

Question 9 (Answer: B)

- Two SO_3^{2-} are needed to build one $\text{S}_2\text{O}_4^{2-}$, so $a = 2$; balancing oxygen then gives $b = 2$.
- Likewise two SO_3^{2-} make one $\text{S}_2\text{O}_6^{2-}$, so $w = 2$.
- Balancing charge in the second equation gives $x = 4$.

Question 10 (Answer: A)

- An oxidising agent is itself reduced, so hydrogen's oxidation number must *fall*.
- In K^+H^- hydrogen is -1 , down from 0 in H_2 – it has been reduced.
- In the other three hydrogen ends up at $+1$, so there it is the reducing agent.

Question 3 (Answer: B)

- Balance the electrons: two H_2S half-equations ($4e^-$) match one SO_2 half-equation.
- That gives $2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 3\text{S} + 2\text{H}_2\text{O}$.
- So 3 mol of sulfur needs 2 mol of H_2S , and 1 mol needs $\frac{2}{3}$ mol.

Question 11 (Answer: D)

- S_8 is an element, so sulfur is 0 .
- $\text{Na}_2\text{S}_4\text{O}_6$: $2(+1) + 4x + 6(-2) = 0$ gives $x = +2.5$; $\text{Na}_2\text{S}_2\text{O}_3$ gives $+2$.
- SO_2Cl_2 : $x - 4 - 2 = 0$ gives $x = +6$, the highest of the four.

Question 11 (Answer: B)

- One MnO_4^- accepts 5 electrons.
- Each FeC_2O_4 supplies 3 : one from $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$ and two from $\text{C}_2\text{O}_4^{2-} \rightarrow 2\text{CO}_2$.
- So $5/3 = 1.67$ mol of iron(II) ethanedioate per mole of manganate(VII).

1(a)(i)	25 protons 30 neutrons 25 electrons
1(a)(ii)	(atoms of an element) with the same number of protons and different number of neutrons
1(a)(iii)	M1 (relative) isotopic mass. OR (relative isotopic) mass of Mn-55 and Mn-53 M2 (relative) abundance of each isotope
1(b)(i)	$1s^2 2s^2 2p^6 3s^2 3p^6 (3d^5 4s^2)$
1(b)(ii)	5
1(c)(i)	Mn / MnO_2 AND it gains electrons
1(c)(ii)	(+)4
1(c)(iii)	<i>Due to an issue with question 1(c)(iii), the question has been removed from the question paper.</i>

1(a)	I All the following data recorded. - two burette readings AND titre for the rough titration - initial and final readings for two (or more) accurate titrations II Titre values recorded for accurate titrations, AND correct headings and units in the accurate titration table - initial / start AND (burette) reading / volume - final / end AND (burette) reading / volume - titre OR volume used / added OR FB 2 used / added - unit: / cm³ OR (cm³) OR in cm³ (for each heading) OR cm³ unit given for each volume recorded. III All accurate burette readings recorded to 0.05 cm³. IV The final accurate titre recorded must be within 0.10 cm³ of any other accurate titre.
	Accuracy (Q) marks Round burette readings to the nearest 0.05 cm³. Check and correct titre subtractions where necessary. Select the best mean titre, using the following hierarchy: - two (or more) accurate identical titres (ignoring any that are labelled “rough”), <i>then</i> - two (or more) accurate titres within 0.05 cm³, <i>then</i> - two(or more) accurate titres within 0.10 cm³, <i>etc.</i> Calculate the Supervisor’s mean titre to two decimal places. Calculate the Candidate’s mean titre to two decimal places. Calculate the difference (δ) between the Supervisor’s and Candidate’s mean titre. Award accuracy Q marks as follows: V award if $\delta \leq 0.50 \text{ cm}^3$ VI award if $\delta \leq 0.30 \text{ cm}^3$ VII award if $\delta \leq 0.20 \text{ cm}^3$
1(b)	Correct calculation of the mean titre - Candidate must take the average of two (or more) titres that are within a total spread of not more than 0.20 cm³. - Working/explanation must be shown OR ticks must be put next to the two (or more) accurate readings selected. - The mean should be quoted to 2 d.p. and be rounded to nearest 0.01 cm³ (e.g. 26.675 cm³ must be rounded to 26.68 cm³).
1(c)(i)	Final answers for (c)(ii) , (c)(iii) and (c)(iv) to 3 or 4 significant figures.
1(c)(ii)	Correctly calculates amount of manganate(VII) = $0.01 \times \text{volume in (b)} / 1000 \text{ mol}$
1(c)(iii)	Correctly uses amount of Fe ²⁺ reacting with FB 2 = (c)(ii) $\times$ 5 mol AND concentration of Fe ²⁺ = ((c)(ii) $\times$ 5) $\times$ 40 mol dm ⁻³
1(c)(iv)	Correctly uses concentration of Fe ²⁺ = (c)(iii) $\times$ 55.8 g dm ⁻³
1(c)(v)	Conclusion yes / correct (because) AND (c)(iv) $\times 1000 / 14$ (> 150 claimed as present in tablet)
1(d)	no because chloride (ions) are oxidised by manganate(VII) / KMnO ₄ . OR no because hydrochloric acid is monoprotic AND might not produce enough H ⁺ . OR yes because hydrochloric acid is a strong acid.