IQM3012 A3 Teacher marking reference

IQM3012 A3 Synthetic Chemistry Paper 2 Responses

This reference supports discussion of the selected exercise extracts. Marks and bands are proposed documentary judgements, subject to human subject review.

Controlling sources: IQM3012 Chemistry Paper 2 Sample 2026–27 Candidate Question Paper, Candidate Answer Booklet, supplied Chemistry Data and Formulae Booklet, and current Staff Mark Scheme and Marking Map v3. All 20 Section A items and five Section B questions are compulsory; the paper is 70 marks in two hours.

Separate proposed reference commentary; human academic review remains required.

Teacher reference selected response discussion

Proposed documentary judgements for the four exercise extracts. These are staff-practice examples and remain subject to human academic review.

Reference A S1 B1 b rate constant

Initial-rate data from the source paper: Experiment 1 [A]=0.100 mol dm^{-3}, [B]=0.100 mol dm^{-3}, rate=2.00×10^{-3} mol dm^{-3} s^{-1}; Experiment 2 [A]=0.200, [B]=0.100, rate=8.00×10^{-3}; Experiment 3 [A]=0.100, [B]=0.200, rate=4.00×10^{-3}. S1's preceding response gives rate = $k[A]^2[B]$. Q1(b) asks for k and units. Maximum 2 marks. Criteria: k = 2.00 (1); units dm^6 mol^{-2} s^{-1} (1).

Selected student evidence (verbatim native working):

$$k = \frac{2.00 \times 10^{-3}}{(0.100)^2(0.100)} = 2.00$$

$$\mathrm{dm^6\ mol^{-2}\ s^{-1}}$$

Proposed decision: 2/2. Earned source points: K, U.

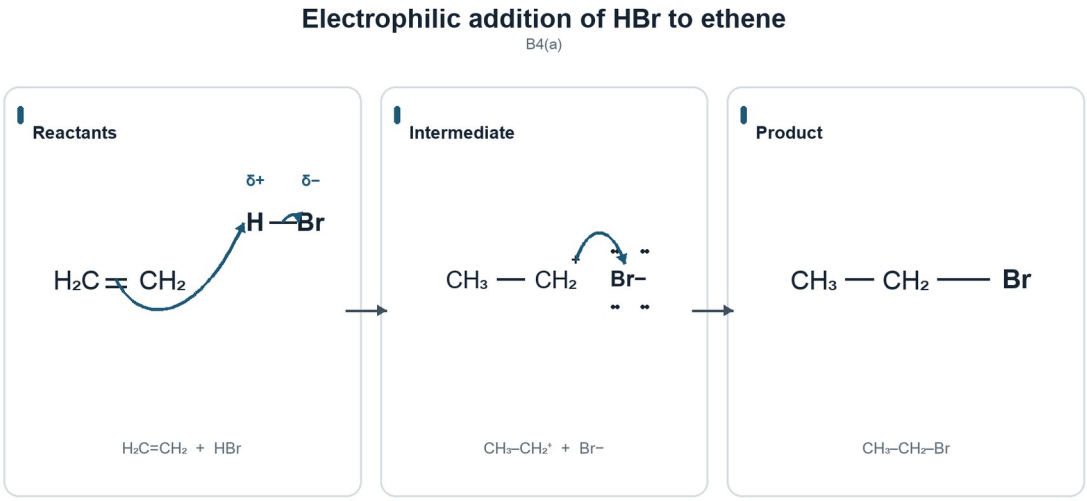
The calculation and units match the source criteria.

Reference B S2 B4 a mechanism

B4(a): draw the electrophilic addition mechanism for ethene and HBr. Maximum 4 marks. Available points: Hδ+–Brδ− and π arrow to H; H–Br arrow to Br and Br−; CH_3CH_2+ intermediate; Br− lone-pair arrow to C+ and CH_3CH_2Br product.

Selected student evidence (verbatim):

The electrophilic addition mechanism is shown in the drawing.



Synthetic student mechanism drawing.

Proposed decision: 3/4. Earned source points: D, B, C.

The final arrow incorrectly begins at C^+ and points toward Br^-; the source requires a Br^- lone-pair arrow toward C^+.

Reference C S3 B2 c pH

B2(c): calculate pH of 0.0200 mol dm^{-3} NaOH at 25 °C. Maximum 3 marks. Available points: [OH−] and pOH; pH/pOH relation or Kw method; final pH 12.30.

Selected student evidence (verbatim native working):

$$\mathrm{pOH} = 1.70$$

$$\mathrm{pH} = 1.70$$

Proposed decision: 1/3. Earned source points: O.

The response supplies only the listed earned point(s). Not evidenced or omitted: Uses pH + pOH = 14.00 at 25 °C, or $[H^+] = Kw/[OH^-]$.; pH = 12.30.

Reference D S1 B5 c NMR

Compound X is known to be either propanal or propanone. Its singly charged molecular ion has m/z 58. Its IR spectrum has a strong absorption near 1720 cm^{-1}. Its high-resolution proton NMR spectrum shows a singlet integrating to six hydrogen atoms. Ignore trace impurities. B5(c) asks for identification and explanation. Maximum 3 marks. Available points: propanone; two equivalent methyl groups give one six-H environment; no H on the carbonyl carbon adjacent to each methyl group, so singlet.

Selected student evidence (verbatim):

X is propanone, CH_3COCH_3. Its two equivalent CH_3 groups give one environment integrating to six H. Each methyl carbon is directly adjacent to the carbonyl carbon, which has no attached H; there is no neighbouring H on that adjacent carbon to split the methyl protons, so the signal is a singlet.

Proposed decision: 3/3. Earned source points: I, E, T.

The answer identifies propanone, connects the six-proton integration to two equivalent methyl groups, and explains the singlet because the adjacent carbonyl carbon has no hydrogen.

Confidentiality and status

Full scripts are restricted to internal staff practice. Do not distribute them as candidate answer material. All marks are AI-proposed documentary judgements; human subject review, moderation, academic approval and any controlled release remain outstanding.