range is between 4.0 and 7.5 mmol/dm^3 and therefore the glucose level is above the normal range.

Q.9 **(a)** Most candidates correctly described the pattern in the graph. Candidates should be careful that if they opt to write chemical formulae they must ensure they are written correctly.

(b) This was not answered well by foundation tier candidates. By far the most common response in (ii) was a reference to combustion of fossil fuels. Only a minority of candidates referenced deforestation and fewer linked this to photosynthesis.

Summary of key points

- Responses to questions designed to test understanding of practical procedures were disappointing. Specified practical work is outlined in the specification and further detail provided in the teacher's guide. Furthermore, assessment objectives require that candidates are assessed on their ability to develop and improve experimental procedures. As described in last year's report this is an area that candidates continue to find challenging.

- The specification outlines the mathematical skills which can be assessed in Combined Science. It is recommended that candidates are given opportunities to develop these skills throughout the course. It is also advised that candidates always show their working when completing calculations as if they fail to get the correct answer they may be awarded marks for their working.

- There was evidence that key information given in questions was often not used by candidates. They are advised to take a highlighter into their exam to highlight key points of information provided.

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COMPONENT 1 – CONCEPTS IN BIOLOGY – HIGHER TIER

General Comments

Many responses showed a clear understanding of Biology and many candidates also demonstrated their ability to apply knowledge in questions. Quality of written communication was an issue for some candidates. In a number of cases candidates lost marks because their answers lacked detail or clarity. Most questions were attempted on the higher tier indicating that time did not appear to be an issue.

Comments on individual questions/sections

Q.1 **(a)** Most candidates gained two marks for correct plotting of points. However, the line quality was poor in many cases. Despite being provided with a number at the origin some candidates made up their own scale.

Nearly all candidates correctly described the trend with a few failing to reference 13.30, consequently gaining only 1 mark.

As expected, responses from higher tier candidates were more detailed than those of foundation tier candidates, and many recognised that this question required an explanation of the role of insulin.

(b) Although a number of candidates correctly referred to using Benedict's reagent in (i), very few stated that it would need to be heated.

Very few candidates answered part (ii) correctly. They were required to use the information on the previous pages to see that the normal glucose range is between 4.0 and 7.5 mmol/dm^3 and therefore the glucose level was above the normal range.

Q.2 **(a)** Most candidates correctly described the pattern in the graph. Candidates should be careful that if they opt to write chemical formulae they must ensure they are written correctly.

(b) **(i)** Part (i) was answered well by higher tier candidates, showing the carbon cycle had been learned and understood.

(ii) By far the most common response in part (ii) was a reference to combustion of fossil fuels Only a minority of candidates referenced deforestation and fewer linked this to photosynthesis.

Q.3 **(i)** A large number of correct responses were seen.

(ii) There was large variation in the quality of responses seen. Some candidates had clearly learned the assumptions that are made when using this technique, whereas in other scripts it appeared that this was unfamiliar to candidates.

(iii) Candidates frequently described the difference in population size without offering an explanation.

(iv) Some vague answers were seen and as described in the foundation tier report few candidates were able to offer a suitable improvement to the investigation.

Q.4 **(a)** A surprising number of candidates could not provide the word equation for photosynthesis, with many getting the reactants and products the wrong way around.

(b) **(i)** Many correctly stated that oxygen was produced in (i), but few linked the oxygen production to the reason why discs became buoyant.

(ii) A number of answers to part (ii) lacked detail. Candidates are reminded to look at the number of marks available to gauge how much detail is expected in their response.

(iii) Candidates are reminded to ensure that they read questions carefully. A number correctly stated that the discs would not rise in part (iii) but did not provide a reason.

(c) Development of practical procedures was not tackled well, and in many cases was left blank. This also applied to (d).

Q.5 **(a)** Disappointingly, very few candidates were able to distinguish between the terms gene and allele.

(b) The first two parts of this question were answered well by most candidates, demonstrating that they could apply their understanding of inheritance.

Part (iii) was a demanding question as candidates were required to consider two possibilities depending on the genotype of individual 6. A number of candidates provided clear answers and in some cases even provided Punnett squares to aid their response.

Q.6 This was the question that candidates found most challenging. As with the foundation tier paper, the quality of written communication was poor. Rarely did candidates attempt to answer the full question, with the majority not referring to why homoeostasis is important. Few candidates used the term osmosis in the correct context.

Q.7 This question was answered very well and in many cases candidates showed a clear understanding of hormones, their place of production and their functions.

Q.8 **(a)** The majority of candidates were able to use their knowledge of the nervous system to label the reflex arc.

(b) Nearly all candidates correctly listed three properties of a reflex arc.

(c) Most candidates gave the correct unit gaining one mark but a number incorrectly divided 50 by 1.5.

(d) Very few candidates gained four marks. A number used the information provided in the diagram to identify that curare blocks receptors and sarin prevents the enzyme breaking down the chemical but few went on to explain the effect on the post-synaptic membrane.

Q.9 **(a)** These questions were designed to test recall of information from section 3.2 of the specification. Few candidates could recall the genus of the mosquito which spreads *Plasmodium* and fewer could state why a fever develops in a person infected with *Plasmodium*.

(b) **(i)** Many gained full credit in (i) for correctly completing the calculation and providing an answer in standard form. A few failed to give their answer in standard form, consequently gaining a maximum of two marks.

(ii) Part (ii) was a challenging question which required candidates to apply their knowledge and understanding of natural selection. It was answered well by a small number of candidates who were able to demonstrate a clear understanding of the theory and apply their knowledge.

(iii) The majority of candidates were able to list two methods of preventing the spread of malaria in (iii). A large number failed to explain how their chosen method could prevent transmission, therefore gaining a maximum of two marks.

Summary of key points

- Responses to questions designed to test understanding of practical procedures were disappointing. Specified practical work is outlined in the specification and further detail provided in the teacher's guide. Furthermore, assessment objectives require that candidates are assessed on their ability to develop and improve experimental procedures. As described in last year's report this is an area that candidates continue to find challenging.

- The specification outlines the mathematical skills which can be assessed in Combined Science. It is recommended that candidates are given opportunities to develop these skills throughout the course. It is also advised that candidates always show their working when completing calculations as if they fail to get the correct answer they may be awarded marks for their working.

- There was evidence that key information given in questions was often not used by candidates. They are advised to take a highlighter into their exam to highlight key points of information provided.

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COMPONENT 2 – CONCEPTS IN CHEMISTRY – FOUNDATION TIER

Overall, candidates were more successful in questions involving data response than those requiring recall of knowledge. Questions 1-6 were attempted by 100 % of candidates. Questions requiring extended writing and/or knowledge of practical work were poorly answered. Questions 8 and 11 had both the lowest facility factors and attempt rates. Basic mathematical skills were evident but more complex calculations were clearly found to be challenging.

Comments on individual questions/sections

Q.1 A straightforward question on metals with a well-answered first section that had a choice of possible answers. Part (b)(i) on materials and their uses was also generally well attempted. Part (b)(ii) was found to be more challenging with few candidates knowing the meaning of (s) after a substance in an equation.

Q.2 Generally well done as many answers could be taken directly from the information at the start of the question or worked out from there.

Q.3 Part (a) was well answered. Many candidates knew that matching patterns of dots showed identical inks, although the idea of solubility in part (b) was less understood. The R_f value in (c) was well calculated overall.

Q.4 Again here, the first four answers were from interpretation of data given in the question so this was often well answered. The graph reading in (b)(i) was in almost all cases incorrect. The vast majority gave the melting point rather than the boiling point.

Q.5 This question gained a high number of marks for many candidates as the graph plotting and mean calculation in (a) were done well. The tangent calculation in (b) was accessible with the guidance given. The volume was also calculated correctly in many cases.

Q.6 Only a few candidates showed good knowledge of the comparison between the reactions of weak and strong acids. Some could name the salt magnesium nitrate, but very few could give the correct formula. The hydrogen gas test should refer to a 'lit splint' rather than simply 'the squeaky pop test' which was the most common answer.

Q.7 Marks scored here were disappointing. Brackets were usually missing from the formula of calcium hydroxide and most failed to identify the ions present in iron(III) sulfate. The name potassium oxide was the most commonly awarded mark here. The formula mass calculation was done reasonably well but percentage mass much less so. Few realised that the mass of two chlorine atoms should be used in the calculation.

Q.8 Most candidates gained 1 or 2 marks on the QER for a basic description of the reactivity order in Group 7, but very few candidates correctly linked this to the observations which were given to help them.

Q.9 Most answers here referred to carbon dioxide rather than the formation of sulfur dioxide and gained no marks. Candidates found extracting the correct data in (b) to be challenging and the calculation itself was poorly done. Few candidates could balance the equation given.

Q.10 Structure and bonding was not well explained in the majority of cases by foundation tier candidates. A few gained marks for the explanation of conductivity in (b)(ii). The volume calculation in (d) was often not attempted and those who did try did not generally give the answer in standard form.

Q.11 Many candidates did not attempt this question. Most candidates gained just one mark in (a) for stating that filtration is necessary. They lost the third mark for not clearly stating that it is water that must be evaporated. The idea of adding excess carbonate was seldom given.

Summary of key points

- The foundation tier paper has several questions in which there is information given to help guide candidates towards the correct answer. It is therefore vital that candidates are encouraged to read questions carefully and use that information in their answers.

- Good knowledge of the specified practical work will benefit candidates in the examination. Understanding of experimental procedures and the ideas of improvement of practical procedures are often assessed in examination questions.

- Fundamental principles of chemistry such as formulae and equations should be practised and referred to at every opportunity throughout the course so that candidates are confident with using them in answers by the time of the examination.

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COMPONENT 2 – CONCEPTS IN CHEMISTRY – HIGHER TIER

General Comments

Question 1-5, 7 and 10 were attempted by 100 % of candidates. Candidates, on the whole, performed better on questions involving data response than those requiring recall of knowledge, although a few candidates did demonstrate a sound knowledge and understanding of principles in chemistry. Questions requiring explanation of ideas or data were less well answered.

Comments on individual questions/sections

Q.1 There were surprisingly few correct descriptions of the formation of acid rain in (a)(i), with a lot of confusion between CO_2 and SO_2 which led to the loss of all marks. The calculations in (b) were answered better with many candidates gaining the marks here. Very few correctly balanced the equation in (c), however.

Q.2 A standard question with knowledge of diamond and graphite required was reasonably well answered by some candidates, although knowledge of buckminsterfullerene for a mark in (c) was less often seen. The volume calculation in (d) was fairly well-attempted although many lost a mark for not giving the answer in standard form.

Q.3 Most candidates gained just one mark in (a) for stating that filtration is necessary, but lost marks for not clearly stating that it is water that must be evaporated and for not giving the idea of adding *excess* carbonate. Lack of understanding of the need for rounding up to 12.5 g in part (b) lost the mark in almost all cases.

Q.4 Disappointingly, few candidates showed knowledge of the practical methods required to collect data in (a)(i) or the idea of excess reactants needed to answer (a)(ii). More gained marks for particle theory in (c), but there was some confusion with concentration here.

Q.5 Most candidates could state that supply was greater than demand but few looked closely enough to realise the correct ratio needed to gain two marks in (a)(i). Some candidates gained three marks for the empirical formula calculation in (c)(i) but incorrect rounding here to give a 1:2 or 1:3 ratio lost many candidates a mark.

Q.6 There were some basic generic descriptions of each reaction type given in the QER, gaining between one and three marks, but very few candidates linked these correctly to the blast furnace. Higher band answers were very rare.

Q.7 Usually one or two marks were awarded in (a) with answers for solution **C** and halogen **D** showing a lack of understanding. There were some very well drawn bonding diagrams in (c) but the common problem of confusing ionic and covalent bonding was evident. Few candidates showed understanding of the comparison of melting temperatures in ionic compounds.

Q.8 Often the highest scoring question on the paper due to the good ability of many to plot a graph and calculate a mean. Part (c) was very poorly answered however, with usually a description of the graph shape given rather than any explanation.

Q.9 Candidates clearly found this question very challenging and few marks were awarded overall. Little knowledge of equilibrium was demonstrated and the standard form used in the rates table was not well understood.

Q.10 The reacting mass calculation in (a) was correctly answered by some candidates but there was little understanding shown of cathode competition or phytomining, so a low scoring question overall.

Summary of key points

- Specified practical work is an essential part of the chemistry course and used in many questions. It is essential that candidates have undertaken these experiments and have an understanding of the skills involved.

- Candidates should be given opportunities throughout the course to practise basic chemistry skills including writing formulae, naming compounds and balancing equations.

- Candidates should practise application of knowledge to unfamiliar contexts in order to prepare them well for such questions in examinations. Many of these questions contain information given to guide candidates to the correct answers and such information must be read carefully and used in their answers.

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COMPONENT 3 – CONCEPTS IN PHYSICS – FOUNDATION TIER

General Comments

Only one question attracted a 100 % attempt rate. This was question 2. Questions 3 and 7 were particularly answered poorly. Question 3 was based on a practical about water waves and question 7 included the QER about Newton's laws. Generally, candidates coped better with calculations than explaining.

Comments on individual questions/sections

Q.1 **(a)** Most candidates recalled the missing regions and correctly completed the em spectrum in the diagram. However, few recognised that the arrow to the right showed increasing frequency or energy and the arrow to the left indicated increasing wavelength.

(b) A minority of candidates knew that light would travel at the same speed as gamma rays through space. Some elaborate calculations were present.

(c) Again, only a minority of candidates knew the region involved in satellite communication.

Q.2 **(a)** Most candidates selected at least two of the correct statements.

(b) Most candidates could recall that hydroelectric power required a short start-up time. Some candidates referred to wind power, but this was given in the graph.

(c) Most candidates correctly calculated the required number of wind turbines operating at maximum output to match a nuclear power station, but fewer could explain why, in practice, the actual number would be different.

Q.3 Performance on this question was very poor. The facility factor of 16 % was the second lowest on the paper.

(a) **(i)** Some candidates failed to achieve the mark for calculating the mean due to incorrect rounding.

(ii) Very few candidates recognised that the difference between the mean values was due to whether the anomalous result had been used or not.

(iii) Very few marks were awarded here.

(iv) Despite the instruction to avoid references to repeating the results, repetition was a common answer.

(v) Few candidates gained any credit here and those that did failed to take the factor of three tray lengths into account.

(b) **(i)** A common answer was that transverse waves go up and down. It was very rare that a mark was awarded here.

(ii) The mark usually awarded was for giving the correct value of the amplitude. The most common answers for wavelength were either 0.8 or 3.2 m. It was evident that candidates did not know the relationship between frequency and period.

Q.4 This was the best answered question on the paper.

(a) Candidates were unable to give creditworthy statements in either part (i) or (ii).

(b) **(i)** Most candidates could correctly name the wires to gain both marks.

(ii) and (iii)

Most candidates gave at least one correct answer in these parts.

(c) **(i)** An advantage of connecting sockets in parallel was not well known.

(ii) The purpose of a fuse was not well known.

(d) Most candidates successfully carried out the calculations and completed the table correctly to earn four marks.

Q.5 **(a)** Most candidates gained a mark for correctly identifying one of the radioisotopes.

(b) About half of the candidates earned credit for identifying X but fewer gave valid reasoning.

(c) Less than half of the candidates were able to complete the equation correctly.

Q.6 Almost 6 % of candidates did not attempt to answer this question.

(a) 8 marks were available for completing calculations. The only recall required was the power equation which few candidates knew. Marks ranged from 5 to zero. Candidates need to realise the importance of the units given after the values. For example, 8 000 kg is not a distance but it was used in an equation as such.

(b) Very few candidates earned any credit here.

Q.7 This was the least well answered question on the paper. 88 % of candidates attempted it.

(a) Some of the 88 % did not put pen to paper here. It was clear that candidates were not secure in their knowledge of Newton's laws so they could not apply them to the given situation. It was very rare to see anything above one mark awarded.

(b) The energy transfers were not known. Rarely, an energy change from kinetic energy to some other form was seen.

(c) Knowledge of crumple zones was poor. Vague responses such as 'it absorbs the impact' were common.

Q.8 It is surprising that, since this included a graph plotting exercise, 4 % didn't even attempt the question.

(a) Candidates failed to recognise that the p.d. across each resistor was 12 V. Therefore, it was very rare to see correctly calculated current values.

(b) Even after allowing an ecf from (a), it was rare to award a mark here.

(c) Very few credit worthy answers seen.

(d) Frequently not attempted. Occasionally credit was given for calculations showing that 60 000 J over 10 minutes was equivalent to 100 J/s.

(e) **(i)** Most candidates gained credit for completing the graph. However, sometimes there were plotting errors and not all scales were linear.

(ii) Most candidates earned a mark here.

Q.9 8% of candidates failed to attempt the question.

(a) The magnetic properties of the Earth were not well known.

(b) **(i)** The shape of the magnetic field around the straight wire was not well known.

(ii) The use of a plotting compass to determine the shape and direction of a magnetic field was not known.

(iii) Most candidates correctly identified A.

Summary of key points

- Encourage candidates to read each question part carefully.
- Provide opportunities for candidates to select values for substituting into equations that require careful attention to units.
- Use assessment for learning methods to develop candidates' skills in producing and assessing each other's explanations of scientific knowledge.
- Provide further practice in graph plotting, in particular to construct linear scales from non-linear data.

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COMPONENT 3 – CONCEPTS IN PHYSICS – HIGHER TIER

General Comments

The performance of candidates was, by and large, well below the standard expected on a higher tier paper, suggesting that centres need to consider their entry policy on tiered entry papers. The very first question was one on which candidates at best achieved half marks and performance got worse from there on. With some gaining single figure total marks, one has to question whether higher tier entry was appropriate for them. On a positive note, nearly all of the candidates attempted part or all of the questions but as expected, the performance diminished towards the end of the paper.

Comments on individual questions/sections

Q.1 Parts (a) to (d) were very poorly answered. The principle of a common p.d. being applied to components in a parallel circuit was not known with the result that the first marks were not even awarded. The summation of three currents in the parallel circuit shown was further not understood to get the answer to part (b) (even applying the error carried forward principle).
Many were saved by having to plot points on a graph grid but the need to set up a linear scale on each axis was missed by some but the need to use a ruler to draw a straight line through the points was recognised by most entrants.

Q.2 Far too many candidates considered that the magnetic compass pointed to the North magnetic pole of the Earth because of some gravitational effect! Very few could draw a series of concentric circles around the current-carrying wire in part (b)(i) of the question but could identify that the point A is the position of the strongest position in the magnetic field in the last part. Very few candidates knew of an alternative method (using a plotting compass) of finding the shape and direction of the magnetic field around the wire in part (b)(ii) of the question.

Q.3 Only 2.1 marks (on average) were awarded on this question. A description of molecular behaviour has often been well answered by candidates but this question was really poorly answered. Part (b) of the question is included under the rubric at the beginning of the question – a principle that many failed to notice to the extent that they talked about changes in volume when heated – even though the gas was held in a container at constant volume!

Q.4 Candidates did often write at some length in answer to this question but the answer was not always relevant to the question. There were three key areas under which to write but candidates often ignored that point.

Q.5 The mass of the glider in the question was often calculated from the ratio of force to acceleration with an individual value of each being taken to find the mass. The unit was frequently quoted as grams and not kg in the answer. In part (a)(ii) it was often the case that a straight line was drawn below the one given in the question - or the part of the question was missed altogether.

Part (b) of the question explored the relationship and conventional practice of presenting the independent variable along the abscissa and the dependent variable along the ordinate axis, but very few candidates could relate to that.
Part (c) was very poorly answered, as was part (d) for which candidates had to choose an equation from page 2 to be able to answer the question. There was very little evidence of candidates relating quantities to letters in equations (this is usually done by setting them up in a list) in helping them to choose which equation to use. The question on the whole was poorly answered.

Q.6 Too many candidates chose to use the wave equation to answer this question, despite the fact that no velocity was given. Most seemed unaware that period is related to frequency.

Q.7 Part (a) was poorly answered but there was an opportunity to start again in part (b) totally independently of part (a) but some wanted to use the answer from (a) in part (b) and earned no marks. Having done that, part (c) presented a real mystery, as too did part (d).

Q.8 The atomic structure of the helium isotope quoted remains a mystery to many who were entered for this paper – but it is straight-forward bookwork! A very small number of candidates knew the difference between the terms “contamination” and “irradiation” or of the ionising effects of an ingested source of alpha radiation. Parts (c)(iv) and (c)(v) explored the application of knowledge to the decay of polonium and the understanding of the half-life of a radioactive substance. The last part was answered by some candidates.

Q.9 On average, candidates gained little over one mark out of the twelve on offer for this question. The use of the equation $F = kx$ could be examined at foundation tier level but here the principle was to apply it to a two spring situation in series. The same force is applied to both springs so it was not unreasonable to expect candidates to apply it twice and add together the answers. But no, - the answers obtained were weird and wonderful. The performance in the remainder of the question was also poor – or non-existent.

Summary of key points

- The raw marks achieved on this paper were very poor as shown by there being no question gaining a facility factor of even 50 %.

- The number of candidates entered was small but the entry was not matched to the demand of the paper resulting in a poor experience for the candidates. Performance was poor on a variety of fronts – knowledge and understanding, application of knowledge, mathematical skills and ability to write coherent scientific statements - they were all shown as being weak by these candidates.

COMBINED SCIENCE

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COMPONENT 4 – APPLICATIONS IN SCIENCE – FOUNDATION TIER

General Comments

The majority of the candidates attempted most questions on this paper. As last year, the content of the responses showed that candidates found the material challenging. This was particularly true for the QER question (Q7) and the section B question.

Comments on individual questions/sections

SECTION A

Q.1 **(a)** **(i)** A significant number of candidates could not name either X or Y.

(ii) Many candidates were not able to give a satisfactory explanation for staining with methylene blue.

(b) **(i)** The majority of candidates were able to draw an arrow to the stage of the microscope.

(ii) Most candidates successfully attempted this part of the question.

(iii) **I** Although most candidates knew lens A was required, only about a third of candidates correctly named B as the other lens.

II All sorts of answers were seen for this question. It was not always apparent how the values were calculated.

(c) **(i)** Very few successfully gave the correct response to this question.

(ii) Many candidates realised that the electron microscope had a greater magnifying power, however relatively few said anything about the size of the mitochondria.

Q.2 **(a)** **(i)** The vast majority recognised the beaker.

(ii) Most gave a suitable explanation for the use of a burette rather than a measuring cylinder.

(b) The majority of candidates recognised this was an exothermic reaction.

(c) The majority gave a suitable answer but a significant minority stated ‘because it turned green’.

(d) This was very poorly responded too. The examiner saw a tick against every number by the end of marking!

(e) **(i)** Most were able to complete the table correctly.

(ii) All sorts of combinations of numbers were circled. Some candidates appeared to miss this question since they failed to circle a number.

(f) Less than half the candidates ticked the correct option. The first box was the most common incorrect response.

Q.3 **(a)** **(i)** Most stated '55°' for which they got 1 mark.

(ii) The examiner can only recall seeing one or two correct statements for the law of reflection.

(iii) Very few were able to gain any marks for this part of the question.

(b) Most candidates were able to show the path of a ray through the glass block but very few were able to explain how the angle of refraction could be measured. Those who were successful showed the angle on their diagram.

(c) Most candidates attempted this part but relatively few got more than one of the three marks available.

Q.4 **(a)** A significant number of candidates realised that the electrodes should be 'switched around'.

(b) All sorts of answers were seen. Incorrect responses included 'switch', pH' and 'add a catalyst' amongst others.

(c) Most gained some marks for the graph, but many plotting errors were seen.

(d) **(i)** Most candidates recognised that the anomalous result was for the third minute but very few identified '7' as the incorrect reading.

(ii) This was marked from the candidates' plot. A significant number did not do this correctly.

Q.5 **(a)** **(i) to (iii)**

The majority of candidates correctly attempted these parts.

(iv) **I** Most candidates achieved some marks on this part.

II Many candidates were able to state 'so the test would be fair'.

(v) This part proved more challenging with relatively few giving a satisfactory answer.

(vi) All sorts of answers were seen in the table. Many candidates did achieve at least one mark. Very few correct responses were seen for step 4 however.

(b) Most candidates were able to give a reason why scientists discussed their results with other scientists.

Q.6 **(a)** **(i)** The vast majority of candidates were able to calculate the mean in the table.

(ii) Very few realised that the results were not becoming more repeatable.

(iii) A reasonable number of candidates stated that extra readings needed to be taken between 80 and 100 cm.

(iv) A sizeable minority correctly answered this part.

(b) Many candidates got one of the two marks. Relatively few were able to get both marks.

Q.7 Candidates often find QER questions challenging. This question was no different. There were hardly any responses worthy of a second band mark. Not all candidates seemed to understand that this was a question about **measuring** rate; many candidates just wrote about how a catalyst works.

Q.8 **(a)** **(i)** Most candidates did not understand what was meant by 'precision of the balance'.

(ii) Hardly any candidates could give an adequate explanation of what is meant by density.

(iii) A surprising number were able to give the correct units, but only very few were able to complete all part of the calculation successfully. However, many were able to get one mark for calculating the volume of the metal.

(b) Many candidates were able to say that the density would decrease but not many were able to give a satisfactory explanation for this change.

SECTION B

Q.9 **(a)** **(i)** Most candidates were unable to give a suitable equation.

(ii) A relatively small number were able to complete the calculation and get both marks.

(b) **(i)** Relatively few could answer this part. Many answers were suggested. These included '3', '4', '5', '6', among others.

(ii) This was a little better done than part (i).

(iii) Unfortunately, very few quoted energy values in their diagram and consequently did not gain any marks.

(c) **(i)** Most candidates did not gain any marks for this part. Most thought it would take Chris longer to recover.

(ii) Most candidates could not answer this part correctly.

(d) It is not surprising that candidates found the last part of this question on the paper challenging. A relatively small number of candidates did realise that they needed to calculate the area under the line and went on to achieve at least some of the marks.

Summary of key points

- Candidates need to read questions carefully checking the key command words such as, state, describe, explain etc.
- In a few cases, it appeared that candidates did not appear to have read the whole question but hit upon certain words filling in the rest of the question themselves.
- The QER continues to cause problems. Candidates often wrote many words but achieved few marks since they did not grasp the question was about practical work and not a theoretical understanding of catalysts.
- Candidates can expect a question based upon a short article each year. It is evident this is a challenge to foundation tier candidates. Centres are advised to incorporate opportunities for candidates to interact with information in this format throughout the delivery of the GCSE.

COMBINED SCIENCE

GCSE

Summer 2019

COMPONENT 4 – APPLICATIONS IN SCIENCE – HIGHER TIER

General Comments

Some candidates would have been better suited to entering the FT paper. They did not cope with the demands of this paper, either because of questions being less structured or the multi-stage calculations they were faced with. In particular, question 9 was answered poorly. This included a QER based on the reactivity series and a calculation to find an empirical formula. Generally, explanations of scientific theory were poor.

Comments on individual questions/sections

Q.1 Candidates interacted reasonably well with only some of the material in the resource booklet.

(a) **(i)** The chemical formula for glucose was given in the resource booklet and the formula for lactic acid is given in the question. Despite this, few candidates were able to complete the balanced equation.

(ii) About half of the candidates determined the required energy value.

(b) Few candidates gained any credit here. Most did not interpret the information in the structural equation, could not explain why aerobic respiration is exothermic, and failed to label energy values on their reaction profile diagram.

(c) **(i)** Most candidates thought Chris' recovery time would be longer because he had run a much greater distance.

(ii) About half of the candidates interpreted figure 4 to quote percentages in the required ranges however they did not always add up to 100 %.

(d) Most candidates realised that the area under the graph was required however most had difficulty calculating it correctly. Often, the graph was treated as a rectangle and an area of $10 \times 11 = 110$ was found.

Q.2 **(a)** **(i)** It is doubtful candidates understand what the term resolution means.

(ii) Candidates had great difficulty in stating the meaning of density.

(iii) Most candidates gained some credit here. However errors were seen. These included an incorrect density formula, an incorrect volume for the piece of wood and incorrect units.

(b) About half of the candidates earned a mark here for recognising that particle spacing or volume would increase.

Q.3 **(a)** Very few candidates could describe how to collect results.

(b) **(i)** Candidates did not recognise the steady activity until 40 °C. The relevance of 40 °C was not included in most responses.

(ii) About half of the candidates earned credit for stating that the enzyme denatured.

Q.4 **(a)** Most candidates stated the risk associated with the procedure but few gave the control measure. Both were required for a mark.

(b) Most candidates could state the effect of temperature on colour but very few could offer an explanation.

(c) **(i)** Few candidates realised why the beetroot cylinders were washed before being used.

(ii) Most candidates understood that this allowed the test tube of water to reach the required temperature.

(iii) Most candidates could state at least one control variable.

Q.5 This was the best-answered question in terms of facility factor.

(a) Most candidates were able to add a lamp and ammeter to the circuit but not a voltmeter. Most often the voltmeter was added in series.

(b) **(i)** Most candidates scored well here. However, errors were seen. These included:

- omitting (0,0) at the origin
- not labelling the units on the scales
- non-linear scales especially on the y-axis
- plotting errors
- not joining the points with a smooth curve.

(ii) Most candidates gained this mark.

(iii) Candidates had difficulty in providing an explanation here.

Q.6 Approximately 8 % of the candidates failed to attempt the question.

This multi-stage calculation resulted in most candidates earning some credit. This was usually for arriving at an energy value arising from the use of the specific heat capacity equation. This earned 3 marks. Rarely was anything else seen that was worthy of credit.

Q.7 **(a)** **(i)** The names of the blood vessels 1 and 2 were quite well known.

(ii) The role of the tricuspid valve was not well known.

(iii) Most candidates knew the aorta was an artery but could not explain why water was not coming out of it.

(b) Candidates thought that one system carried oxygenated blood and the other deoxygenated.

Q.8 **(a)** Most of the candidates' marks were obtained in this part of the question especially for completing the diagram correctly.

(b) It was common to see all three parts left blank.

(c) Candidates had no idea how to use the graph and others provided information to calculate the time taken.

Q.9 This was the least well answered question on the paper. Also, just under 5 % of candidates failed to attempt it.

(a) Most commonly credit was earned for using the data to place the metals in order of reactivity plus, sometimes, a statement about the firmness of the conclusion. Candidates were not secure in explaining the reactions in terms of oxidation and reduction.

(b) Occasionally credit was given for calculating the mass of oxygen. Very few instances of further credit being achieved were seen.

Q.10 Just over 3 % of candidates did not attempt the question.

(a) **(i)** It was surprising that a significant number of higher tier candidates failed to calculate the area of the field.

(ii) As a result of an incorrect answer in part (i), it was common for an ecf to be applied here. Even so, some candidates failed to calculate the mean number of daisies per m^2.

(iii) Most candidates correctly stated this was for random placements of the quadrat.

(b) **(i)** Few candidates understood there was an environmental gradient involved.

(ii) About half of the candidates stated that a transect should be used but could not explain how. There was a reference to using the capture/recapture method of counting daisies.

Summary of key points

- Encourage candidates to read each question part carefully.
- Provide further opportunities for candidates to work through multi-stage calculations.
- Use assessment for learning methods to develop candidates' skills in producing and assessing each other's explanations of scientific knowledge.
- Provide further practice in graph plotting, in particular to construct linear scales from non-linear data.

- Provide more opportunities for candidates to calculate the area of regular shapes including areas under graphs

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