

M1.D [1]

M2.A [1]

M3.B [1]

M4.C [1]

M5.A [1]

M6.A [1]

M7. (a) *Trend*: decrease **(1)** **C.E if wrong**
Explanation: number of shells increases (or atomic radius increases) **(1)**
increased nuclear shielding **(1)**
or less attraction for bond (pair electrons)

3

(b) (i) *Observation*: brown solution or black solid **(1)**
purple wrong

Equation: $\text{Br}_2 + 2\text{I}^- \rightarrow \text{I}_2 + 2\text{Br}^-$ **(1)**

Allow NaI, KI

(ii) Br₂ is a weaker oxidising agent than Cl₂ **(1) (or converse)**

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*OR Br₂ is less reactive than Cl₂
penalise Cl, Br, Cl⁻, Br⁻ etc*

(c) *Observation with KF (aq): no change **(1) (or colourless)**
Observation with KBr(aq): cream/off white ppt **(or solid) (1)***

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(d) $KF + H_2SO_4 \rightarrow KHSO_4 + HF$ **(1)**

*or $2 KF + H_2SO_4 \rightarrow K_2HSO_4 + 2 HF$
Allow ions*

1

(e) $2 H_2SO_4 + 2 Br^- \rightarrow \underline{SO_2 + Br_2} + 2 H_2O + SO_4^{2-}$ **(1)**
Balanced equation **(1)**

*Allow $2 H_2SO_4 + 2 NaBr \rightarrow SO_2 + Br_2 + 2 H_2O + Na_2SO_4$
 $H_2SO_4 + 2 HBr \rightarrow 2 H_2O + Br_2 + SO_2$ etc*

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[11]

M8.C

[1]

M9.D

[1]

M10.C

[1]

M11. (a) (i) Halides:- Fluoride
Chloride (1)
Equation:- $H^+ + F^- \rightarrow HF$ (or molecular / for a correct halide) (1)

(ii) Halides:- Bromide and iodide (1)
Equation:- H_2SO_4 (or $2H^+ + SO_4^{2-}$) + $2H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ (1)
 $2Br^- \rightarrow Br_2 + 2e^-$ (1)
 $H_2SO_4 + 2H^+ + 2Br^-$ (or $2HBr$) $\rightarrow Br_2 + SO_2 + 2H_2O$ (1)

*Q of L penalise wrong symbol for fluoride or bromide once
Ignore state symbols in equations*

(iii) Products Sulphur (or S_8 not S_2) (1)
Hydrogen sulphide (1)
Equation:- H_2SO_4 (or $2H^+ + SO_4^{2-}$) + $6H^+ + 6e^- \rightarrow S + 4H_2O$ (1)
OR
 H_2SO_4 (or $2H^+ + SO_4^{2-}$) + $8H^+ + 8e^- \rightarrow H_2S + 4H_2O$

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*Ignore halide if given even if incorrect
Do not allow elements, molecules or atoms in part (a)*

(b) Addition of silver nitrate
Chloride gives white precipitate / solid (1)
Bromide gives cream precipitate / solid (1)
Iodide gives yellow precipitate / solid (1)
Addition of ammonia
Chloride precipitate soluble in dilute (1)
Bromide precipitate soluble in concentrated (1)
Iodide precipitate insoluble (1)

Do not allow halogen or sodium halide

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[15]

M12.D

[1]

M13.A

[1]

M14.

- (a) (i) -2 OR 2-
- (ii) NaI or NaAt or I⁻ or iodide or At or Astatide (1)
Not atoms or molecules
- (iii) Smell of bad eggs (1)
Allow PbAc₂ goes black and K₂Cr₂O₇/H⁺ goes cloudy green
- (iv) $8 e^- + 8 H^+ + H_2SO_4 \rightarrow H_2S + 4H_2O$ (1)
OR $10 H^+ + SO_4^{2-}$

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- (b) (i) HF or HCl (1)
CE = 0 if redox answer given
If wrong halide given allow max one in b(iii)
If NaF or NaCl, or F⁻ or Cl⁻ given lose mark in (i)
Mark on if X is e.g. HF₂ or H₂F

- (ii) NaF or NaCl or F⁻ or Cl⁻ (1)
- (iii) A proton donor or an acid (1)
- (iv) $H^+ + F^- \rightarrow HF$
OR $H_2SO_4 + NaF \rightarrow NaHSO_4 + HF$
OR $H_2SO_4 + 2 NaF \rightarrow Na_2SO_4 + 2 HF$
OR for chloride

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[8]

M15.C

[1]

M16.D

[1]