Cambridge Technicals

Laboratory Skills

Level 3 Cambridge Technical Certificates in Laboratory Skills
05879, 05847

Level 3 Cambridge Technical Diplomas in Laboratory Skills
05848, 05849

OCR Report to Centres June 2017

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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Unit 1 – Science Fundamentals

General Comments:

This paper was the first assessed for the new Cambridge Technical Level 3 (CT3) qualification in Laboratory Skills, Unit 1 (Science Fundamentals). It was clear that some candidates were sufficiently well-prepared for a range of topics covered within the specification and that the most able candidates were challenged by the use of a phase diagram to demonstrate the different states of water and were stretched by the final question based on an electric circuit. Some candidates did particularly well with items relating to cell and tissue structure and function, the impact of temperature on enzyme activity and the involvement of DNA and RNA in protein synthesis. Others struggled with a number of chemistry-related items. Although it was considered that the depth of knowledge required for one or two topics, including the roles of iron and calcium, was not overly challenging at this level of assessment, it was apparent that candidates were not sufficiently prepared. In general, the majority of candidates were able to respond the all questions in the time available, some using the additional pages in an appropriate manner.

Comments on Individual Questions:

Question 1(a)
The majority of candidates were able to correctly state the electron configuration of oxygen. This was a most accessible question and no clear pattern of alternative responses was identified.

Question 1(b)
As for 1(a), the majority of candidates provided a correct response.

Question 1(c)(i)
Fewer candidates determined the number of neutrons in oxygen-18. Again, a clear pattern of alternative responses was not apparent.

Question 1(c)(ii)
It was surprising to note that relatively few candidates were able to deduce the nuclear notation of oxygen-18. The marking of this item was opened up to accept the numbers 18 and 8, even without the inclusion of O for oxygen.

Question 1(d)(i)
The symbol equation for the generation of water from a reaction between oxygen and hydrogen was expected to be relatively straightforward. However, only some candidates were able to correctly identify the formulae for the reactants and even fewer balanced the equation correctly.

Question 1(d)(ii)
Covalent bonding was identified by many candidates and some correctly noted that the electrons are shared. A number of candidates were allocated a mark for referring to their non-metal status.

Question 1(d)(iii)
Very few candidates explained that neon and oxygen have 8 electrons in their outer shells. However, many were awarded two marks for a reference to both having full outer shells.

Question 1(e)(i)
Although the stem of this question referred to the Periodic Table (provided at the rear of the paper), the instruction at (i) was based solely on the description of Fig. 1.2 (without further reference to the Periodic Table). As a result, most candidates did not present the anticipated description of group number and period. However, straightforward descriptions of rows and columns were accepted as valid marking points. Many candidates were therefore able to access the marks available.

Question 1(e)(ii)
Many candidates successfully expressed the difference between the two sets of data (comparing 220pm with 202pm). The explanation of a weaker attraction between the nuclei and electrons was not observed in most responses.

Question 2(a)(i)
The expected description of Fig.2.1 was to include clear references to values shown at key points along the two curves, for both 'with' and 'without' the enzyme papain. A variety of responses were seen for this question. Some descriptions were excellent and provided a full response, including values for temperature and oil extracted. However, some responses described general features without reference to values and others confused the two sets of data. In some cases, only one curve was considered.

Question 2(a)(ii)
Some candidates provided very good explanations of the relationship between temperature and enzyme activity, with effective descriptions of collision rates, optimum activity and denaturation. It was unfortunate that some candidates provided an explanation within the descriptive account expected for 2(a)(i). This presented a problem for such candidates when they moved onto question 2(a)(ii). The relationship between temperature and enzyme activity did not appear to be well understood by many candidates, and yet this is a common feature of different GCSE Biology/Science specifications.

Question 2(b)(i)to (iii)
The relationship between the different molecules outlined in this question appeared to be challenging for a number of candidates. Some confidently referred correctly to the type of chemical reaction taking place for all three parts of the question but others failed to include the name of the reaction in their responses. However, the most common and correct response was for the displacement reaction at 1(b)(iii). Some candidates were able to articulate a response for the addition and reduction reactions to include a reference to the hydrogen atoms. The removal of the double bond during the addition reaction (benenic acid from erucic acid) was identified by a number of candidates.

Question 3(a)(i)
Fig.3.1 was a clear TS image of bone. Some candidates were unable to identify this tissue type and referred to a range of tissues/organs including nervous tissue, testis and ovaries.

Question 3(a)(ii)
It was surprising to note that a number of candidates correctly provided functional characteristics of strength/support/protection, even without the correct tissue identified in 3(a)(i). For those who realised that Fig.3.1 was bone, they were able to progress further and explain the link between function and layering or compactness of the tissue. Red blood cell production was an acceptable answer, although evidence of this function was not provided in Fig.3.1.

Question 3(a)(iii)
Many candidates correctly labelled the three cell components in Fig.3.2. Some were somewhat puzzled by the features and included golgi body as structure A. Unfortunately, one or two candidates referred to chloroplasts for this cell taken from the same type of (animal) tissue displayed earlier in the question. Structure B was ideally identified as the nucleus (with nucleolus included) but the absence of nuclear pores in the nuclear envelope led many candidates to assume that B was the cytoplasm of an adjacent cell. This was a fully understandable response and was creditworthy.

Question 3(a)(iv)
A good functional summary for the ribosome/RER was frequently seen. The functions of the cytoplasm (or nucleus) were realistic but not fully described by many candidates. No clear pattern of alternative responses was apparent.

Question 3(b)(i)
The expected response was based on the large/prominent nucleus and the density of ribosomes/mitochondria. However, on this occasion a clear reference to such organelles was sufficient for the mark. It is understood that candidates would not necessarily be expected to appreciate detailed, distinguishing features for such a protein-synthesising cell.

Question 3(b)(ii)
This question was based on a general reference to connective tissue features. Many candidates correctly outlined the features of strength and flexibility and it was interesting to see the use of named examples including tendons and ligaments in the correct context.

Question 4(a)(i) and (ii)
It was anticipated that many candidates would be informed of (carboxylic) acid and amino groups for the amino acid molecule. However, a significant number of candidates were unable to complete this task correctly. A number circled the R groups of the two amino acids, whilst others circled part of the acid functional group for valine.

Question 4(b)
The majority of candidates were unable to redraw the two amino acids as reactants and to progress on to the formation of the dipeptide (showing the peptide bond). This was not anticipated. However, some correctly noted the generation of a molecule of water.

Question 4(c)
It was surprising that a number of candidates were not be able to identify the bond as peptide (or covalent). This GCSE Biology/Science topic appeared to be challenging for many.

Question 4(d)(i) to (v)
Many candidates did well with this series of linked questions, based on Table 4.1 The most common and correct responses were seen for the amino acid with an alcohol group (iv) and for the amino acid that does not have optical isomers (v). It was apparent that many were challenged by the combination of amino acids with hydrocarbon groups (i). Few candidates were able to achieve a mark for this particular feature.

Question 4(e)
The topic of protein synthesis, involving transcription and translation is well versed in GCSE Biology/Science specifications. Many candidates were able to recall some steps in either transcription or translation, but necessarily both. Some candidates provided excellent responses with a full account of DNA and RNA (both mRNA and tRNA) involvement. One common error included the link between the nucleic acids and amino acid ‘formation/production’.

Question 5(a)
A dichotomy of responses was observed for this question. A significant number of candidates were confident and capable of listing the five ingredients in Table 5.1 as inorganic compounds. They were able to list four or five correctly and obtain full marks. However, it was unfortunate that the remaining candidates were very challenged by the data and presented confusing responses including yeast and E-factors. It was not possible to identify a common error for this second group of candidates since the responses were diverse.

Question 5(b)(i)
The majority of candidates were able to respond to this question and obtain both accessible marking points. They noted that calcium was in bones (and teeth) and that its role involved strength/support.

Question 5(b)(ii)
The role of calcium in muscle contraction was not fully appreciated by the majority of candidates. A complex and detailed response was not anticipated. However, it was considered that the features of calcium storage within the tissue, its capacity to flood into muscle cells/fibres and to shorten muscles cells by removing/dislodging the barrier between the microfilaments (actin/myosin) would be achievable.

Question 5(b)(iii)
The role of calcium in plants is interesting since it also provides strength/support but via different means. It was expected that candidates would not necessarily appreciate the location of calcium between adjacent plant cell walls (in calcium pectate) but it was anticipated that the key features would be understood. Relatively few candidates successfully completed this question and yet some were able to achieve full marks. Some candidates also referred correctly to the additional role of calcium in photosynthesis (no details needed).

Question 5(c)
The biological function of iron in the human body appeared to be a challenging topic for some candidates. The responses varied greatly. Some candidates were capable of outlining the key functions of oxygen transport via haemoglobin within red blood cells. Such candidates progressed onto Level 2 marks (3 or 4) for this 'Level of Response' question. It was good to see that some candidates were also aware of the function of iron in myoglobin and as a component of electron transport chains. Detailed responses were not expected and the marking of this question therefore reflected the challenging nature for many candidates.

Question 6(a) to (c)
A number of candidates were unable to complete this question successfully. The presentation of a phase diagram for water appeared to be unfamiliar. Candidates were frequently confused by the nature of T on the diagram (specific temperature and pressure) and were therefore unable to deduce the physical state of water at point T (solid, liquid and gas). Due to the position of T within the phase boundary of liquid, candidates assumed that it represented water as a liquid rather than an interface for all three states. It was encouraging to see that the overall description [6(c)] for some candidates included references to melting, freezing, evaporation and condensation, but such references were relatively rare. This appeared to be the most novel and challenging question for candidates and the allocation of marks for 6(c) was therefore as accessible as possible.

Question 7(a)(i) to (iv)

This final question of the paper also appeared to generate a dichotomy of responses. Some candidates were very confident and successfully completed the calculations for parts (i) and (ii). Other candidates were clearly challenged and struggled to use the data provided in Fig.7.1 and Table 7.1. It appeared that they were not familiar with circuit diagrams. An explanation for the difference between the actual resistance R_6 and the theoretical resistance R_{6T} was stretching for the most able candidates. The topic was discriminatory for both candidate knowledge and application. The final question (iv) was successfully completed by a number of candidates, who were able to refer to Ohm's Law in the correct manner and to complete the necessary calculation to achieve the comparison required.

Unit 2 – Laboratory Techniques

General Comments:

This paper was very different than has probably been seen before by candidates or Centres. Historically candidates do not sit a paper that contains more than one science discipline in a level 3 paper. There is also a lot of application and understanding of contexts that candidates may have struggled with. Centres are encouraged to use sample papers and in future this paper with the candidates in order to give them practice at the style of paper and the questions within.

Some areas were answered well and candidates showed good knowledge of microscopy and chromatography. Candidates showed good skills when drawing the graph.

Other areas were weaker. The chemistry based questions were generally poorly answered and showed a lack of basic knowledge.

Candidates also found it difficult to explain why certain laboratory procedures are carried out.

Comments on Individual Questions:

Question 1(a)(i) to (iii)
This group of question is looking at basic laboratory health and safety. It is important that candidates do not confuse hazards and risks. The hazard is the substance/object that might cause an injury and the risk is the type of injury. Candidates did get these confused for example staing bacteria was a risk for ai. It is important that candidates did not just repeat the stem especially in ai. Many wrote food poisoning as the risk but as this is in the question they needed to show an understanding of what this is.

It is important that candidates learn hazards and risks that are in the specification. Many did not know enzymes were the risk in a biological washing powder. Many were able to score a mark of X-rays for aiii but those who just wrote radiation did not get the hazard mark. This was too generic and ionizing radiation or irradiation was necessary.

It is important that candidates give control measures specific to the hazard. General use of PPE would not score. Aiii was the best answered of these questions.

Question 1(b)
This question was about the importance of laboratory procedures and was not asking for a description of the procedure itself. Many candidates misunderstood this question and answered in terms of how a pH meter is calibrated.

Question 1(c)
Candidates lost marks here because their answers were too vague. For example they wrote “heat and put in bin” rather than “sterilise and dispose of according to laboratory guidelines”. Heat was insufficient unless they stated 121^{o}C for 15 minutes. Almost no candidate stated to enclose it in a biohazard bag. many just stated “seal and throw away” and this did not gain marks.

Question 2(a)(i)
It was nice to see that most candidates gained this mark.

Question 2(a)(ii)
Many candidates just gave TLC plate as an answer and this was insufficient to gain a mark.

Question 2(a)(iii)
To gain full marks candidates must give advantages and a disadvantage. Many did not give both. Many were awarded a mark for paper chromatography being cheaper but few were able to give advantages of TLC.

Question 2(b)
It was nice to see that most candidates gained this mark. Those who did not get the mark had usually left the answer blank.

Question 2(c)
Many candidates did not read the question or did not understand the question and so suggested dyes, specifically ninhydrin. Thise who gained a mark did so for ultraviolet light but did not go on to say that you would see fluorescence.

Question 2(d)(i)
Many got this mark. Those who did not, had misunderstood the terminology and had done things such as add up all the distances to get the solvent front.

Question 2(d)(ii)
There was an error carried forward for this question from question 2di so if candidates had filled in the table they could still get the first mark here even if their numbers for 2di were wrong. Those who did not get the second mark did not understand that it was not possible to state what B was and usually wrote monoglyceride again. Candidates need to understand that no result or being unable to interpret a result is part of the process of working in a laboratory.

Question 2(d)(iii)
This was not well answered because candidates suggested using published values which is in the question, or found it difficult to explain. Answers such as “identify the colour and distance” were common but not creditworthy as it was not clear what colour or distance was being identified.

Question 3(a)
This was answered badly. Candidates do not seem to have basic chemistry knowledge. Many missed out on the third mark point because they used end point rather than equivalence point. Many did not know the indicator and many stated got the type of reaction wrong. A lot of weak answers such as , “when it reacts you can see a clear colour change” were seen.

Question 3(b)
This was also badly answered with few candidates getting more than 1 mark. Candidates did not specify the strength of the acid and the alkali; they used neutral rather than buffer solution; they used end point rather than equivalence point; many gave vinegar or ethanoic acid rather than sodium ethanoate.

Question 3(c)
This was a levels based question. Candidates could get marks using the indicative content although other creditworthy statements would have been credited. These were not seen. The most common creditworthy statement was that the “autotitrator gave the results automatically”. Few candidates were able to give more detail. Many discussed lack of human error which was awarded a compensatory mark but candidates did not know how the autotitrator worked . Many stated it was faster than other methods but this was not credited as they did not show an understanding that it was only faster once it was calibrated.

Question 4(a)(i)
Most candidates gained this mark and as “microscope” was in the question just writing “light” was sufficient.

Question 4(a)(ii)
Candidates struggled with this question. This is skill required by the specification and it would be a good idea for Centres to practice this skill with candidates. Many measured the 100, the 65 and the 28 but then did not know what to do with those numbers. Some hedged their bets by taking 28 away from 65 but also dividing 100 by 65. Many candidates did not use the 65 at all and multipled the 28 by 1 over a 100.

Question 4(a)(iii)
This was another example where candidates did not have basic knowledge. Their answers were very vague e.g. “ get the microscope set up with a eye piece graticule and compare that to a known measurement e.g. metric using a ruler you can see how many mms it is from their x or / by 1000 for which unit you want it in” Although this candidate knows it is a comparison and remember words such as “graticule” they have a lack of understanding and so gain no marks. When marks were awarded it was mostly for candidates who stated where the eyepeice graticule would be placed; that the eyepiece graticule needs to be rotated and the graticule and micrometer need to be lined up.

Question 4(a)(iv)
Candidates struggled with this question. Most drew a line with no real scale or units. It was unclear why the length of the scale bar had been chosen. They did not use the correct numbers. Candidates could still get full marks here if they had 4aii wrong as long as they used their answer for this question.

Question 4(b)(i)
Most candidates gained this mark. It was important that the word scanning was present but not the word microscope.

Question 4(b)(ii)
This question was answered well with most candidates able to get at least one mark. Many gained the mark for “higher resolution”. Misunderstandings and answers that were not in depth enough included “you can see the outside of the grain”; “you get to see great detail”; “more accurate”. Good candidates commented on being able to see detail in 3D, or see more surface detail.

Question 5(a)(i)
Again this question showed that candidates did not have basic knowledge. Good candidates got the first two mark points but did not always state it gave a clear, colourless solution. Some candidates misunderstood the question and discussed having to replace the pipes.

Question 5(a)(ii)
Very few candidates gained marks here. Centres should practice writing and balancing appropriate equations from the specification.

Question 5(a)(iii)
Again very few candidates knew this and this answer was often left blank. Some candidates attempted to answer and knew they had to suggest a metal ion. Metals such as tin or iron were suggested.

Question 5(b)(i)
This is another question about choices of procedures. Candidates struggled to answer this because they did not know the procedure. Vague answers about accuracy or ease were often seen. E.g. “for accuracy”. This would not be enough to gain the mark. It is important that candidates know all the procedures in the specification.

Question 5(b)(ii)
Again candidates gave vague answers that did not quite meet the required level of understanding needed. E.g. “no risks of contamination of standard solutions” . The mark scheme is looking for concentration having defined degree of accuracy or standards are same degree of accuracy each time. Comments on adding traceability would also have been credited.

Question 5(b)(iii)
Candidates did well on this question and most were able to get 3 or 4 marks. Marks were lost where the axis was the wrong way round or the line of best fit was missing, too thick or inappropriate. A mark was also lost if the correct unit wasn’t given on the x-axis. Candidates should use a sharp pencil and a ruler when drawing a straight line on a graph.

Question 6(a)(i)
Candidates got most marks for understanding that the process prevented contamination of the culture and of the environment. In general this was quite well answered. Very few discussed erroneous results.

Question 6(a)(ii)
Candidates lost marks here due to poor terminology. “Clean work area” is not sufficient to gain the sterile work area mark. Some candidates just wrote “sterilised” but did not state what was sterilised and so did not gain a mark. General comments on PPE such as wear gloves were not creditworthy.

Question 6(b)(i)
Again candidates gained marks for understanding this was to stop contamination. Candidates struggled to explain in enough depth and so did not get marks. E.g. “ the airflow cabinet is to make sure that the air in the cabinet is always flowing so no harmful bacteria are floating around” did not quite meet any mark point.

Question 6(b)(ii)
Candidates often gained marks here for the idea that there was risk of a fire. The better learners also recognised that the heat would cause turbulence and may affect the metabolism of the microorganisms. Ideas such as “create a convection current” were credited.
Candidates need t make sure if there are 3 mark points then they give 3 different responses. So “there could be flammable objects and it can catch fire” would only be worth one mark.

Question 6(c)(i)
There were a lot of not creditworthy answers that mentioned cleaning, rinsing or washing e.g. “wash with sodium hydroxide solution”. “sterilise by washing” was not creditworthy as the method (autoclave) needed to be given. Many candidates thought using a Bunsen burner was appropriate but this gained no marks.

Question 6(c)(ii)
Many candidates answered this question in exactly the same way as they answered 6ci. Sterilise in autoclave was the only creditworthy response.

Question 6(c)(iii)
Use of alcohol was accepted. If candidates wrote “ wash with alcohol” this did gain the mark.

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