(b) Separate aqueous solutions of calcium bromide and of calcium iodide reacted with acidified silver nitrate to produce a precipitate.
Concentrated aqueous ammonia was added to each precipitate.

Complete the table.

(2)

Solution	Formula of precipitate with silver nitrate	Colour of precipitate with silver nitrate	Observation with concentrated aqueous ammonia
calcium bromide(aq)			
calcium iodide(aq)			

(c) Describe a chemical test for the sulfate ion giving the positive result.

(2)

.....

.....

.....

.....

(d) What mass of potassium sulfate (K_2SO_4) would be needed to prepare 250 cm^3 of a solution of concentration 0.250 mol dm^{-3}?

The molar mass of K_2SO_4 is 174.3 g mol^{-1}.

(1)

- ☒ **A** 1.96 g
- ☒ **B** 7.84 g
- ☒ **C** 19.6 g
- ☒ **D** 31.4 g

(Total for Question 3 = 10 marks)

(c) Some information about acids in aqueous solution is given.

Comment on these pH values. No calculations are required.

(4)

Name of acid	Formula of acid	pH of a solution of $0.100\,mol\,dm^{-3}$ acid
hydrochloric acid	HCl	1.00
sulfuric acid	H_2SO_4	0.98
propanoic acid	CH_3CH_2COOH	2.94

10 Vitamin C has the molecular formula $C_6H_8O_6$.

The label on a bottle of vitamin C tablets stated that a 2.50 g tablet contained 6% of vitamin C by mass. The tablet was analysed to check the accuracy of the label. The procedure involved a series of steps.

(a) Step **1** Dissolving the tablet.

A 2.50 g vitamin C tablet was crushed and dissolved to make an aqueous solution of volume 250.0 cm^3.

Describe how to make this solution from the crushed tablet.

(3)

Pearson Edexcel

Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCE
In Chemistry (9CH0)
Paper 01: Advanced Inorganic and Physical Chemistry

Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)	An answer that makes reference to the following points: • first row correct **(1)** • second row correct **(1)** • third row correct **(1)**	<table><tr><th>Species</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th></tr><tr><td>^{32}S</td><td>16</td><td>16</td><td>16</td></tr><tr><td>^{33}S</td><td>16</td><td>17</td><td>16</td></tr><tr><td>$^{34}S^{2-}$</td><td>16</td><td>18</td><td>18</td></tr></table> If no marks are scored, allow 1 mark for each correct column	**(3)**

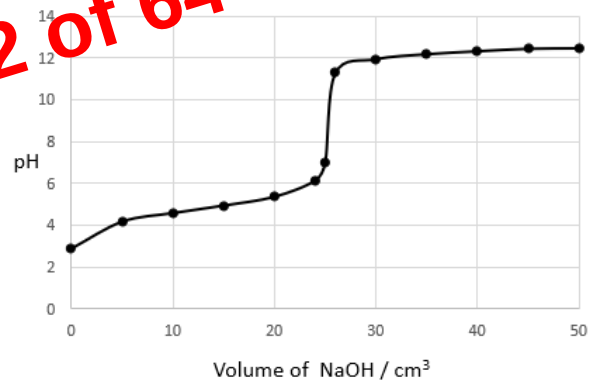
Question Number	Acceptable Answer	Additional Guidance	Mark
1(b)(i)	• calculation of missing value	<u>Example of calculation</u> (100 − 95.02 – 0.75 – 0.02 =) 4.21 (%)	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)	An explanation that makes reference to the following points: • electron affinity becomes less negative / less exothermic / less energy is released going from chlorine to iodine / down the group **(1)** • atomic radius increases / number of shells increases / increased distance between the nucleus and the outer / valence electron(s) **and** there is less attraction between the nucleus and the incoming / added electron / valence electron(s) **(1)** • (there is) increased shielding (from inner electron shells) **(1)** • (increased) shielding outweighs the effect of increasing nuclear charge **or** (increased) repulsion between the (inner) electron shells and the incoming electron outweighs the effect of increasing nuclear charge **or** (increased) distance of the outer shell / energy level outweighs the effect of increasing nuclear charge **(1)**	Allow reverse arguments up the group / comparison of specific elements. Penalise 'losing an electron' or incorrect reference to oxidation once. Allow the electron affinity becomes more positive / more endothermic going from chlorine to iodine Ignore electron affinity increases / decreases Do not award requires / produces energy Do not award any reference to ions, ionic radius, charge or charge density for M2 unless point is clearly made that ions are being formed from atoms Allow there is an increase in repulsion between the (inner) electron shells and the incoming electron(s)	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)(ii)	A description that makes reference to the following points: • calcium bromide and calcium iodide: orange–red / brick–red **(1)** • potassium sulfate: lilac **(1)**	Allow orange / red / yellow-red / yellow- orange Do not award brown, crimson, dark-red, carmine or ruby Do not award purple / mauve / violet / pink / blue-lilac	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)	A description that makes reference to the following points: • calcium bromide correct **(1)** • calcium iodide correct **(1)**	<table><tr><th>Solution</th><th>Formula of precipitate with silver nitrate</th><th>Colour of precipitate with silver nitrate</th><th>Observation with concentrated aqueous ammonia</th></tr><tr><td>calcium bromide(aq)</td><td>AgBr</td><td>cream / pale-yellow / off white</td><td>dissolves / disappears / Allow soluble</td></tr><tr><td>calcium iodide(aq)</td><td>AgI</td><td>yellow</td><td>does not dissolve / remains / no change Allow insoluble / no reaction</td></tr></table> If no other mark is awarded then award 1 mark for 4 correct boxes Ignore state symbols	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following point: • (a Brønsted-Lowry acid is a) proton donor / donator	Allow donates protons / H^+ (ions) / hydrogen ions	(1)

Question Number	Answer	Mark
4(b)	**The only correct answer is B** () ***A*** *is not correct because this is the titration curve of 0.100 mol dm^{-3} of a strong acid and 0.100 mol dm^{-3} of a strong base* ***C*** *is not correct because this is the titration curve of 0.100 mol dm^{-3} of a weak acid and 0.100 mol dm^{-3} of a weak base* ***D*** *is not correct because this is the titration curve of 0.100 mol dm^{-3} of a strong acid and 0.100 mol dm^{-3} of a weak base*	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
4(c)	An answer that makes reference to the following points: • hydrochloric acid is a strong acid **(1)** • sulfuric acid is diprotic / can ionise two H^+ ions / protons **(1)** • the second ionisation of sulfuric acid is not complete / is suppressed by the first ionisation **(1)** • propanoic acid is a weak acid / partially dissociated **(1)**	Allow HCl is (almost) fully dissociated / ionised in solution Allow HCl $\longrightarrow$ $H^+ + Cl^-$ Do not award reversible arrow Ignore just H_2SO_4 is more strongly acidic than HCl Allow $H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$ Ignore reversible arrow Allow this shown in an equation $HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$ Allow $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$ Ignore just propanoic acid is weakly acidic / weakest acid	**(4)**

(Total for Question 6 = 6 marks)

Question Number	Answer	Mark
7(a)(i)	**The only correct answer is D** ($\frac{p(SO_3)}{p(SO_2)\,p(O_2)^{\frac{1}{2}}}$, $atm^{-\frac{1}{2}}$) *A is not correct because the expression is correct but the units are incorrect* *B is not correct because both the expression and the units are incorrect* *C is not correct because the expression is not correct*	**(1)**

Question Number	Answer	Mark
7(a)(ii)	**The only correct answer is B** (temperature) *A is not correct because this would affect the rate of the reaction but not the value of K_p* *C is not correct because this would affect the rate of the reaction but not the value of K_p* *D is not correct because this would affect the rate of the forward reaction temporarily but not the value of K_p*	**(1)**