1. Some people have warts on their skin.

Warts can be removed by treating them with a corrosive solution of acids.

The acids in the medicine are weak acids.

Weak acids are safer to use on skin than strong acids because they are less corrosive.

(i) Which statements about weak and strong acids are **true** and which are **false**?
Put a tick (✓) in one box in each row.

	True (✓)	False (✓)
Both types of acids form water in neutralisation reactions.		
Weak acids have a slower rate of reaction with magnesium.		
Strong acids have a lower degree of ionisation than weak acids.		

[3]

(ii) Ellen uses the hydrogen ion concentration to estimate the pH values of acids.

Estimate the pH of 0.001 mol/dm^3 hydrochloric acid.

pH = _____

[2]

2. Rose is a laboratory technician.

She makes up a dilute solution of lime water (calcium hydroxide).

Rose makes 200 cm^3 of 1.50 g/dm^3 solution of calcium hydroxide.

(i) The formula for calcium hydroxide is $Ca(OH)_2$.
Calculate the concentration of the solution in mol/dm^3.

Give your answer to three significant figures.

concentration of solution _____ mol/dm^3 **[3]**

(ii) Lime water is used to remove sulfur dioxide from waste gases produced by industry.

The equation for this reaction is

$$Ca(OH)_2(aq) + SO_2(g) \rightarrow CaSO_3(s) + H_2O(l)$$

Calculate the volume of sulfur dioxide that Rose's lime water could remove.

(Assume that one mole of gas has a volume of 24 dm^3 at room temperature and pressure)

Volume of sulfur dioxide _____ dm^3 **[3]**

3(a). Sam works in a lab that tests samples of vinegar to check their quality.

Vinegar is mainly a mixture of ethanoic acid and water. Vinegar needs to have a minimum of 5% acidity to be used to preserve food.

He uses a titration to find out how much 1 mol/dm^3 sodium hydroxide he needs to add to exactly react with 25.0 cm^3 of vinegar.

Calculate how much ethanoic acid needs to be in 25 cm^3 of vinegar.

Use the equation:

$$\% \text{ acidity} = \frac{\text{mass of ethanoic acid (g)}}{\text{mass of vinegar(g)}} \times 100$$

1 cm^3 of vinegar = 1.01 g

amount of ethanoic _____ g **[2]**

(b). The equation below shows ethanoic acid behaving as an acid.

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

Calculate the minimum volume of sodium hydroxide Sam uses in his titration.

Relative formula mass of CH_3COOH = 60.0

volume of sodium hydroxide _____ cm^3 **[3]**

4(a). A scientist works in a quality control laboratory for a chemical company.

The company makes acids for use in cleaning products.

The scientist tests two acids, **acid A** and **acid B**.

He does a series of titrations for each acid.

He does a rough titration. He then repeats the titration three times taking more care.

These are his results.

Acid	Volume of sodium hydroxide solution used in cm^3				
	Rough	Repeat 1	Repeat 2	Repeat 3	
A	25.0	24.5	24.4	24.6	
B	28.0	27.7	26.1	25.0	

(i) What is the range of volumes of sodium hydroxide used for the **repeats** for each acid?

range for **acid A**: from _____ to _____ cm^3

range for **acid B**: from _____ to _____ cm^3

[2]

(ii) The scientist looks at the ranges to decide whether he needs to do more repeats.

Do you think he needs to do more repeats for **acid A**?

Do you think he needs to do more repeats for **acid B**?

Explain your reasons.

acid A _____

_____

acid B _____

_____

[2]

(b). The scientist tests some samples of another four dilute acids, **C**, **D**, **E** and **F**.

He uses the same volume of dilute acid each time.

He measures the pH and does titrations using sodium hydroxide solution.

He uses the same concentration of sodium hydroxide solution in each titration.

His results are shown in the table below.

Acid	pH	Mean volume of sodium hydroxide solution used in titration (cm^3)
C	5	12.0
D	1	18.5
E	4	25.0
F	1	12.0

The scientist looks at his results.

He wants to know whether each acid is a strong acid or a weak acid.

He wants to compare the concentrations of the acids.

What conclusions can you make from the results about the **strength** and **concentration** of each of the four acids, **C**, **D**, **E** and **F**?

The quality of written communication will be assessed in your answer.

[6]

5(a). Emma analyses an indigestion tablet to find the mass of magnesium hydroxide.

(i) Work out the relative formula mass (RFM) of magnesium hydroxide, $Mg(OH)_2$.

Show your working.

(Relative atomic masses: H = 1; Mg = 24; O = 16)

RFM of magnesium hydroxide = _____ **[1]**

(ii) Emma uses hydrochloric acid with 73.0 g of hydrogen chloride in each 1.0 dm^3 of the acid solution.

It takes 15.1 cm^3 of this hydrochloric acid to neutralise the tablet.

Work out the mass of hydrogen chloride in 15.1 cm^3 of the hydrochloric acid.

Give your answer to the nearest 0.1 g.

Show your working.

mass of hydrogen chloride = _____ g **[2]**

(iii) Work out the mass of magnesium hydroxide in the tablet.

Use your answers to **(i)** and **(ii)** and this equation to help you.

$$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$$

Show your working.

mass of magnesium hydroxide in the tablet = _____ g **[2]**

(b). Emma works for a company making indigestion tablets.

Her job is to find the mass of magnesium hydroxide in tablets from each batch.

Emma titrates the magnesium hydroxide in each tablet with hydrochloric acid.

$$\underset{\text{magnesium hydroxide}}{Mg(OH)_2} + \underset{\text{hydrochloric acid}}{2HCl} \rightarrow \underset{\text{magnesium chloride}}{MgCl_2} + \underset{\text{water}}{2H_2O}$$

Emma analyses six tablets from each batch.

The table shows Emma's results for four batches of tablets.

	Mass of magnesium hydroxide in g					
Tablet number	1st	2nd	3rd	4th	5th	6th
Batch A	0.95	0.93	0.95	0.96	0.94	0.93
Batch B	0.88	0.86	0.89	0.87	0.89	0.87
Batch C	1.13	1.16	1.14	1.15	1.13	1.16
Batch D	1.03	1.13	1.05	1.04	1.15	1.03

The label on each pack of indigestion tablets says that each tablet contains 1.0 g of magnesium hydroxide.

The standard set by the company is that each tablet must be within 0.1 g of this figure.

For each batch decide whether it meets the standard and explain your answers.

---

[4]

6. Joe does an experiment to find out the **total mass** of dissolved solid in a sample of water from his local town.

He takes 50 cm^3 of the water and evaporates it to leave a solid.

He stores the solid in a desiccator and finds its mass a few days later.

(i) Why is it important that he uses a desiccator?

Put ticks (✓) in the boxes next to the **two** best answers.

to keep the solid dry	☐
to keep the solid warm	☐
to make sure that the mass reading is accurate	☐
to allow ions in the solid to separate	☐
to neutralise the solid	☐

[2]

(ii) The table shows Joe's results.

Volume of water in cm^3	Total mass of solid in g
50	0.02

Calculate the amount of solid in **1 dm^3** of water. Give your answer in g / dm^3.

(1 dm^3 = 1000 cm^3)

_____ g / dm^3 **[2]**

(iii) Use your answer to work out the number of **milligrams** (mg) of solid in 1 dm^3 of water.

(1 g = 1000 mg)

_____ mg / dm^3 **[1]**

(iv) Joe uses the same technique to analyse a sample of water from London.

He finds that the sample contains 450 mg / dm^3 of dissolved solid.

Joe's research found that London water contains 160 mg / dm^3 of calcium ions.

Why are the two values different?

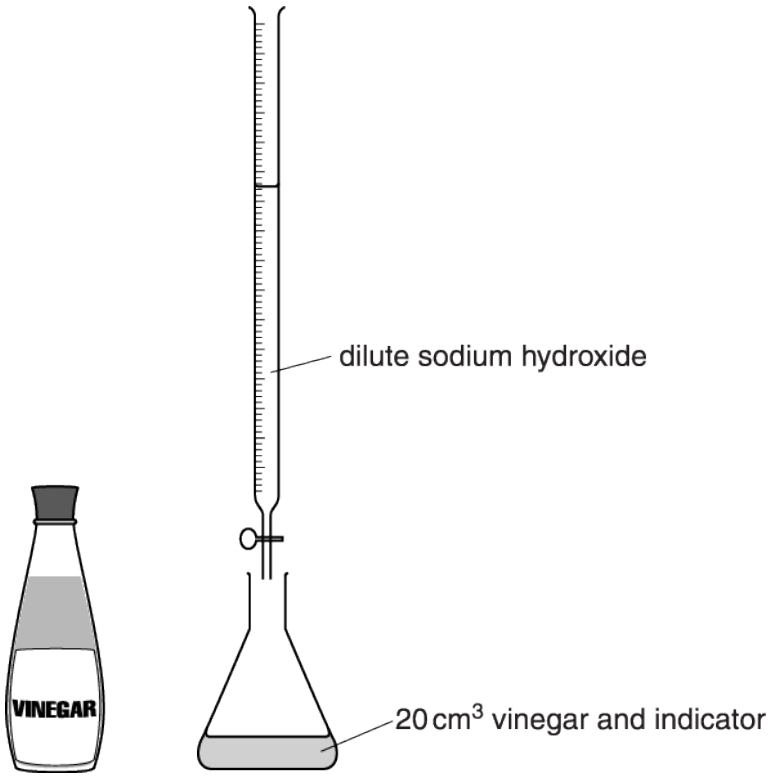
Put a tick (✓) in the box next to the best answer.

Joe overheated the solid so that it decomposed.	☐
The water contained ions other than calcium.	☐
Joe used too small a volume of water in his experiment.	☐
The relative atomic mass of calcium is higher than Joe realised.	☐

[1]

7(a). Some students do titrations to find out the concentration of acid in vinegar.

The diagram shows the equipment they use.



Each student does a first titration then repeats the titration several times.

Each student calculates an average result from their repeats.

The first titration result is **not** used to calculate the average.

Which statement best explains why?

Put a tick (✓) in the box next to the **best** answer.

The first result is usually lower than the others. ☐

The first titration is done without an indicator. ☐

The students do not follow the method carefully the first time. ☐

The first result is used to give a rough idea of the volume needed. ☐

[1]

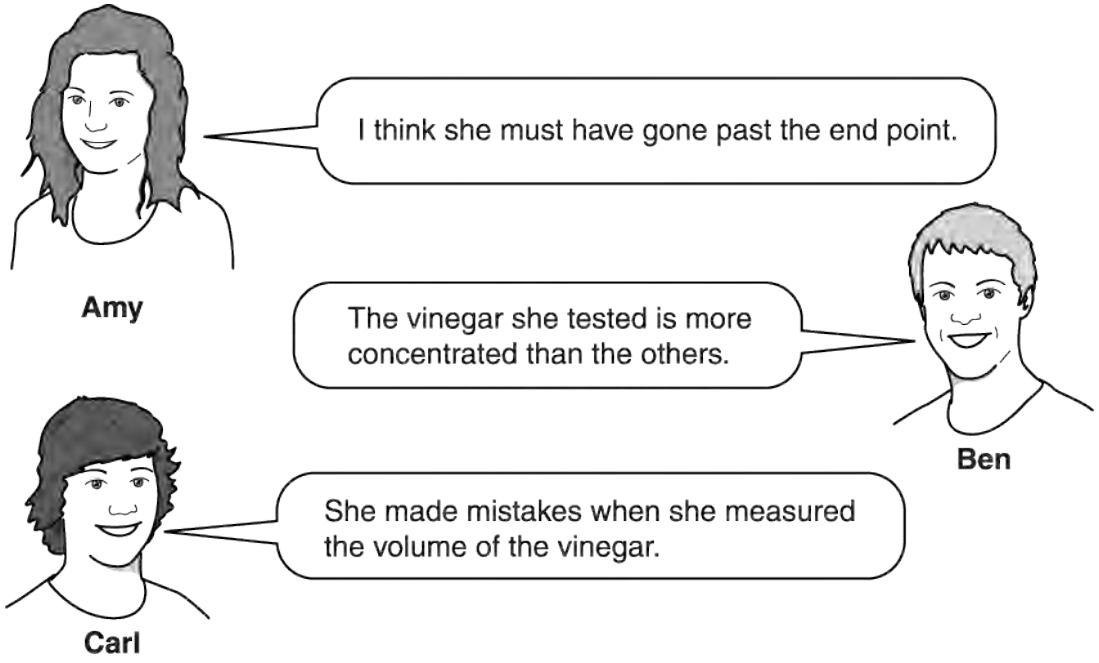
(b). All students test vinegar from the same bottle and use the same concentration of sodium hydroxide.

The students record their average results in a table.

Name of student	Average volume of sodium hydroxide used in cm^3
Amy	23.4
Ben	24.1
Carl	23.8
Dee	18.2

The students notice that Dee's result is very different from the others.

They suggest explanations for this.



Which student has the best explanation for Dee's result?
Explain why you **agree** or **disagree** with the ideas suggested by each student.

Best explanation _____

Reasoning _____

_____

_____

_____

_____

_____ [3]

8(a). James does a titration with an acid and an alkali.

He uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.

Describe and explain how James would carry out a set of titrations to get an accurate value for how much acid reacts with 25.0 cm^3 of the sodium hydroxide.

The quality of written communication will be assessed in your answer.

---

[6]

(b). The sodium hydroxide solution contains 40g/dm^3 of sodium hydroxide. How much sodium hydroxide is in 25.0 cm^3 of the solution?

answer _____ g **[2]**

(c). James gets these results.

titration number	1	2	3	4
volume of acid in cm^3	26.4	25.2	25.6	25.4

James decides that the best value for the volume of acid is 25.4 cm^3.

Show how he arrived at this value.

---

[2]

(d). The equation for this reaction is

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

(i) The relative formula mass of sodium hydroxide is 40.
Calculate the relative formula mass of sulfuric acid.
Relative atomic masses are given in the Periodic Table on the back page.

answer _____ [1]

(ii) What mass of sulfuric acid reacts with 40g of sodium hydroxide?
Show your working.

answer _____ g [2]

9.

Mia does a titration.

She puts the sulfuric acid in a burette.

She measures out 25.0 cm^3 of 0.100 mol / dm^3 NaOH.

(i) She wants to measure the 25.0 cm^3 of NaOH as accurately as possible.

Which piece of apparatus should Mia use?

Put a (ring) around the correct answer.

conical flask 100 cm^3 measuring cylinder volumetric pipette volumetric flask

[1]

(ii) Calculate the number of moles in 25.0 cm^3 of 0.100 mol / dm^3 NaOH.

Use the equation: concentration (mol / dm^3) = number of moles of solute ÷ volume (dm^3)

Number of moles = ---------- mol [3]

(iii) This is an equation for sulfuric acid reacting with NaOH.

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Mia finds that 24.5 cm^3 of H_2SO_4 reacts exactly with the NaOH.

Calculate the concentration of the sulfuric acid in the burette in mol / dm^3.

Use the equation: concentration (mol / dm^3) = number of moles of solute ÷ volume (dm^3)

Give your answer to **2** significant figures.

Concentration = ---------- mol / dm^3 **[3]**

END OF QUESTION PAPER

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td></td><td>i</td><td>
<table>
<tr><th></th><th>true (✓)</th><th>false (✓)</th></tr>
<tr><td>Both types of acids form water in neutralisation reactions.</td><td>✓</td><td></td></tr>
<tr><td>Weak acids are always less concentrated than strong acids.</td><td></td><td>✓</td></tr>
<tr><td>The same concentration of a weak and strong acid will have a different pH.</td><td>✓</td><td></td></tr>
<tr><td>Weak acids have a higher degree of ionisation than strong acids.</td><td></td><td>✓</td></tr>
</table>
</td><td>3</td><td>All correct = (3)
2 or 3 correct = (2)
1 correct = (1)</td></tr>
<tr><td></td><td></td><td>ii</td><td>FIRST CHECK THE ANSWER ON THE ANSWER LINE
If answer = 3 award 2 marks

$HCl \rightarrow H^+ + Cl^-$
$[H^+] = 0.001$ moles.
$= 1 \times 10^{-3}$ molest ✓
pH = 3 ✓</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>2</td><td></td><td>i</td><td>FIRST CHECK THE ANSWER ON THE ANSWER LINE
If answer = 0.0202 award 3 marks

calculates formula mass of $Ca(OH)_2$ = 74.1 (g) ✓

1.5 / 74.1 = 0.0202(42…) ✓

gives answer to 3 sig figs ✓</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>FIRST CHECK THE ANSWER ON THE ANSWER LINE
If answer = 0.09696 award 3 marks

200 cm^3 = 0.2 dm^3 ✓

0.0202 x 0.2 = 0.00404 ✓

volume of SO_2 (1:1 ratio) = 0.00404 x 24 = 0.09696 (dm^3) ✓</td><td>3</td><td>ALLOW answers to significant figures or more correctly rounded
ALLOW 0.0971(65…) calculator value carried forward from 12(b)(i)
ECF</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance
3	a		FIRST CHECK ANSWER ON ANSWER LINE if answer = 1.2625 g award 2 marks mass of vinegar in 25 cm^3 = 25 × 1.01 g = 25.25 ✓ mass of ethanoic acid = $\frac{5 \times 25.25}{100}$ = 1.2625 (g) ✓	2	ALLOW answer of 1.26 to 1.3 (g)
	b		FIRST CHECK ANSWER ON ANSWER LINE if answer = 21 cm^3 award 3 marks number of moles of ethanoic acid in 25.0 cm^3 = $\frac{1.2625}{60}$ = 0.021 ✓ ratio 1:1 0.021 moles of Na0H required 1 (conc of Na0H) = $\frac{0.021}{\text{volume}}$ ✓ volume of Na0H = 0.021 dm^3 = 21 (cm^3) ✓	3	ALLOW ECF from 15(a)
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
4	a	i	24.4-24.6; (1) 25.0-27.7; (1)	2	**Accept:** 24.6-24.4; **Accept:** 27.7-25.0; **Accept** 25 instead of 25.0 **Examiner's Comments** Almost all candidates successfully identified the two ranges, with the most common mistake being to include the values for the rough reading in their range. In this case, examiners allowed answers such as '25' instead of '25.0', though that will not always be the case in future. Candidates also showed an excellent ability to decide and explain whether more readings should be taken.
		ii	Acid A no more repeats AND acid B needs more repeats; (1) Acid B range is large / results are not concordant / not consistent / not repeatable / results vary OR Acid A results are close together / AW ; (1)	2	**Allow** Acid A 'No' AND Acid B 'Yes' for 1 mark **Accept** "Acid B results not reliable" **Ignore** "Acid B results not accurate" **Ignore** "Acid B results contain outliers" **Ignore** "because of the range"

Question			Answer/Indicative content	Marks	Guidance
	b		[Level 3] Both strength and concentration correct for most of the acids. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Both strength **and** concentration correct for **some** of the acids. **OR** Makes correct statements about concentration for **most** acids **or** strength for **most** acids. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Makes correct statements about concentration **OR** strength for **some** acids; Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] **Insufficient** or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A* Indicative scientific points may include: Level 3 indicative points • Acid C is a weak acid AND has a low concentration. • Acid D is a strong acid and more concentrated than C • Acid E is a weak acid and high in concentration • Acid F is a strong acid AND has a low concentration. • Accept comments about dibasic acids Concentration • Acid C and acid F have the lowest concentration. • Acid C and acid F have the same concentration • Acid E has the highest concentration. • Acid D is more concentrated than C or F • Acid D is less concentrated than acid E Strength • Acid D is a strong acid • Acid F is a strong acid • Acid C is a weak acid • Acid E is a weak acid • Acid C is the weakest acid • Acid D and F are the strongest acids • Acid E is stronger than acid C Statements such as “Acid C&F have ***lowest*** concentration” OR “Acid D and F are the ***strongest*** acids” qualify as statements about MOST of the acids. If reasoning faulty, give the lower mark of the level Use the L1, L2, L3 annotations in RM Assessor; do not use ticks. Examiner's Comments

Question			Answer/Indicative content	Marks	Guidance
					The most able candidates showed an easy understanding of the relationship between acid strength and pH, and of concentration and the amount of sodium hydroxide used in a titration. Others had great difficulty in coping with the idea that an acid could be both strong *and* dilute, or weak *and* concentrated, and tried to combine them in some way. Answers such as "D and F are both strong acids because they have a pH of 1, but D is the stronger of the two because it uses more sodium hydroxide" were not uncommon. This question also exposed other misunderstandings. Many candidates suggested that the smaller the amount of alkali used, the *more* concentrated the acid would be. Also, and unsurprisingly, many felt that low pH numbers indicated weak acidity. In several cases examiners suspected that candidates understood the material, but that the candidates' expression was ambiguous to the point where examiners were not able to award the mark with confidence. This question asked candidates to differentiate between two very specific terms: acid strength and acid concentration. This meant that examiners had to focus carefully on the precise words that candidates used. A lack of precision in answering let some candidates down here, since very general statements such as 'it was the most/least acidic' were inadequate in this context – and had to be ignored.
			Total	10	

Question			Answer/Indicative content	Marks	Guidance
5	a	i	58	1	Examiner's Comments The calculation in (i) was performed correctly by most candidates. 24 + ([16 + 1] x 2) = 58 A common incorrect answer was 56.
		ii	0.0151 x 73.0 (1) = 1.1 (1)	2	**allow** both marks for correct answer without working **ignore** additional figures after sig fig if they would round down to 1.1 Examiner's Comments In (i) only the stronger candidates calculated the mass of hydrogen chloride correctly. 0.0151 x 73.0 = 1.1 g It was clear from the jumble of figures many candidates wrote that they had little idea of how to approach this calculation.
		iii	58 x 1.1/73 (1) = 0.87 (1)	2	**allow** ecf from **(i)** and **(ii) ie (i) x (ii) / 73** **allow** both marks for correct answer without working **allow** 0.9 Examiner's Comments Only a few of the strongest candidates performed the calculation in (iii) correctly, even allowing for the carrying forward of errors from the previous two parts. 58 x 1.1/73 = 0.87 g Most candidates had little idea of where to begin.

Question			Answer/Indicative content	Marks	Guidance
	b		batch A is OK because each tablet is within the allowed range (1) batch B is unsatisfactory because the tablets contain less (than the minimum permitted amount) (1) batch C is unsatisfactory because the tablets contain more (than the maximum permitted amount) (1) batch D is unsatisfactory because some tablets contain more (than the maximum permitted amount) (1)	4	each answer must say indicate whether the batch is satisfactory or unsatisfactory and explain why **do not credit** calculation and use of average / mean values **Examiner's Comments** This question differentiated well across the ability range. Many candidates realised that batch A meets the standard and could explain why. For batches B, C and D a lack of detail in the explanation of why these did not meet the standard cost marks for many candidates. A large number of candidates calculated the average mass for each batch and used this as a basis for deciding each batch met the standard. They did not appreciate the idea that every tablet in a batch had to meet the standard, despite this having been pointed out in the stem.
			Total	9	

Question			Answer/Indicative content	Marks	Guidance
6		i	to keep the solid dry (1) to make sure that the mass reading is accurate (1)	2	Examiner's Comments Almost all candidates knew at least one reason for the use of a desiccator. Over half selected both correct answers.
		ii	correct answer = 0.4 g / dm^3 (2) *If answer is not fully correct allow (1) mark for:* converts volume to dm^3 (50 ÷ 1000) (=0.05 dm^3) OR gives answer 0.0004 g / dm^3	2	Examiner's Comments About half of the candidates gained both marks for calculating the mass of solid. The most common errors were involved in the conversion of the volume. Many candidates were not sure whether to multiply or divide by 1000.
		iii	400	1	**Allow** ECF answer to (ii) × 1000 Examiner's Comments This question was a developed quantitative task, in which the answer to 4bii was needed to calculate the answer to 4biii. About half of the candidates gained the available mark. Where the answer to the first part was incorrect, 'error carried forward' was allowed to ensure that there was no barrier to scoring in the second part.
		iv	the water contained ions other than calcium	1	Examiner's Comments Most candidates correctly concluded that there must be other ions in the water.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
7	a		The first result is usually lower than the others. ☐ The first titration is done without an indicator. ☐ The students do not follow the method carefully the first time. ☐ The first result is used to give a rough idea of the volume needed. ✓	1	Examiner's Comments Almost every candidate knew that the first titration result is used as a 'rough'.
	b		Any 3 from (Dee's result) is too low / lower than the others; Amy (going past the end point would make) volume of sodium hydroxide higher / volume would be 'too high'; Ben (If the vinegar was more concentrated) more sodium hydroxide would be needed / volume would be 'too high' / all from the same bottle / same vinegar / same concentration; Carl Must have measured out too little vinegar at the start / AW;	3	no marks for 'Carl' alone all marks are for explanations Maximum 2 marks can be scored if Carl is not given as answer ignore 'Dee's result is very different / it is an outlier' ignore 'made mistakes when she measured the volume' Examiner's Comments This was another question that asked candidates to process provided information. An even spread of scores from 0 to 3 were seen. Better answers addressed the question fully by referring to the different ideas of each person. Some answers only addressed some of the ideas and so limited the possible marks that could be scored.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
8	a		**[Level 3]** Gives most of the essential stages in the method AND makes a statement about accuracy AND makes a statement about repeating. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives most of the essential stages in the method AND makes a statement about accuracy OR makes a statement about repeating. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes points about the titration. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to B** **Indicative scientific points may include:** **Method - Essential stages [cued in stem]** • alkali [solution] in flask / beaker • indicator into alkali • add acid / acid in burette • [sudden] indicator / colour change **Method - Other points** • read the burette • swirl • stop adding acid [at endpoint] **Accuracy** • [measure alkali using] pipette • Run acid through tap [to flush out air] • drop by drop / slowly • meniscus • look for similar results / concordant **Repeating** • repeat; • rough; A level 1 method may include any statements from the method lists. Incorrect statements limit the mark to the lower mark of the level at levels 2 & 3 e.g. “indicator goes clear” [rather than colourless] If they make up the alkali solution from solid, ignore the **whole** of that section, until the titration begins. Consider this to impede QWC at level 3. N.B. The alkali must then be transferred to a flask / beaker to gain credit for the first point in the essential stages. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments** Most candidates were clearly familiar with the procedure for carrying out a titration,

Question			Answer/Indicative content	Marks	Guidance
					but there was also a significant minority who appeared to have little or no practical experience. There was a surprising number of descriptions of a burette as a "titration stick" or "titration tube"
	b		1g [2] Either 40x25.0 or divides by 1000 [1]	2	**Examiner's Comments** Able candidates had no difficulty calculating the mass of sodium hydroxide in the solution, though others found it more taxing. Few candidates showed their working, so were not even able to gain that mark. This part was not attempted by a minority of candidates.
	c		Any two from He calculated a mean; ignored 26.4; it is an outlier / rough result;	2	**Ignore** It is the middle of the other two values **Ignore** take the median 25.2 + 25.6 + 25.4 [=76.2] divided by 3 (2) **Examiner's Comments** Most candidates realised that the first result was an outlier and that the best value was the mean of the other three results. Some candidates showed confusion between mean and median. Also common was "after discarding the first reading, 25.4 is in the middle of the other three".
	d	i	98	1	Enter text here.
		ii	49g [2] 98/2 [1]	2	ECF on di ie half the answer to di [2] Recognises that the reacting ratio is 1:2 eg 196g or di) x 2 [1] **Examiner's Comments** While calculating the relative formula mass was within the reach of most candidates, using the equation to decide what mass of acid reacts with 40g of sodium hydroxide was a lot more difficult and was not attempted by a significant minority.

Question			Answer/Indicative content	Marks	Guidance
			Total	13	

Question			Answer/Indicative content	Marks	Guidance
9		i	Volumetric pipette ✓	1 (AO 1.2)	
		ii	FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.0025 (mol) award 3 marks Unit conversion cm^3 to dm^3 = 25 × 10^{-3} = 0.025 dm^3 / divides 25 by 1000 / shows 25 × 0.001 in working ✓ Shows × 0.1 in working ✓ Correct answer = 0.0025 (mol) ✓	3 (AO 1.2) (AO 2 × 2.2)	ALLOW ECF Examiner's Comments This question depended on candidates rearranging an equation before substitution. Most were able to do this and earned at least two marks. Fewer recognised the need to convert units of concentration from cm^3 to dm^3.

Question			Answer/Indicative content	Marks	Guidance
		iii	FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.051 (mol / dm^3) award 3 marks moles H_2SO_4 = ANS (ii)/2 / 0.0025 / 2 (= 0.00125) ✓ conc H_2SO_4 = 0.00125 (ECF) / 0.0245 ✓ conc H_2SO_4 =0.051 (mol / dm^3) ✓	3 (AO 3 × 2.2)	ALLOW ECF (including from part (ii)) 0.102 = (1) for MP2 ALLOW answer with working to 2 sig figures Examiner's Comments Although an equation was given, this calculation was nevertheless very challenging for all but the higher ability of candidates. Candidates needed to use their values from a previous calculation and to remember to both use the reacting ratio in the question, manage the volume unit conversion and to round their answers to two significant figures. Most earned some partial credit for managing at least one stage correctly. Again there was a low omit rate for this difficult question. Copyright
			Total	7	