CAMBRIDGE TECHNICALS

OCR
Oxford Cambridge and RSA

Examiners' report

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

APPLIED SCIENCE

OCR Level 3 Cambridge Technical in Applied Science

Certificate: 05879

Extended Certificate: 05847

Foundation Diploma: 05848

Diploma: 05849

Extended Diploma: 05874

Unit 2 Summer 2025 series

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.

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Unit 2 series overview

This combined science paper is quite different in style from that which most candidates will be used to. 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 seem 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 those from previous exam series 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 health and safety, although many did not understand the difference between a hazard and a risk. They had good knowledge of standard procedures for dealing with biological waste. They found describing calibration of a pipette difficult. Many were able to interpret chromatograms. Most candidates struggled with explaining how instrumentation works, the principles behind them and the advantages of using specific instruments. They were able to choose basic laboratory glassware for a particular purpose. They struggled with mole calculations, but they had good knowledge of microscopy. They had good knowledge of standard procedures when using agar plates to grow cultures but sometimes did not gain marks as they did not answer in the context of the question.

Occasionally, their lack of good scientific terminology prevented them answering questions to the required standard. This was especially seen when describing scientific principles and procedures, for example when interpreting a mass spectrum and describing calibration techniques. For most questions there is an improvement in candidates answering in terms of the context of the question and this did impact positively 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 and the scientific principles behind the technique. 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 practised exam technique ensuring they read the question carefully and followed instructions • could interpret chromatograms, spectra and graphs **[Q2 (b), 2 (d), 3 (b) (ii) and 3 (c) (ii)]** • had experience of calibration techniques **[Q1 (a) and 3 (b) (i)]** • were able to calculate concentrations **[Q3 (c) (iii)]**. They were confident in using given equations, choosing and substituting numbers correctly **[3 (a)]** • had experience of microscope techniques **[Q4]** and so could successfully calculate magnification • responded appropriately to the context of the question **[Q5 (b) and 6 (b) (iii)]** • used accurate and precise science terminology **[Q1 (a), 1 (c), 2 (c) (i), 2 (c) (ii), 2 (d) (i), 5 (a) (i), 5 (b) and 6 (b) (iii)].**	• showed poor exam technique by not attempting all questions and not answering questions in the context they are set • struggled to correctly interpret chromatograms, spectra and graphs **[Q2 (b), 2 (d), 3 (b) (ii) and 3 (c) (ii)]** • did not seem to understand a range of skills and knowledge as outlined in the specification **[Q1 (a) and 3 (b) (i)]** • struggled with calculations even where scaffolding was provided and did not show logical working. **[Q3 (c)]** • were unable to describe or explain how microscopes are used **[Q4]** • gave responses based on basic knowledge rather than responding to the context of the question **[Q5 (b) and 6 (b) (iii)]** • struggled to demonstrate the knowledge and skills required to respond effectively to the questions, failing to use accurate and precise terminology **[Q1 (a), 1 (c), 2 (c) (i), 2 (c) (ii), 2 (d) (i), 5 (a) (i), 5 (b) and 6 (b) (iii)].**

Question 1 (a)

1 A chemistry technician plans to carry out an annual check on a range of laboratory glassware.

(a) The technician starts by checking the calibration of a 25.0 cm^3 pipette.

Complete the following sentences to outline the steps involved in the procedure.

Use the pipette to measure 25.0 cm^3 of ....

Put a small beaker on a .... and press the tare button.

Run the .... from the pipette into the beaker and note the reading

on the ....

If the pipette is correctly calibrated the reading should be ....
[3]

This is a standard operating procedure, and so candidates should be familiar with this. Many did not gain marks because they were imprecise with their language, e.g. using liquid rather than water or 'scale' rather than 'scales'. 'Scale' was not accepted as it is unclear whether they mean a weighing scale or another sort of scale such as a pH scale. Use of correct scientific terminology will help candidates gain marks.

Question 1 (b) (i)

(b) After checking the calibration of the pipette, the technician uses the equipment to complete a range of acid-base titrations.

Before starting the experimental work for the titrations, the technician completes a risk assessment.

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

....

....

.... **[2]**

Although some candidates gained 2 marks here, for those that didn't was often because their answers were too vague. Many responses used one word to define the other, e.g. 'a hazard causes a risk' and this would not have been credited. Others confused the two. Some responses gave examples and this was also not given marks without the definitions.

Assessment for learning

It would be useful to spend time on the difference between hazard and risks as these are often confused.

Expected definitions are:

Hazard: something that can cause harm

Risk: type of harm possible due to or caused by a hazard OR the chance of a person being harmed by the hazard

Question 1 (b) (ii)

(ii) Identify **two** hazards associated with completing an acid-base titration.

1 ....

2 ....

[2]

Many candidates gave risks rather than hazards. The expected responses were broken glass and chemicals. Many stated cuts or burns. These are risks. In some cases, they stated examples such as 'you can get burns from the chemicals' but as it was not clear whether they understood the chemical was the hazard they could not score.

Question 1 (b) (iii)

(iii) Suggest **two** control measures to minimise the hazards given in **(ii)**.

1 ....

....

2 ....

....

[2]

Many candidates gave generic lab safety which did not respond to the question. Keeping the glassware in the centre of the table did not score as it is not necessarily safe to work leaning over the centre of the desk. Ideas about securely clamping glassware were rarely seen. Most scored one mark for safety glasses. Be aware that 'glasses' alone would not score.

Question 1 (c)

(c) The technician works in a laboratory which produces hazardous biological and chemical waste.

Describe the standard procedures for dealing with and disposing of hazardous biological **and** chemical wastes.

Refer to **specific** examples of waste in your answer.

....

....

....

....

....

.... **[6]**

Most candidates were able to access marks in this question. They needed to describe procedures for both dealing with and disposing of hazardous wastes. They needed to do this for both biological and hazardous wastes. They also needed to give examples of each type of waste. Many had good basic knowledge about lab safety. Those that did less well did not score the marks because they were very generic and did not respond to the question set. Good responses gave specific examples of each and then described the procedures for both.

Exemplar 1

An example of ~~a~~ ~~biological hazard~~ hazardous biological waste would be bacteria cultures on an agar plate. To dispose of these you'd put the ~~dish in~~ plate into an autoclave running at 121°C for 15 minutes. You'd then take the plate out and ~~wash~~ throw it into a biological waste bin.

An example of ~~a~~ hazardous chemical waste would ~~a~~ ~~beaker~~ conical flask filled with hydrochloric acid. You'd pour out the acid into a sink then place the conical flask ~~into an autoclave for 15 minutes at 121°C. You'd then~~ ~~under~~ under a ~~tap~~ tap and wash it out with distilled or filtered water. You'd then let it dry or throw it into a sharps objects bin.

[6]

Exemplar 1 gains Level 3 - 5 marks. The response has a good description for dealing with and disposing of a named biological waste, (bacterial cultures) - this would get top of Level 2. They have mentioned a named chemical waste (hydrochloric acid) but only given basic methods to deal with dilute acid, so they just get into Level 3. The statements about throwing the flask in the sharps bin was ignored. They could have improved their mark by giving a specific method of dealing or disposing of the acid.

Exemplar 2

- one procedure for dealing with and disposing of hazardous biological and chemical waste is staff must Dispose of the waste in the right bins such as a Sharps bin and the technician should also wear full ppe when handling hazardous waste such as gloves, face masks and eye masks to keep the technician safe. The technician should also use Aseptic techniques when handling hazardous biological and chemical waste such as autoclaving, filtering if needed this is to ensure the technician does not get contaminated and possibly pass it to another individual. If the chemical is flammable like ethanol then disposing [6] correctly is important or storing away for example in a flammables cuboard, to depict the rise of a fire.

Exemplar 2 gains Level 2- 3 marks. The first paragraph is very generic and does not link disposal to specific types of waste. This could have gained some marks at Level 1. The response is confused and it is not clear if the candidate thinks autoclaving is used for chemical waste as well as biological. They have named ethanol and have an idea about storage as it is flammable. This allowed them to access Level 2. If they had also discussed disposal of ethanol they would have been given marks at the top of Level 2.

Question 2 (a)

2 HPLC is a technique used to separate and identify the components in a mixture.

(a) State what the abbreviation HPLC stands for.

....

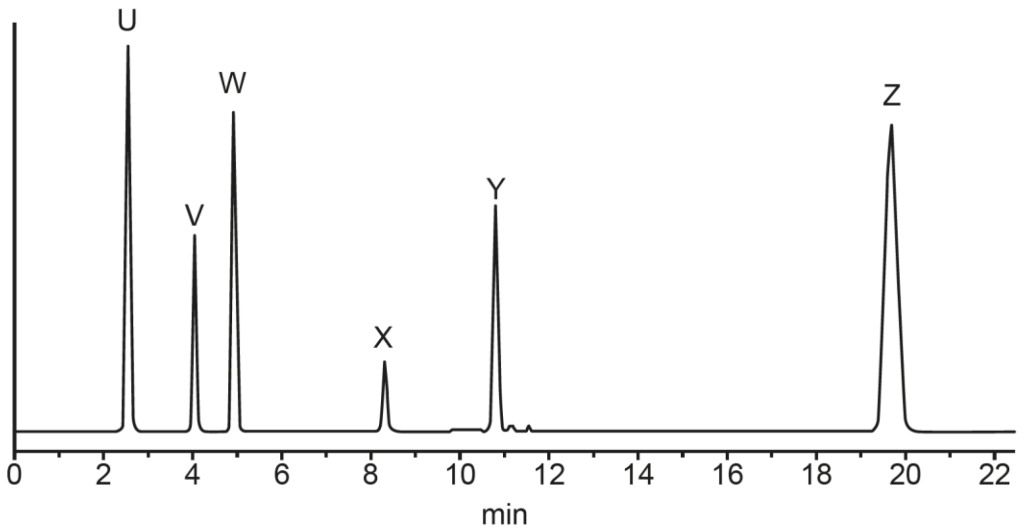
.... **[1]**

This was a high scoring question. Candidates that lost the mark often did so because they did not know what P (performance) stood for. While it is common in science to use abbreviations, it is important to explicitly learn what these abbreviations stand for. This will help candidates understand the process or the instrument and its use.

Question 2 (b) (i), (ii) and (iii)

(b) **Fig. 2.1** shows the HPLC chromatogram of a health supplement containing some unknown vitamins.

Fig. 2.1



(i) Estimate the retention time of vitamin W.

.... **[1]**

(ii) Estimate which vitamin is present in the lowest amount.

Put a ring around the correct answer.

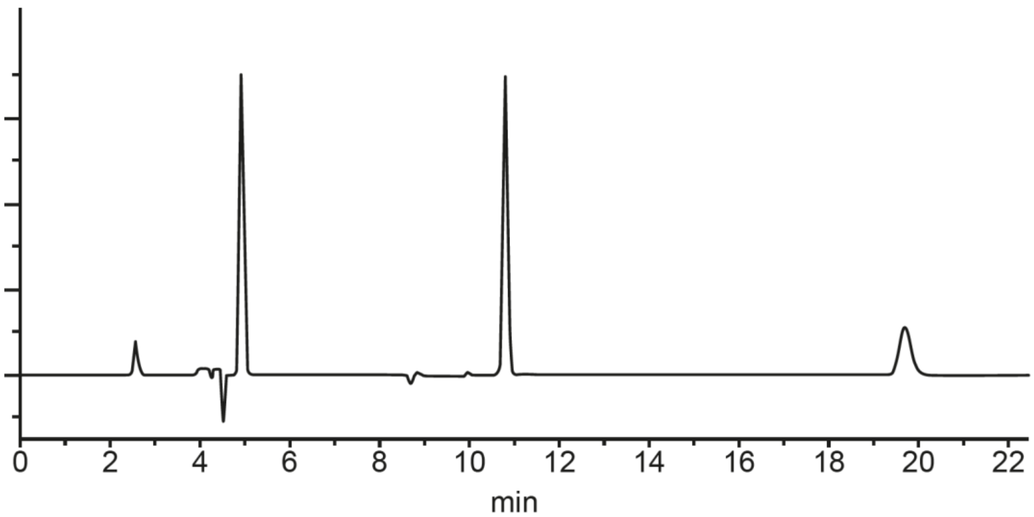
U **V** **W** **X** **Y** **Z**

[1]

(iii) Some vitamins are water-soluble and some are fat-soluble.

Fig. 2.2 shows the HPLC chromatogram for a mixture containing the four fat-soluble vitamins in the health supplement.

Fig. 2.2



Use **Figs. 2.1** and **2.2** to identify which vitamins in the health supplement are fat-soluble and which are water-soluble.

Fat-soluble ....

....

Water-soluble ....

....

[2]

Candidates were able to interpret this chromatogram correctly. Some candidates tried to explain why the vitamins were fat soluble or not. This was not required by the question and so was ignored, even if the explanation was incorrect, and full marks were still given for correct identification.

Question 2 (c) (i)

(c) A mass spectrometer is often linked to an HPLC instrument.

(i) Describe **two** advantages of linking an HPLC instrument to a mass spectrometer.

1 ....

....

2 ....

....

[2]

Candidates often discussed accuracy, speed or ease of use. These were not creditworthy responses. Few candidates understood why a mass spectrometer is used. This is an applied paper and it is important that the instruments and the techniques specified are understood. If possible centres should give candidates access to the relevant instrumentation. Where this is not possible videos or demonstrations should be used.

Question 2 (c) (ii)

(ii) Mass spectrometry involves five stages.

Name the stages by completing the table below. The stages must be in the correct order from 1 to 5.

Stage 2 has been done for you.

Stage	Name
1	
2	fragmentation
3	
4	
5	

[4]

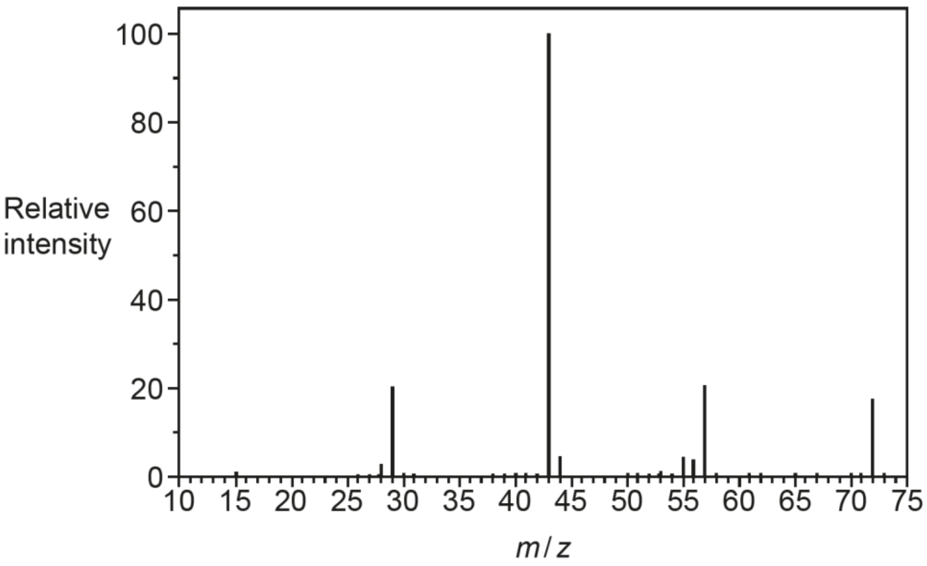
Many candidates scored highly on this question. They showed they understood the principles behind mass spectrometry. Understanding principles behind instruments used is a key skill for this paper.

Question 2 (d) (i)

(d) A mixture of hydrocarbons is separated by HPLC and each component is then analysed using mass spectrometry.

One of the components is pentane, $CH_3CH_2CH_2CH_2CH_3$.

The mass spectrum of pentane is shown below.



(i) How does the spectrum confirm that pentane has a molecular formula C_5H_{12}?

(Relative atomic masses: H = 1, C = 12)

....

....

.... **[2]**

Most candidates attempted this question. Many did not gain marks because they were not precise enough in their language. They recognised that pentane has a molar mass of 72 and many showed this by a calculation. This gained the second mark. However, even though they recognised that there was a peak at 72 they were not clear that it was the highest peak. 'Last peak' also showed this understanding so although not as well written was still credited. Some just circled the 72 on the spectrum but this did not show enough understanding and was not credited.

Assessment for learning

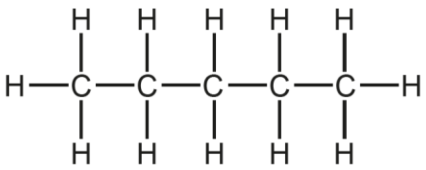
It is useful to spend time practising interpreting the range of spectra and chromatograms in the specification. Candidates should also be able to explain their interpretation.

Possible useful resources:
https://edu.rsc.org/resources/introduction-to-mass-spectrometry/943.article

https://edu.rsc.org/lesson-plans/determining-the-structure-of-compounds-16-18-years/130.article

Question 2 (d) (ii)

(ii) The displayed formula of pentane is



During fragmentation, the C – C bonds in pentane are broken at different points along the chain.

Identify the fragment ions that give rise to the following peaks in the mass spectrum.

m/*z* 57 is ....

m/*z* 43 is ....

[2]

Many candidates struggled with this question. Although most attempted it many of those tried to name the ions or gave unrelated numbers. Those that understood they had to write the formula often struggled to do so correctly. This again shows the importance of understanding the principles behind the techniques used.

Question 3 (a) (i) and (ii)

3 A group of students is finding out about titration curves.

You will need to use the following equations in your answers to the numerical questions.

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

(a) A laboratory technician plans to prepare 250 cm^3 of 0.0500 mol dm^{-3} potassium hydroxide, KOH (aq).

The molar mass of KOH is 56.1 g mol^{-1}.

(i) Calculate the number of moles of KOH required to make a final volume of 250 cm^3 of a 0.0500 mol dm^{-3} standard solution.

Number of moles = ... mol **[1]**

(ii) Calculate the mass of KOH needed to give this number of moles.

Mass = ... g **[1]**

Candidates tended to do well on Questions 3 (a) (i) and 3 (a) (ii). They were able to use the equations given and gain both these marks. Candidates should practice substituting into equations and rearranging equations. These are standard skills that are regularly tested.

Question 3 (a) (iii)

(iii) Name the piece of laboratory equipment that would be most suitable to make the standard solution up to 250 cm^3.

Put a ring around the correct name.

beaker **burette** **measuring cylinder** **pipette** **volumetric flask**

[1]

Measuring cylinder was a common wrong answer here. Making a standard solution is a standard operating procedure so candidates should be familiar with the techniques and equipment used.

Question 3 (b) (i)

(b) The students investigate how the pH changes when they add a strong base such as potassium hydroxide to a strong acid such as hydrochloric acid.

The students use a pH meter to measure the pH.

(i) A pH meter must be calibrated before use.

State the name of the type of solution used to calibrate a pH meter.

.... **[1]**

It is important that candidates read the question carefully. This question asks for the 'type' of solution not the 'name' of the solution. So *buffer* is the only correct answer. Many suggested solutions of specific pH, so understood what the technique required but did not answer the question posed.

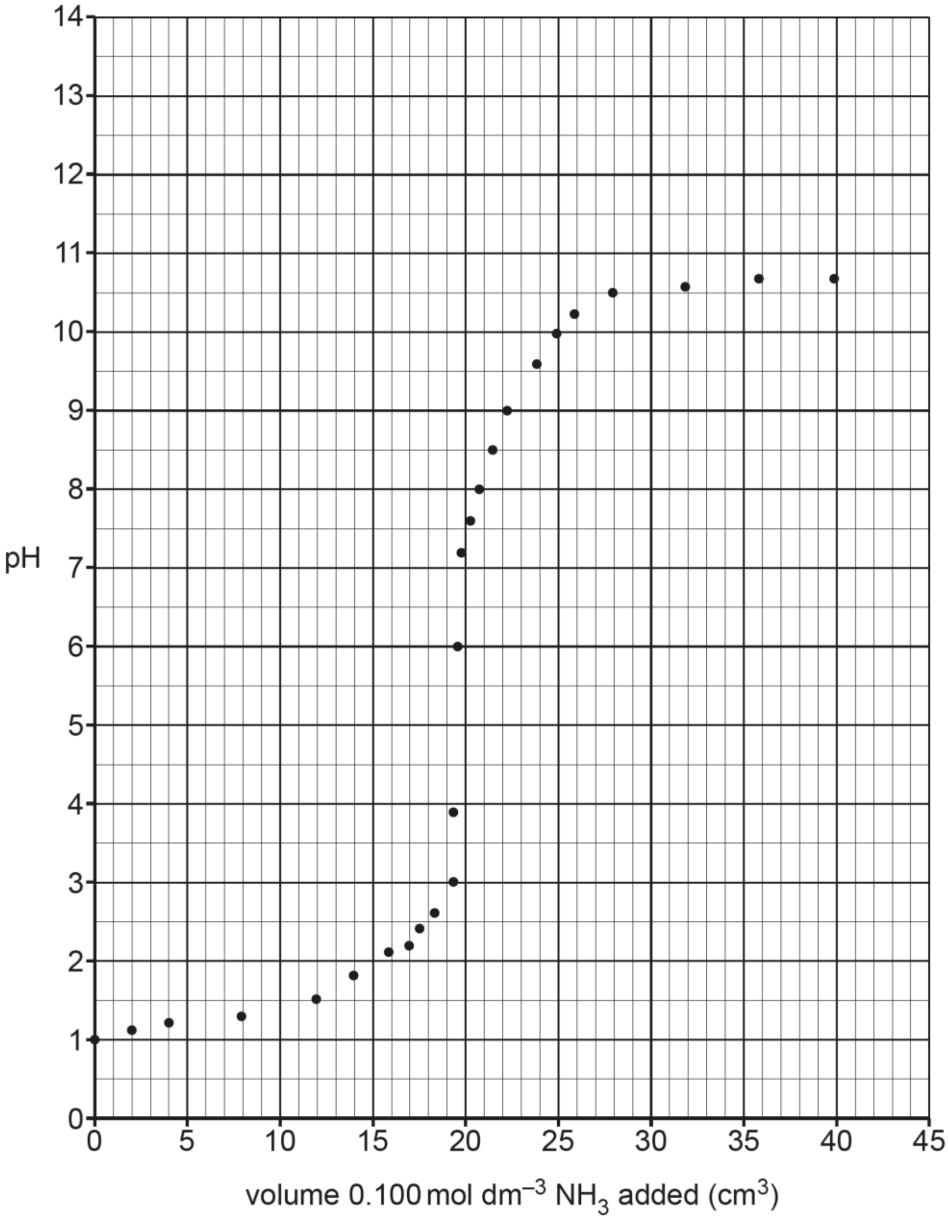
Question 3 (c) (i), (ii) and (iii)

(c) The students then investigate how the pH changes when they add a weak base such as aqueous ammonia to a strong acid such as hydrochloric acid.

They gradually add 0.100 mol dm^{-3} aqueous ammonia, $NH_3(aq)$ to 25.0 cm^3 hydrochloric acid, $HCl(aq)$, and measure the pH after each addition of base.

They then plot a graph of pH against volume of 0.100 mol dm^{-3} ammonia solution added.

Their graph is shown below.



(i) Draw a curve through the points. **[1]**

(ii) Use the graph to estimate

- the pH range of the vertical portion of the graph,

....

- the volume of 0.100 mol dm^{-3} NH_3(aq) required to reach the equivalence point.

....
[2]

(iii) Use the volume of 0.100 mol dm^{-3} NH_3(aq) required to reach the equivalence point to calculate the concentration of the HC*l*(aq).

The equation for the reaction between HC*l* and NH_3 is

$HCl(aq) + NH_3\,(aq) \rightarrow NH_4Cl(aq)$

Concentration of HC*l*(aq) = ... mol dm^{-3} **[3]**

Question 3 (c) (iii) involved a calculation to determine concentration. They had to use the data extracted in Q3 (c) (ii) from the graph completed as part of Q3(c) (i). There was no equation given and many candidates struggled because of this. Some candidates used 25cm^3 rather than their response to Q3(c) (ii). Concentration calculations are often present on this paper, so it is worth practising those from past papers as part of their revision.

Question 3 (c) (iv)

(iv) The pH range of an indicator is the range of pH values over which the indicator changes colour. Different indicators change colour at different pH values.

The table shows the pH range of three indicators.

Indicator	pH range
Bromothymol blue	6.0 – 7.6
Methyl orange	3.1 – 4.4
Phenolphthalein	8.3 – 10.0

State which indicator is suitable for the titration between $HCl(aq)$ and $NH_3(aq)$.

Explain your answer.

Indicator: ....

Explanation: ....

....
[2]

Most candidates were able to draw a smooth curve for Q3 (c) (i), but some did not draw the curve through most of the plots and others used a ruler which is inappropriate. Many were able to use their graph to answer 3 (b) (ii). In some cases, candidates gave the size of the pH range (4) rather than the actual range (3-7) and this was not credited. For 3 (c) (iv) candidates could state the correct indicator but struggled to explain why. Common, vague, answers, such as 'it is in the pH range' did not gain the mark. The response needed to be clear that the pH range must be within the vertical portion of the pH curve or the equivalence point is in the pH range of the indicator.

Assessment for learning

The specification states candidates should be able to recognise and describe the shape of titration curves for the combinations:

- strong acid/strong base
- strong acid/weak base
- weak acid/strong base

Candidates must also understand that a suitable indicator for a titration should change colour around the equivalence point of the titration and be able to use a pH curve to determine the most suitable indicator.

Plotting graphs and drawing appropriate lines of best fit is a key skill and it is useful for candidates to have practised this.

They needed to use the information from the graph as well as from the table to answer Q3 (c) (iv).

There were 6 marks on the above part of the specification [Q3 (b) (ii), 3 (c) (i), 3 (c) (ii) and 3 (c) (iv)] and they all involved drawing or interpreting graphs. There are often several marks on this paper for drawing or interpreting graphs and so these are skills it is worth spending time on in the classroom using a range of contexts.

Question 4 (a) (i)

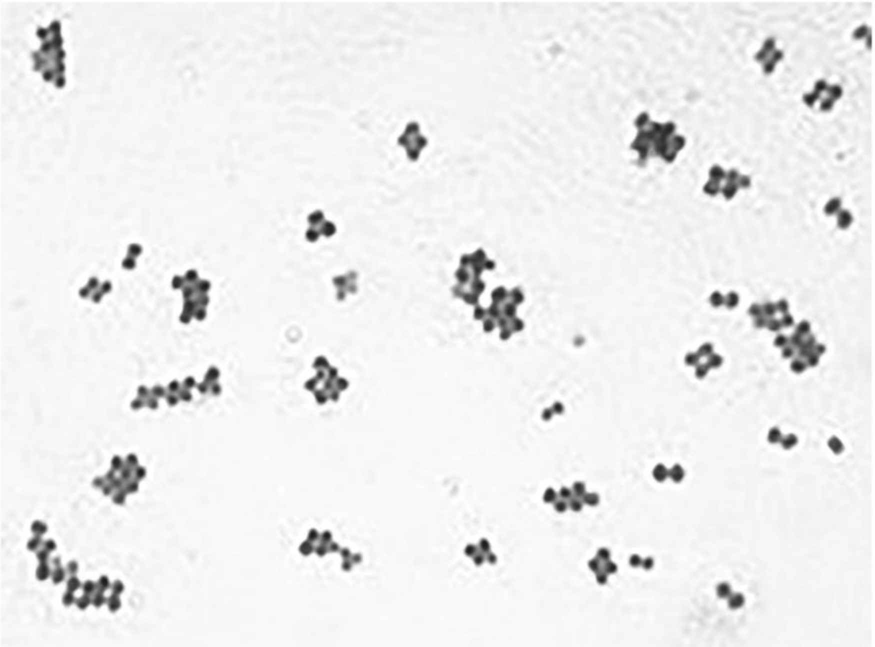
4

(a) A student is investigating different types of microscope.

The student uses a light microscope to study biological specimens.

Fig. 4.1 shows what the student observes through the eyepiece of the light microscope.

Fig. 4.1



(i) The image was viewed through a 10× eyepiece lens and a 100× objective lens.

Calculate the overall magnification of the microscope.

Magnification .... × **[1]**

Most candidates did well here. It is worth encouraging them to check their final answer as some responses showed correct working but not correct answers.

Question 4 (a) (ii)

(ii) Explain the difference between the magnification and the resolution of light microscopes.

Magnification ....

....

Resolution ....

.... **[2]**

Many candidates used very vague wording here. The specification demands that they know the difference. Responses for magnification such as 'how big it looks' or 'how zoomed in it is' did not gain the mark. Responses for resolution such as 'how blurry/clear it is' were also too vague. Precise language is needed when defining or differentiating between terms.

Question 4 (a) (iii)

(iii) State what limits the resolution of a light microscope.

....

....

....

.... **[2]**

Very few candidates understood that wavelength of visible light was the limiting factor. This shows they do not understand the principles behind light microscopy.

Question 4 a (iv)

(iv) Put a ring around the best estimate of the resolution of light microscopy using both a 10× eyepiece lens and a 100× objective lens.

2nm **20nm** **200nm** **2000nm**

[1]

This was very well answered. 2000nm was a common incorrect response.

Question 4 (a) (v)

(v) Name the **two** pieces of equipment needed to measure the length of specimens when viewed using a light microscope.

1 ....

2 ....
[2]

Candidates are clearly familiar with using microscopes and many got both marks here. It is important to understand that regular use of an instrument or technique will help candidates answer questions about those instruments and techniques.

Question 4 (a) (vi)

(vi) The student identifies the type of biological specimen viewed using the light microscope.

Tick (✓) **one** box to confirm the identity of the biological specimen seen.

cells ☐

organelles ☐

tissues ☐

[1]

This was generally scored by candidates. Tissues was a common incorrect answer.

Question 4 (a) (vii)

(vii) Give **one** advantage of using a light microscope to view biological specimens.

.... **[1]**

Being able to see living samples/processes was a common correct answer. Candidates are familiar with using light microscopy and so did well on the questions testing that in general.

Question 4 (b) (i)

(b) The Rabies virus is far too small to be seen using a light microscope.

(i) Name **one** piece of equipment that could be used to observe the Rabies virus.

.... **[1]**

Most candidates recognised that an electron microscope should be used. They should take care to be precise and spell correctly as electric microscope was seen regularly and would not score.

Question 4 (b) (ii)

Fig. 4.2 shows an image of Rabies viruses.

Fig. 4.2

Electron micrograph of rabies virus
© veteriankey.com, Veterian Key.
Item removed due to third party copyright restrictions.

(ii) Measure the width of a Rabies virus along the line labelled **AB** using the ruler on **Fig. 4.2**.

Give your answer in mm.

Width of Rabies virus .... mm **[1]**

The question asks for the answer in millimetres. So, candidates that gave an answer in centimetres did not score. It is important to read the question carefully. Ticking off each instruction is good exam technique.

Question 4 (b) (iii)

(iii) The actual width of a Rabies virus is 62.5 nm.

Calculate the magnification of the image.

Magnification = ... **[3]**

Many candidates either did not carry out the conversion or converted incorrectly. A good answer converted the width of the virus first and then used that to calculate the magnification.

Assessment for learning

A correct answer on the answer line was given all three marks. However, if the answer on the answer line was incorrect the examiner had to check the working. So, it is important for all working to be shown and to be logical. Many calculations on this paper involve converting whether it is a concentration for a titration or a magnification, etc, and this is often worth a mark even if nothing else is shown. Spending time with candidates on when and how to convert is essential. Using double number lines can be a useful tool when practising this skill.

Question 5 (a) (i)

5

(a) Flame tests are used to identify which cation is present in a sample.

(i) Describe how to perform a flame test.

....

....

....

.... **[3]**

Candidates are clearly familiar with flame tests. Some candidates did not gain marks because they were not precise in how the test is carried out. A clean nichrome wire should be used as should a blue flame. It is recognised that not all candidates have used a nichrome wire. Many have clearly used a wooden splint. This is acceptable and will gain marks, however, it must be clear that the splint is not contaminated for full marks. An inoculating loop is not correct but was seen on several scripts. As the question asks how the test is performed there is no need to describe seeing a colour or giving the colours seen. This was ignored.

Question 5 (a) (ii)

(ii) State the colour of the flame given by these cations.

Barium Ba^{2+} ....

Lithium Li^{+} ....

[2]

Candidates did well on this question. The colours on the mark scheme are the only colours acceptable. Many suggested orange-red for lithium. This did not gain the mark. Nor did blue-green for barium.

Question 5 (b)

(b) Aqueous sodium hydroxide is used as a chemical test to identify cations in ionic compounds.

A student has two crystalline solids in different containers, but they are not labelled.

The student is told that one of the solids is iron(II) sulfate and the other is aluminium sulfate. Both compounds are soluble in water.

Describe how the student would use sodium hydroxide solution to positively identify which solid is iron(II) sulfate and which is aluminium sulfate.

You should outline the method the student would use and describe what would be observed for iron(II) sulfate and for aluminium sulfate.

Method ....

....

....

....

Observations ....

....

....

....

[4]

Candidates should be familiar with the chemical tests for cations. It was clear that many candidates did not read all the information in the question as most did not dissolve the solids before testing with sodium hydroxide. To gain marks for the observations the answer should show that they have added sodium hydroxide even if they have not stated that precipitates have formed and so not gained the method marks. As the precipitates for the two ions are different colours it was sufficient to state these for the observation marks as they knew the ions were either iron or aluminium. Some candidates did not attempt this question and it is possible they have not carried out these tests. Access to as much practical work as possible is key for this applied qualification.

Question 5 (c)

(c) The student is asked to identify a white powder labelled Compound **X**.

When tested using a flame test the student observes a violet flame.

The student dissolves the sample in water and adds a few drops of dilute hydrochloric acid followed by a few drops of aqueous barium chloride.

The student observes that a white precipitate is formed.

Use the student's results to identify Compound **X**.

.... **[2]**

Most candidates recognise that potassium burn with a violet flame and so gained at least one mark. Less were familiar with the test for sulfate and bromide as a common incorrect response.

Question 5 (d) (i)

(d) Emission spectroscopy is an important technique for analysing substances.

(i) Give **two** advantages of using emission spectroscopy compared to flame tests and chemical tests.

1 ....

....

2 ....

....

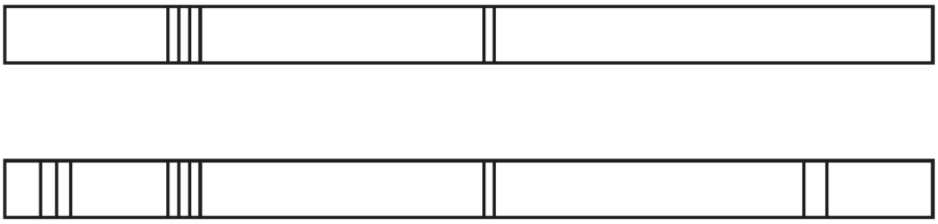
[2]

As with the question on mass spectrometry candidates often discussed accuracy, speed or ease of use. These were not creditworthy responses. Few candidates understood why emission spectroscopy is used. This is an applied paper and again it is important that the instruments and the techniques specified in the specification are understood. If possible, centres should give candidates access to the relevant instrumentation. Where this is not possible videos or demonstrations should be used.

Question 5 (d) (ii)

(ii) A geologist uses emission spectroscopy to determine whether copper is present in a rock sample.

The geologist compares the spectrum of copper(II) sulfate with the spectrum of the rock sample.



What can the geologist conclude about the rock sample?

Explain your answer.

....

....

.... **[2]**

Most candidates recognised that there were similar lines in copper (II) sulfate and the rock sample spectra. To gain the second mark candidates needed to recognise that there must be another metal or substance in the rock sample due to the extra lines. Where candidates scored, they usually scored one only. for the first mark point.

Question 6 (a) (i)

6 Micro-organisms can grow in diesel fuel which has been stored for a long time.

This contaminated diesel fuel can cause damage to engines.

This microbial contamination is called "diesel bug" but it is not caused by a single micro-organism.

A team of scientists are investigating the micro-organisms that cause diesel bug.

(a) The scientists grow micro-organisms from a sample of contaminated diesel fuel on an agar plate.

Fig. 6.1 shows the appearance of the agar plate after a 12 hour incubation period at 30 °C.

Fig. 6.1

Agar plate © fueltest.com.au, Fuel Test Australia.
Item removed due to third party copyright restrictions.

(i) Suggest the minimum number of different types of micro-organism growing in the contaminated diesel fuel.

.... **[1]**

Candidates did well here. 2 was a common incorrect answer, possibly because they could see two colours, black and white...

Question 6 (a) (ii)

(ii) Explain why this is the minimum number.

....

.... **[2]**

Common correct answers were 'too small to see' or 'not grown yet'. Very few candidates gave two points.

Misconception

Many candidates misunderstood this question and thought it was the minimum number that they could count.

It is important for candidates to use good exam technique and understand that for most questions (excluding Level of Response questions) they should write a point for each mark available on the question.

Question 6 (b) (i) and (ii)

(b) The scientists decide to study the different types of micro-organisms in isolation.

To do this they select an individual colony from the plate and streak it onto another agar plate.

Fig. 6.2 shows the appearance of this second agar plate after it was incubated under the same conditions.

Fig. 6.2

(i) Draw a label line and add the word "started" on **Fig. 6.2** to show where the streaking process was started. **[1]**

(ii) Draw a second label line and add the word "ended" on **Fig. 6.2** to show where the streaking process ended. **[1]**

Many candidates gained both these marks in Questions 6(b) (i) and 6(b) (ii). They are familiar with streaking techniques. Those that did not get the marks usually had a line pointing to close to the centre of the agar plate.

Question 6 (b) (iii)

(iii) Describe a procedure used to streak a single colony onto the plate, resulting in the appearance of the agar plate shown in **Fig. 6.2**.

....

....

....

....

....

....

.... **[5]**

Candidates are very familiar with aseptic techniques and most picked up some marks here. Using a nichrome wire instead of an inoculating loop is incorrect.

Misconception

Most candidates did not realise they had to describe a procedure to streak a single colony that had been selected from the first plate. Instead, they described using a sample from a broth culture. They did not respond to the context of the question and so did not gain full marks. As this is an applied paper many questions will be set in an applied context, and it is important that candidates respond to that context.

Question 6 (c) (i)

(c)
(i) The agar plates must be disposed of using the correct protocol when the investigations are completed.

Describe the correct protocol to dispose of the agar plates.

....

....

....

.... **[3]**

Candidates did well on this question and are obviously familiar with the protocol. They need to be specific in the response so answers stating 'put in a bag' did not gain the first marking point as it must be an autoclave bag. Many did not suggest it is disposed of in general waste, instead suggesting a sharps bin which did not gain credit. Some responses were very vague and suggested a 'specialised' bin, but this was not enough for the mark.

Question 6 (c) (ii)

(ii) Suggest **one** piece of personal protective equipment (PPE) to be used by the scientists when disposing of the agar plates.

.... **[1]**

Nearly all candidates scored here.

Question 6 (d) (i)

(d) The scientists work for a company that makes test kits for diesel bug.

(i) Explain why sterile conditions are required when the test strips are being manufactured.

....

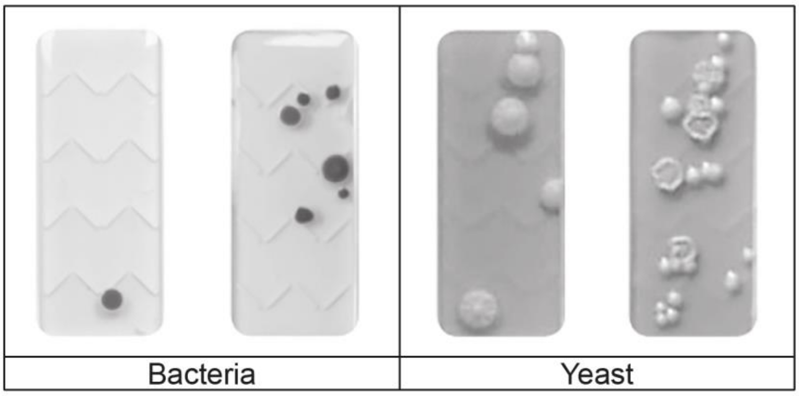
.... **[1]**

Most candidates scored here for understanding that the company wants to prevent contamination or false positives.

Question 6 (d) (ii)

(ii) **Fig. 6.3** is an image of a test kit showing positive results for the presence of bacteria and yeast from a sample of diesel.

Fig. 6.3

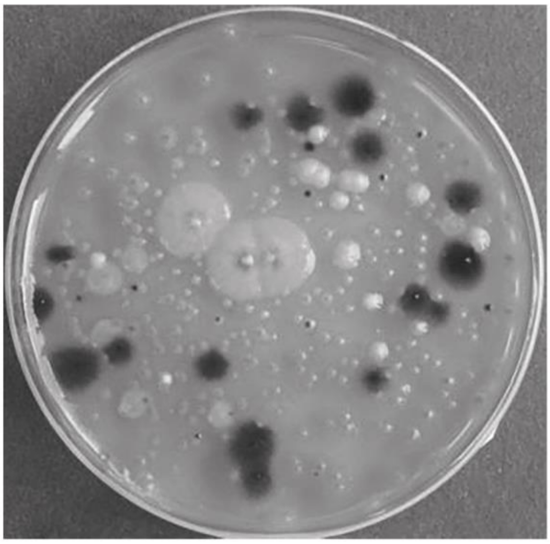


Use the test kit image shown in **Fig. 6.3** to identify and label **one** colony of bacteria and **one** colony of yeast on **Fig. 6.1**.

Fig. 6.1 is repeated below.

Draw **one** line from each label to **one** colony.

Fig. 6.1



colony of bacteria

colony of yeast

[2]

Most candidates scored here.

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