CAMBRIDGE TECHNICALS

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Examiners' report

APPLIED SCIENCE

05847–05849, 05879, 05874

Unit 2 January 2024 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

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.

A full copy of the question paper and the mark scheme can be downloaded from Teach Cambridge.

Unit 2 series overview

This paper is likely to be quite different from those the majority of students will have experienced. Historically candidates do not sit a paper that contains more than one science discipline in a Level 2 or 3 paper. However, most Centres are familiar with the style of paper and in general candidates' performance is improving, even considering the difficulties of the last few years. Most candidates seemed prepared for this style of paper. Most candidates attempted all questions.

There is a lot of application and understanding of contexts that some candidates may have found challenging. Centres are encouraged to use sample papers and any from previous series available with the candidates to give them practice at the style of paper and the questions within.

Some areas were answered well, and candidates showed good knowledge of sampling techniques. They were also able to answer questions on medical imaging techniques such as ultrasound and X-ray scans. They did less well when interpreting chromatograms and mass spectra. They struggled to calculate concentration of a solution. They were able to interpret a calibration graph.

In some cases, their lack of good scientific terminology prevented them answering questions to the required standard. They also found it challenging to answer in terms of the context of the question and this did impact negatively on their ability to score marks.

This is a techniques paper and so it is the techniques they need to know how to describe. They also need to explain why a technique is used. Candidates who have had the opportunity to carry out and discuss the techniques are much more able to answer the questions successfully. Good use of demonstrations and video clips is also important.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• attempted all questions and had practiced exam technique ensuring they read the question carefully and followed instructions • related their responses to the context of the questions (Questions 1 and 6) and so were able to discuss relevant hazards and sampling techniques • had experience of laboratory techniques and medical imaging (Questions 2, 4 and 5) and were able to describe procedures and use of laboratory equipment from the specification • had good understanding of titration techniques (Question 3) and were able to calculate concentrations. They were confident in using given equations, choosing and substituting numbers correctly • used accurate and precise science terminology (Questions 2(a)(i), 3(a)(ii), 3(b)(i), 3(b)(ii), 4(c)(ii), 4(c)(iv)).	• showed poor exam technique by not attempting all questions and not answering questions in the context they are set • were unable to interpret spectra (Question 2(b)) or chemical test results (Question 5(a)) • had gaps in their knowledge of sampling techniques and procedures (Question 1) • did not seem to acquire a range of skills and knowledge as outlined in the specification, including medical imaging equipment (Question 4) • struggled with calculating concentrations even where scaffolding was provided and did not show logical working (Question 3(c)) • struggled to demonstrate the knowledge and skills required to respond effectively to the extended response question, choosing to rewrite the stem rather than answer the question asked (Question 3(b)(i)).

Question 1 (a) (i)

1 Beth is a forensic scientist.

She is called out to a crime scene where she uses swabs to collect blood samples.

The blood samples will be sent to the laboratory for analysis.

The results of the tests can be used as evidence in court.

(a)

(i) State **one** hazard that each blood sample presents to Beth.

..... **[1]**

Generally, candidates were able to gain this mark, mostly for bacteria or pathogen, although some named pathogens such as HIV. There is still a confusion for many candidates regarding the difference between 'hazard' and 'risk. This can also be seen in responses to Question 1(a)(iii). Many gave a response that was the risk rather than the hazard such as 'disease'. This was not given the mark.

Misconception

There is still a confusion for many candidates concerning the difference between 'hazard' and 'risk'.

Question 1 (a) (ii)

(ii) Name **one** item of PPE that Beth should wear to minimise this hazard.

..... **[1]**

Most candidates answered this correctly. Those that didn't mostly suggested face mask. They had not read the question and thought it was about taking medical blood samples, not swabs of blood from a crime scene. Although forensic scientists may normally wear a mask it would not minimise this hazard and so was ignored as an answer.

Assessment for learning

It is important to allow candidates time to look at practice exam questions and analyse them to see what the context is and how that might affect their response.

Question 1 (a) (iii)

(iii) Explain the difference between a hazard and a risk.

.....

.....

.....

..... **[2]**

This was not answered well. Many candidates gave an example of a risk and the hazard that would cause it but did not explain what each was. The examples were not enough to gain the marks as this did not answer the question set. Other candidates confused the two, or simply struggled to explain them correctly.

Question 1 (b) (i)

(b) Beth puts each swab inside a separate tube.

She then puts each tube inside a bag.

She seals each bag, labels them all and sends them back to the laboratory where they are stored in a fridge before being analysed.

(i) Suggest **two** things Beth should include on the labels of the blood sample bags.

1 .....

2 .....

[2]

It is important for candidates to be specific when answering any question. Many gave 'the name' as one response. This could not be given a mark as the name of the sampler was allowed but the name of the patient was not. Several suggested time taken, which was ignored as the question was looking for date taken.

Question 1 (b) (ii)

(ii) Suggest **two** reasons why the evidence bags must be sealed before they are transported.

1 .....

2 .....

[2]

Many candidates had the misconception that the sample was liquid. It is likely they thought they were discussing blood samples taken from a patient. However, these were swabs from a crime scene and so not liquid and unlikely to leak or spill. This meant these type of responses did not gain marks.

Misconception

It is important that candidates read the whole question carefully and answer in relation to the context given. This is an applied qualification and it is important that they can apply their knowledge and understanding correctly within different scenarios.

Question 1 (b) (iii)

(iii) Explain why the swabs are stored at low temperatures while they are waiting to be analysed.

.....

.....

..... **[2]**

Candidates that recognised the samples were from a crime scene understood the importance of preserving the blood for accurate analysis. Those that thought it was from a patient did not gain marks because they discussed analysis to do with disease. Others said it was to prevent denaturing. This is inappropriate terminology and not relevant here. This shows the importance of using the correct scientific terms.

Question 1 (c) (i)

(c) The laboratory she works in contains many chemicals. There are rules about how these chemicals must be labelled, stored and disposed of.

(i) Draw lines to link the type of chemical to the correct storage location.

Chemical	Storage location
Concentrated hydrochloric acid	Flammables cupboard
Ethanol	Toxic chemicals locker
Sodium cyanide	Corrosives cupboard

[2]

It was good to see most candidates getting full marks here. Those that didn't, did not recognise that sodium cyanide needed to go in the toxic locker.

Question 1 (c) (ii)

(ii) Draw lines to link the type of waste to a standard disposal method.

Type of waste	Standard disposal method
A shattered beaker	Pour down a designated sink
The sample swabs	Place in a broken glassware box
1 mol dm^{-3} hydrochloric acid	Place in an autoclave

[2]

It was good to see almost all candidates getting full marks here.

Question 2 (a) (i)

2 Digoxin is a medication used to treat various heart conditions. It belongs to a group of chemicals called alkaloids.

Digoxin and other alkaloids can be extracted from the leaves of some plants using solvents.

The extracted mixture of alkaloids can then be separated using HPLC.

(a)
(i) State what HPLC stands for.

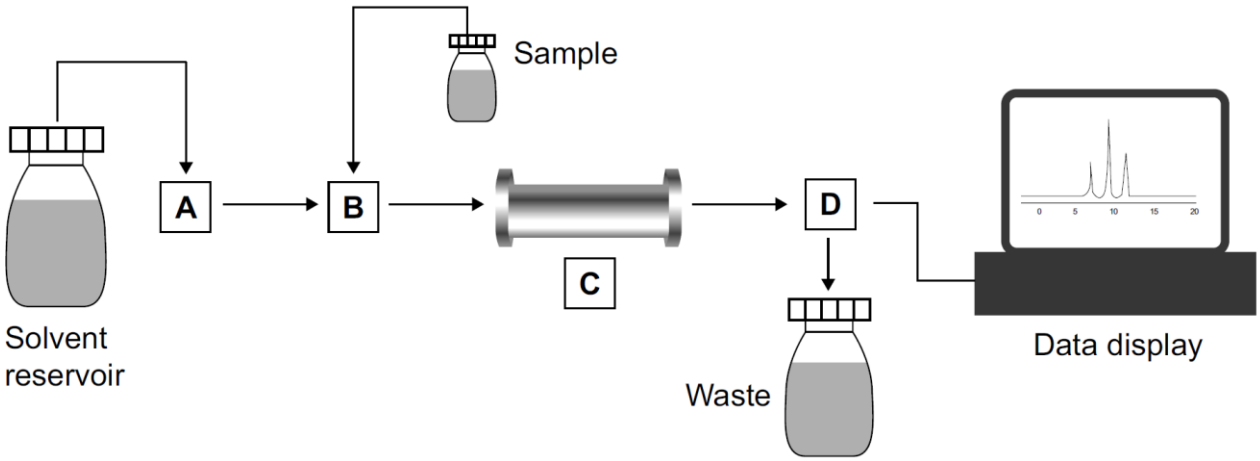
.....

..... **[2]**

Many candidates knew this. Some good exam practice was seen, with candidates writing out the words they were sure of and then making a sensible guess at the others. This often gained at least a mark and was better practice than leaving it blank.

Question 2 (a) (ii)

(ii) A partially labelled block diagram of an HPLC system is shown below.



Four labels have been done for you.

Identify **A**, **B**, **C** and **D** using words from the list below.

detector **HPLC column** **pump** **sample injector**

A .....

B .....

C .....

D.....

[3]

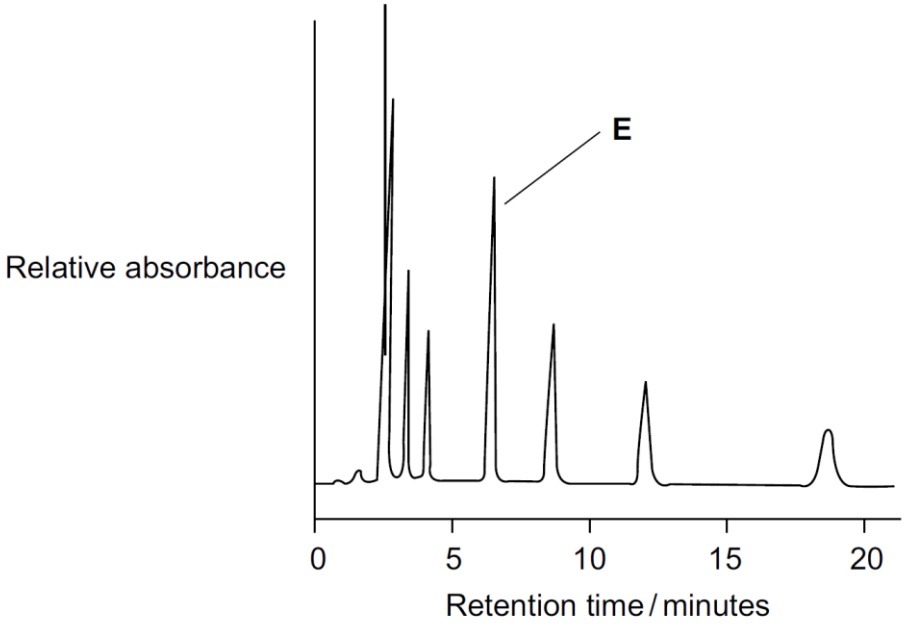
This was generally answered well. If marks were lost it was often because pump and sample injector were in the wrong order. This shows that candidates are doing better at understanding processes and techniques.

Question 2 (b) (i)

(b) Mia and Kofi work for a pharmaceutical company. They are using HPLC to separate alkaloids extracted from plants.

An HPLC chromatogram of extracted alkaloids is shown below.

The peak that Mia and Kofi think is digoxin is labelled **E**.



(i) Estimate the retention time of the peak labelled **E**.

..... min **[1]**

Most candidates could answer this, giving an answer between 6 and 7.

Question 2 (b) (ii)

(ii) Mia thinks there are eight different alkaloids in the extract.

State how the chromatogram shows this.

..... **[1]**

This was answered very well. Most candidates recognised that 8 peaks meant 8 different alkaloids. However, there were some candidates that just gave an answer of 'the number of peaks'. This was not enough to gain the mark. Candidates need to be very clear in their responses. We can only award marks when we have evidence that they understood it was the 8 peaks that showed there were 8 alkaloids.

Question 2 (b) (iii) and (iv)

(iii) Use the chromatogram to explain how the **relative** amount of digoxin in the sample can be determined.

.....

..... **[2]**

(iv) Describe how Mia and Kofi could determine the **actual** amount of digoxin in the sample.

.....

..... **[2]**

Questions 2(b)(iii) and 2(b)(iv) were very discriminating questions on this paper. Candidates had to have a good grasp of how to understand and interpret a chromatogram. Very few marks were scored on either question. The more successful candidates understood that area of the peak(s) should be used to determine amount of digoxin, but they struggled to explain how.

Assessment for learning

Practice with using and interpreting these type of chromatograms would allow candidates to access these more challenging questions. Once candidates have the skill with a chromatogram for one substance, they will be able to transfer it to chromatograms for other substances.

Question 2 (c) (i)

(c) The alkaloids extracted from plants can be positively identified using MS.

(i) Put a (ring) around the correct meaning of MS from this list.

Mass spectrometry	**Mass standards**
Measurement standards	**Molar spectrometry**

[1]

Most candidates gained this mark. Molar spectrometry was a common response for candidates that did not know.

Question 2 (c) (ii)

(ii) A series of five steps occur inside an MS machine.

Number the steps in the order they occur. The first one has been done for you.

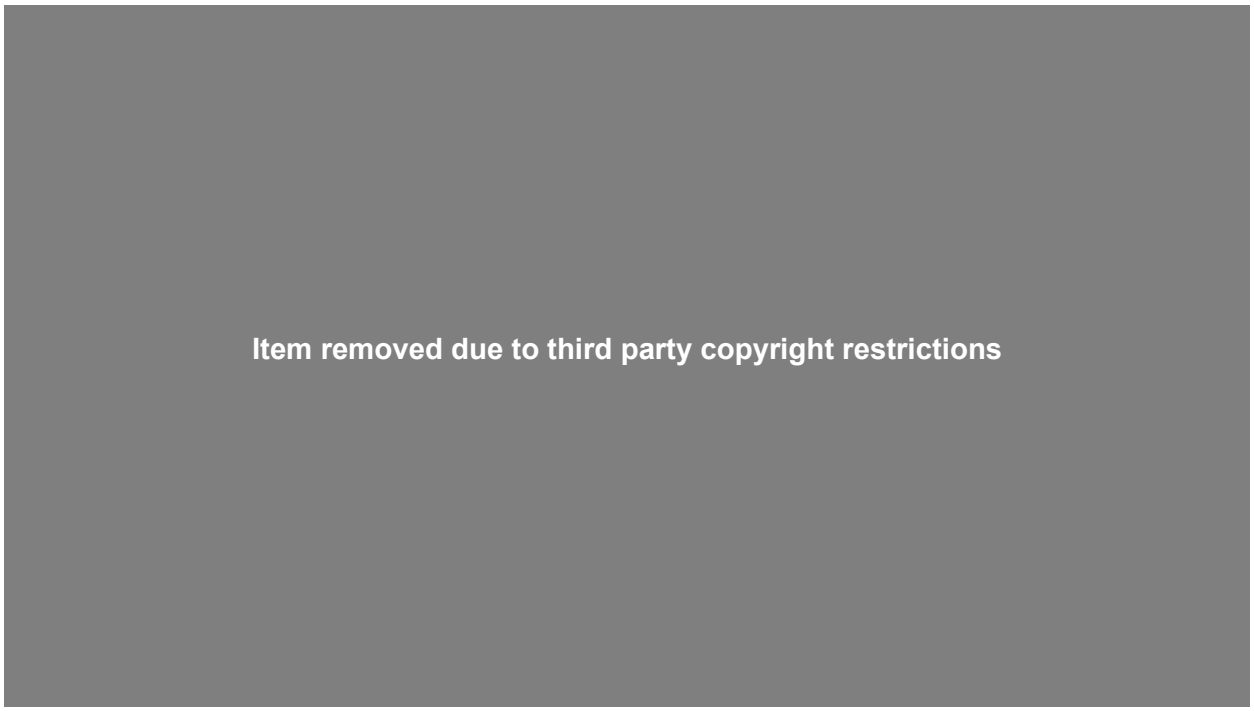
Steps	Order
Fragmentation	
Ionisation	1
Detection	
Deflection	
Acceleration	

[2]

Many candidates did not know the correct order. It is important that candidates learn the techniques on the specification.

Question 2 (c) (iii)

(iii) The spectrum obtained for digoxin is shown below.



Use the spectrum to estimate the molar mass of digoxin.

..... $g\,mol^{-1}$ **[1]**

Many candidates gained this mark. Those that did not appeared to have overthought it. They started with 800 and then did a calculation, often dividing by 100, or subtracting one of the other numbers on the spectrum.

Assessment for learning

As with chromatograms, if candidates have experience interpreting spectra they will have a skill that will transfer to spectra of other substances.

Question 3 (a) (i)

3 Jane and James are laboratory technicians working for a chemical company that manufactures household cleaners.

The active ingredient in drain cleaners is sodium hydroxide, NaOH.

They plan to do a titration with hydrochloric acid, HC*l* to determine the concentration of NaOH in a drain cleaner.

They need to use the following equations in their calculations.

- Number of moles = $\frac{\text{concentration in mol dm}^{-3} \times \text{volume in cm}^3}{1000}$
- Concentration in g dm^{-3} = concentration in mol dm^{-3} × molar mass in g mol^{-1}

(a) For the titration they need a 0.100 mol dm^{-3} solution of HC*l* which they make from concentrated (12.05 mol dm^{-3}) hydrochloric acid.

(i) Calculate the volume, in cm^3, of 12.05 mol dm^{-3} hydrochloric acid that contains 0.100 mole of HC*l*.

Volume = ... cm^3 **[1]**

In many cases candidates chose the correct numbers but did not use the equation correctly and so did not gain the mark.

Assessment for learning

Candidates need to practice choosing correct numbers from a question, choosing the correct equations and then substituting the numbers into the equation. There are always marks for calculations on this paper, so practising these skills will help candidates. The skills are the same even if the numbers and context are different.

Question 3 (a) (ii)

(ii) Complete the sentences below using words from the list.

1 dm^3 measuring cylinder	**10 cm^3 graduated pipette**	**1 dm^3 beaker**
1 dm^3 volumetric flask	**10 cm^3 measuring cylinder**	**10 cm^3 beaker**

1. The volume of concentrated HC*l* calculated in **(a)(i)** should be measured using

   a .....

2. The correct volume of concentrated HC*l* should be transferred to

   a ..... and made up to 1 dm^3 with distilled water.

[2]

Candidates were able to choose the correct size equipment, however many did not choose the correct type of equipment.

Assessment for learning

It is important when doing practical work that candidates think about why a particular piece of equipment is used in terms of accuracy.

Question 3 (b) (i)*

(b) Jane and James dilute 50 cm^3 of drain cleaner by a factor of 5.

They then do a titration with the diluted drain cleaner.

They use the following method for the titration:

- Transfer 25.0 cm^3 of the diluted drain cleaner into a conical flask.
- Add 3 drops of a suitable indicator.
- Fill a burette with 0.100 mol dm^{-3} HC*l*.
- Titrate the diluted drain cleaner against the 0.100 mol dm^{-3} HC*l*.

(i)* Describe **and** explain the steps the technicians should take to ensure that their results are as accurate as possible.

Include the name of the apparatus they would use to measure out the 25.0 cm^3 of diluted drain cleaner, and the name of a suitable indicator.

.....

.....

.....

.....

.....

..... **[6]**

Many candidates did not read the question carefully and just repeated the stem, giving the method already given in question. Some candidates suggested using a graduated pipette, possibly because it was a possible response in an earlier question. This shows they were not really thinking about the question as set, especially those that suggested a 10 cm^3 graduated pipette. Many were able to give improvements to the method description for some credit but did not explain why they were improvements.

It is essential, when candidates are doing any practical work, that they are encouraged to consider why each piece of equipment or technique is being used. Many understood repeats were essential and that they needed to be done to get concordant results. However, they did not show evidence that they understood why this was an improvement. Many suggested ideas such as reading from the meniscus. This is not a method point. This is just good practice and so cannot be given as an improvement.

Question 3 (b) (ii)

(ii) The technicians obtained the following results.

	Rough Titration	Titration 1	Titration 2	Titration 3
Final reading /cm^3	32.60	32.50	32.60	32.50
Initial reading /cm^3	0.00	0.20	0.05	0.10
Titre /cm^3	.....	.....	.....	.....

Complete the table, state which titres are concordant and explain how the technicians should use their results to calculate the mean titre.

.....

.....

.....

..... **[3]**

Although there were many good responses, there were also a number of candidates that did not understand the purpose of the rough titration, or the meaning of concordant. Many included the rough titre volume when deciding which were concordant, or when calculating the average titre. Many thought concordant meant 'not the rough titre'. Other candidates gave the correct concordant titres but then included all titre volumes in calculating the average. Many candidates lost a mark for not giving their calculated titres to 2 decimal places.

Question 3 (c) (i)

(c) Complete steps **(i)** to **(iv)** to calculate the concentration of NaOH in the drain cleaner.

(i) Use the mean titre to calculate the number of moles of HC*l* used in the titration.

..... **[1]**

This was not answered well. Candidates need more practice with standard form as many that appeared to know how to do this calculation removed the standard form from their response and so gave an answer that was too high by several powers of ten.

Question 3 (c) (ii)

(ii) In the titration, 1 mole of HCl neutralises 1 mole of NaOH.

Use your answer to **(c)(i)** to deduce the number of moles of NaOH in 25.0 cm^3 of the diluted drain cleaner.

..... **[1]**

Many candidates realised that the answer here would be the same as that for Question 3(c)(i) and so gained the mark. They understood the molar ratio.

Question 3 (c) (iii)

(iii) Calculate the number of moles of NaOH in 1 dm^3 of the diluted drain cleaner.

..... **[1]**

Many candidates did not use the equation given to them earlier in the question and so were unable to carry out the correct calculation. This shows the importance of reading the question carefully.

Question 3 (c) (iv)

(iv) The drain cleaner was originally diluted by a factor of 5.

The molar mass of NaOH is 40.0 g mol^{-1}.

Calculate the concentration of NaOH in g dm^{-3} of the **undiluted** drain cleaner.

Give your answer to **3** significant figures.

Concentration of NaOH ..... g dm^{-3} **[2]**

Many candidates lost marks because they did not show logical working. Marks can be gained for working, even if the final answer is incorrect, if the calculation question is worth more than 1 mark. Many candidates missed the instruction to give the answer to 3 significant figures and so lost the final mark. Again, this shows the importance of reading the question carefully and following all instructions.

Question 4 (a) (i)

4 Radiographers can use ultrasound and X-ray images to reveal structures hidden inside the human body.

(a) An ultrasound scanner being used on a patient's abdomen is shown below.

(i) Complete the following sentence.

Ultrasound waves are sound waves with a frequency .....

than the range of human hearing. **[1]**

Most candidates gained this mark for 'higher'.

Question 4 (a) (ii)

(ii) Name the part labelled **A**.

..... **[1]**

Although many candidates gained this mark, many had not read the question and gave the answer as 'scanner'. It is clear from the question that the entire piece of equipment is called the scanner and so this was not creditworthy.

Question 4 (a) (iii)

(iii) Tick (✓) **one** box that best describes the function of the part labelled **A**.

To direct the ultrasound into the patient and receive the reflected ultrasound from the patient.	☐
To direct the ultrasound into the patient's abdomen.	☐
To produce the ultrasound image.	☐
To receive the reflected ultrasound from the patient.	☐

[1]

This was answered well, although some candidates ticked the second box not realising the probe directed **and** received the ultrasound.

Question 4 (a) (iv)

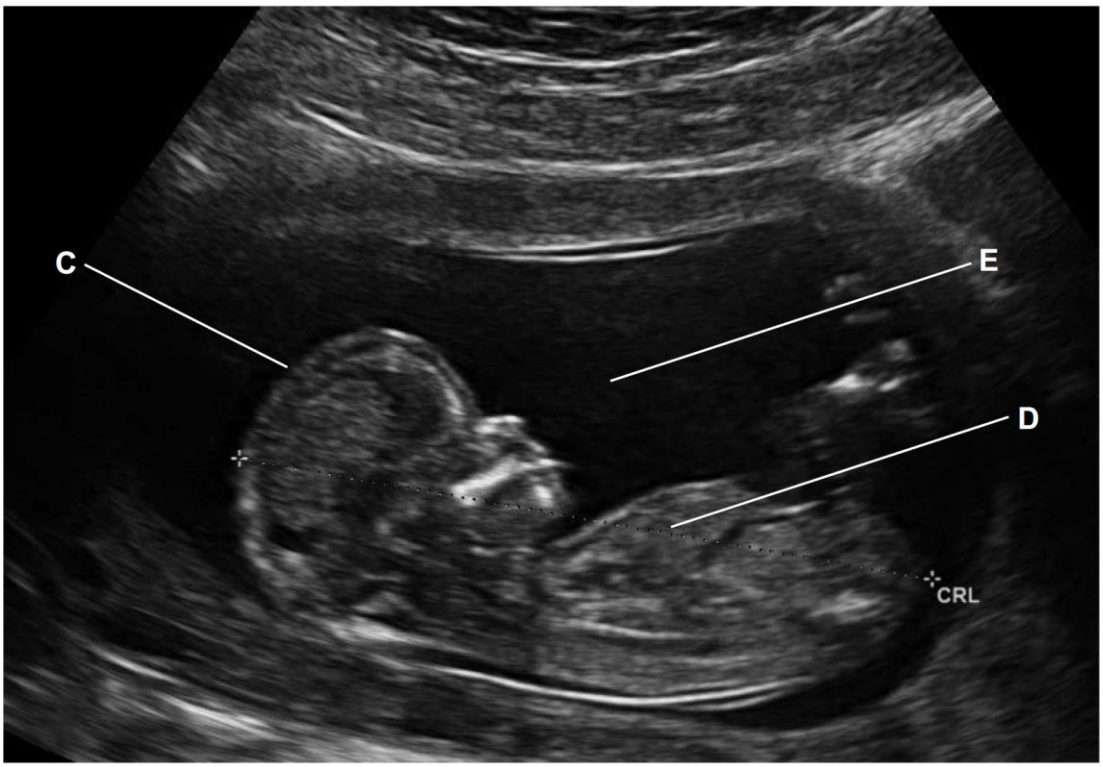
(iv) Name the substance labelled **B**.

..... **[1]**

Many gave the correct answer of gel. Several tried to name the gel and if it was a correct gel then the mark was given.

Question 4 (b) (i)

(b) An ultrasound scan of a 12 week foetus is shown below.



(i) Which area, **C**, **D** or **E**, is most likely to be fluid-filled?

..... **[1]**

Most candidates gained this mark.

Question 4 (b) (ii)

(ii) Name the type of tissue or organ protected by **C**.

..... **[1]**

This was well answered. Those that did not gain this mark had not read the question and gave the name of C (the skull) or named the uterus, thinking this was being protected.

Question 4 (c) (i)

(c) An image of a patient having an X-ray scan is shown below.

(i) Complete the sentence below using words from this list.

electromagnetic **high** **longitudinal** **low** **medium** **sound**

X-rays are ..... energy .....

waves used for medical diagnosis.

[2]

Many candidates gained both marks. Even those that lost the marks tended to pick the correct words but put them in the incorrect order.

Question 4 (c) (ii)

(ii) Name the part labelled **F**.

..... **[1]**

Many candidates gave scanner as a response which was not given the mark. They needed to name the specific part of the equipment labelled.

Question 4 (c) (iii)

(iii) Tick (✓) **one** box that best describes the function of the part labelled **F**.

To detect the X-rays that leave the patient.	☐
To produce X-rays and direct them to the patient.	☐
To produce X-rays and to detect the X-rays that leave the patient.	☐
To reflect X-rays.	☐

[1]

Many candidates answered this question correctly. Detecting X-rays was a common wrong response.

Question 4 (c) (iv)

(iv) Name the part labelled **G**.

..... **[1]**

There were a lot of incorrect suggestions here, including bed and scanner. It is important that candidates know how to label equipment covered in the specification.

Question 4 (c) (v)

(v) Tick (✓) **one** box that best describes the function of the part labelled **G**.

To detect the X-rays that leave the patient.	☐
To generate the X-ray image.	☐
To produce X-rays and direct them to the patient.	☐
To produce X-rays and to detect the X-rays that leave the patient.	☐

[1]

This was well answered. There was no common wrong response.

Question 4 (d)

(d) Explain why pregnant women are more likely to be scanned using ultrasound rather than X-rays.

.....

.....

..... **[2]**

Most candidates recognised that ultrasound would not harm the foetus or that X-ray could. Most did explain this in terms of ionising radiation or high energy.

Question 5 (a) (i)

5

(a) A group of students has been asked to identify two ionic compounds: **X** and **Y**.

The tests they plan to use are:

- Flame test
- Barium chloride test
- Sodium hydroxide test
- Silver nitrate test.

(i) The table shows steps for the sodium hydroxide test.

Number the steps in the order they occur. The first one has been done for you.

Step	Order
Add a few drops of aqueous sodium hydroxide.	
Add the aqueous sodium hydroxide until it is in excess and record the result.	
Dissolve a small quantity of the unknown solid in distilled water.	1
Place about 5 cm^3 of the solution into a test tube.	
Record the colour of any precipitate that is formed.	

[2]

Most candidates struggled to order the tests correctly.

Assessment for learning

Candidates should have practical experience of these tests and time should be spent on them planning the tests, so they understand how to do them.

Question 5 (a) (ii)

(ii) The students obtained the following results.

Test	Results for compound X	Results for compound Y
Flame test	Lilac flame	No change to normal flame colour
Addition of aqueous barium chloride	No precipitate	White precipitate
Addition of aqueous sodium hydroxide	No precipitate	Green precipitate which is insoluble in excess NaOH(aq)
Addition of aqueous silver nitrate	Yellow precipitate	No precipitate

Use the results to identify compounds **X** and **Y**.

Compound **X** .....

Compound **Y** .....

[4]

Most candidates were able to score a mark for potassium. Very few gained all 4 marks. Chemical testing is a part of the specification and is often tested. Candidates should know the tests, the results of the tests and should be able to identify ions and compounds based on these results.

Question 5 (a) (iii)

(iii) The students were then asked to show that a third compound, **Z**, contained carbonate ions.

Describe the test they would use and what they would observe.

.....

.....

.....

..... **[2]**

Most candidates know the limewater test for carbon dioxide. However, this is not what the question was asking for. They needed to recognise that adding acid to Z would produce bubbles. The limewater test would not work until this step had been carried out. Candidates need to make sure they apply their knowledge to the question as set, and do not just recall facts. They could not gain full marks for this question without explaining how the carbon dioxide would be produced.

Question 5 (a) (iv)

(iv) Put a (ring) around the correct formula of the carbonate ion.

CO_3^- CO^{2-} CO_2^{3-} CO_3^{2-} **[1]**

This question was answered correctly by a good proportion of candidates. There was no common wrong response.

Question 5 (b) (i)

(b) Cadmium is a metal that is toxic to humans. Some food contains very small amounts of cadmium ions.

For milk to be safe to drink, the concentration of cadmium ions must be below 10 $\mu g\,dm^{-3}$.

Analytical laboratories use ICP-AES to determine the concentration of cadmium ions in samples of milk.

(i) A technician working in the analytical laboratory first produces a calibration graph.

The technician uses ICP-AES to measure the intensity of the emitted radiation using four different concentrations of cadmium ions.

The technician starts by preparing a solution with a cadmium ion concentration of 20 $\mu g\,dm^{-3}$.

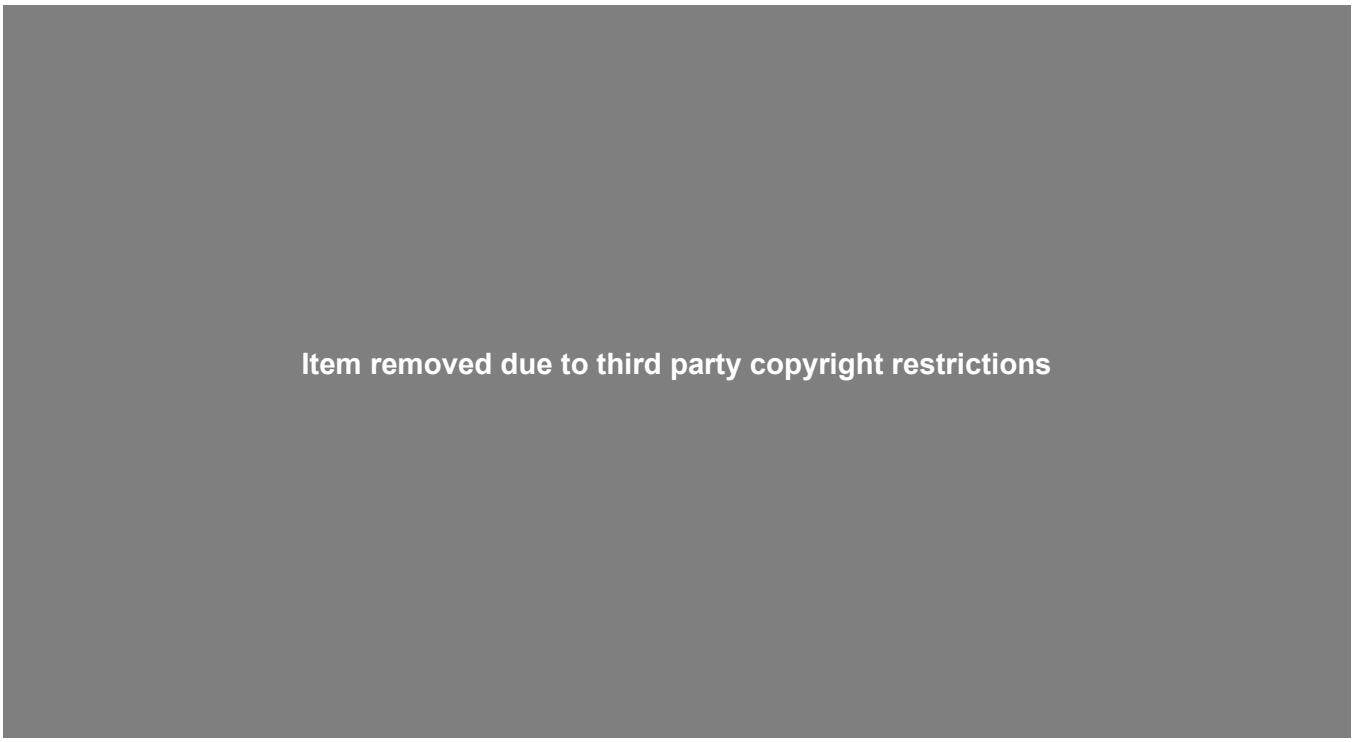
What technique is used to prepare the other solutions for the calibration?

..... **[1]**

Very few candidates gave the correct answer here. They should know the techniques in the specification and be able to recognise them when they are described.

Question 5 (b) (ii)

(ii) The technician obtains the following calibration graph.



The technician then prepares and analyses a sample of milk using ICP-AES.

The relative signal intensity was found to be 0.032.

Explain if the milk is safe to drink. Show your working on the graph.

.....

.....

..... **[3]**

Most candidates gained 2 or 3 marks here. They were able to show evidence of interpolation on the graph and use that to make a conclusion. Where marks were lost it was often for not reading the scale on the graph correctly and so giving a number that was out of the acceptable range, but still lower than 10.

Assessment for learning

Practising drawing and analysing graphs will help candidates in future series as the skills are the same whatever the context.

Question 5 (b) (iii)

(iii) ICP-AES is used to identify many different metals, but AES can only identify a small number of metals.

Put a (ring) around each cation in the list below that can be identified using AES.

Li^+ Mg^{2+} Ni^{2+} Zn^{2+} **[1]**

Many candidates only circled one cation. The instruction was to circle each cation and this should have helped candidates recognise that it could be more than one. There were no common wrong responses but most candidates circled one or two cations only.

Question 6 (a)

6 Vaccines for influenza (flu) can be manufactured in eggs using the following steps:

- Injecting eggs with live influenza virus
- Allowing the virus to multiply inside the eggs
- Purifying the influenza virus from the eggs
- Processing the virus so that it is attenuated (no longer harmful to humans)
- Packaging the attenuated virus (vaccine) into glass vials.

(a) The figure below shows influenza virus being injected into an egg.

What is the most effective way of sterilising the surface of the eggs?

Tick (✓) **one** correct method.

Autoclaving the eggs. ☐

Irradiating the eggs with gamma rays. ☐

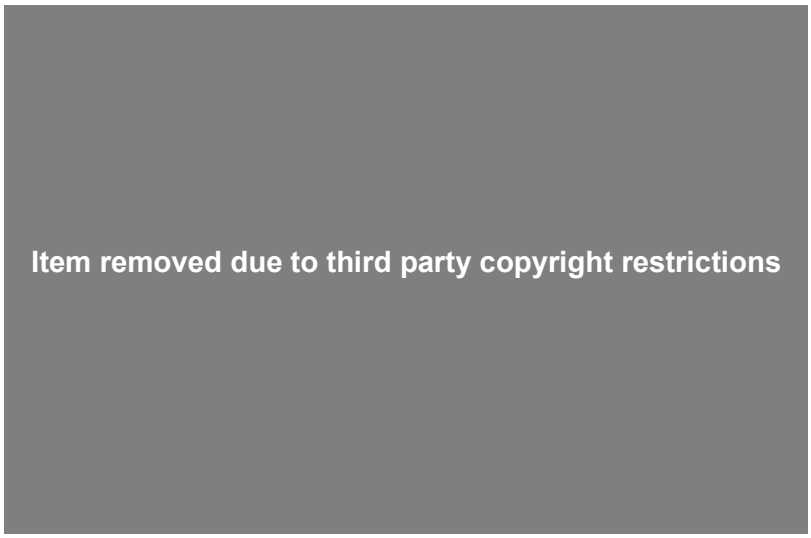
Wiping the eggs with a disinfectant. ☐

[1]

This was well answered. Autoclaving the egg was a common incorrect response.

Question 6 (b) (i)

(b) The influenza-inoculated eggs are then incubated in a clean room, as shown below.



(i) Bacteria can contaminate the virus-inoculated eggs.

Suggest how the number of bacteria in the air of the clean room could be reduced.

.....

..... **[1]**

Most candidates did not know that filtration would reduce bacteria number. Many discussed keeping people out of the room or wearing PPE. Others discussed fume cupboards or air flow systems.

Question 6 (b) (ii)

(ii) Describe how the number of bacteria in the air of the clean room can be monitored.

.....

.....

..... **[2]**

There were many vague responses here about taking samples of air and testing it. Others suggested scanning for bacteria or taking swabs of air. Others were even more vague and discussed checking filters or people for bacteria but did not say how. Very few suggested using agar plates. Those that did usually also suggested counting colonies and so were given both marks. Lots of candidates suggested counting bacteria showing a misunderstanding of the size of bacteria.

Question 6 (b) (iii)

(iii) Name **three** pieces of PPE that **can be seen** in the figure that would prevent contamination of the employee by virus particles in the air.

1 .....

2 .....

3 .....

[3]

Most candidates gained all 3 marks. A few stated glasses which is not creditworthy, they must be clearly safety glasses or goggles. Others were equally vague and suggested suits or eye covering. We would expect candidates to be more specific at this level.

Question 6 (b) (iv)

(iv) Suggest another reason for the employee wearing the PPE in the figure.

.....

..... **[1]**

Most candidates recognised this was to prevent contamination of the eggs. Those that did not score gave vague responses such as to prevent cross contamination without identifying what would be contaminated and so were not given the mark.

Question 6 (c)

(c) The influenza virus can be observed using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

Transmission electron microscopes and scanning electron microscopes have different features.

Put ticks (✓) in the correct boxes to indicate the features of the two types of microscopes.

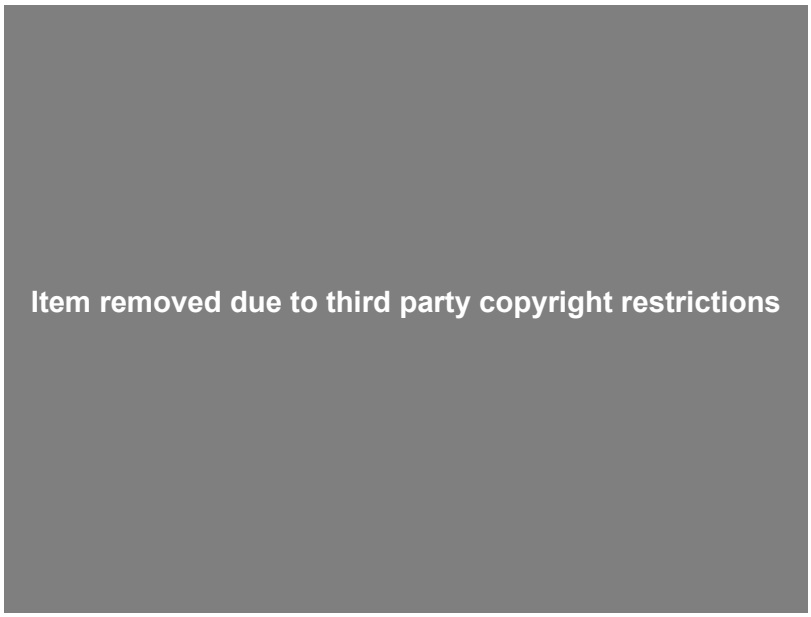
Feature	TEM	SEM
Electrons are reflected off the surface of the virus.		
The image produced is two dimensional.		
Maximum magnification can be up to x 50 million.		
A typical resolution of 0.4 nm is achieved.		

[3]

Most candidates only gained 1 or 2 marks here. As stated throughout this report, it is important that candidates know the features of the equipment in the specification.

Question 6 (d)

(d) Some new influenza vaccines are produced by growing influenza viruses in animal cells that are being grown in sealed bioreactors, as shown below.



Explain why this new production method is safer for employees than the older method.

.....

.....

..... **[2]**

Many candidates understood that the virus was contained. However, many repeated the question and stated the virus was in a sealed container. This is in the stem of the question and so did not gain any marks. Many used bacteria and virus interchangeably. If it was clear what they meant and they gave a mark point, then they would gain the mark. However, it is important that they read the question and use scientific terminology correctly as this sort of error could lead to losing marks.

Question 6 (e)

(e) Give **three** examples, other than vaccine and pharmaceutical production, of laboratory work where aseptic technique is required.

1 .....

2 .....

3 .....

[3]

Most were able to gain 1 or 2 marks. Several gave the same response twice, e.g. cell culture and tissue culture, and this would only gain 1 mark. Many discussed being clean and so showed they did not understand aseptic techniques. They suggested food preparation for example. It is important that candidates know when techniques from the specification should be used.

Copyright information

Question 2(b) HPLC chromatogram, Adapted from 'Isocratic separation of the Digoxin and Digitoxin series of Glycosides', www.knauer.net, KNAUER GmbH, https://www.knauer.net/Application/application_notes/short_apps/vph0019j_short_application.pdf

Question 4(a) image, doctor performing ultrasound, Shutterstock Credit: Gorodenkoff

Question 4(b) image baby ultrasound, Baby Ultrasound scan. www.upload.wikimedia.org, Wikimedia - free to use, Creative Commons

Question 6(a) image injecting eggs, iStock Credit: dra_schwartz

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