

- M1.(a)** (i) 1.08×10^{-2}
Do not penalise precision but must be to at least 2 significant figures.
Do not accept 1×10^{-2} 1
- (ii) $5.4(0) \times 10^{-3}$
Allow (i) / 2
Do not penalise precision but must be to at least 2 significant figures. 1
- (iii) 266.6
Lose this mark if answer not given to 1 decimal place. 1
- (iv) mass = $5.4(0) \times 10^{-3} \times 266.6 = 1.44 \text{ g}$ **M1**
Allow (ii) \times (iii). 1
- percentage = $1.44 \times 100 / 2.25 = 64.0$ **M2**
Allow consequential answer from M1
Lose this mark if answer not given to 3 significant figures.
Correct answer with no working scores M2 only. 1
- (v) 1 Would give an incorrect / too large mass (of silver chloride)
Do not allow 'to get an accurate result' without qualification. 1
- 2 To remove soluble impurities / excess silver nitrate (solution) / strontium nitrate (solution)
Do not allow 'to remove impurities'.
Do not allow 'to remove excess strontium chloride solution'. 1

- (b) (i) $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$
 Allow $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{OH})_2(\text{s})$
 Allow multiples, including fractions.
 Lose mark if state symbols are missing or incorrect.
 Lose mark if incorrect charge on an ion. 1
- (ii) Does not produce CO_2 / gas which distends stomach / does not produce wind / does not increase pressure in stomach
 Allow 'prevents flatulence' and 'prevents burping'.
 Do not allow 'gas' without qualification. 1
- (c) $(\text{CH}_3\text{COO})_2\text{Ca} \rightarrow \text{CH}_3\text{COCH}_3 + \text{CaCO}_3$
 Allow multiples.
 Allow propanone as $\text{C}_3\text{H}_6\text{O}$
 Allow $(\text{CH}_3\text{COO})_2\text{Ca}^{2+} \rightarrow \text{CH}_3\text{COCH}_3 + \text{Ca}^{2+}\text{CO}_3^{2-}$ 1
- (d) Ca (salt) - no visible change with sodium chromate(VI) **M1**
 Allow 'yellow solution formed' or 'no ppt. forms'.
 Allow **M1** and **M2** in any order. 1
- Sr and Ba (salts) give (yellow) precipitate with sodium chromate(VI) **M2**
 Lose this mark if precipitate has an incorrect colour. 1
- Sr precipitate (chromate(VI)) dissolves in ethanoic acid / Ba precipitate (chromate(VI)) does not dissolve in ethanoic acid **M3**
 If ethanoic acid is added first, allow access to **M1** and **M3**. 1
- (e) C 42.09 / 12, H 2.92 / 1, N 8.18 / 14, O 37.42 / 16 and S 9.39 / 32.1
 Accept any other correct method of working.
 If relative atomic mass has been divided by the percentage

composition is used then CE = 0 / 2

1

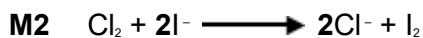


Correct answer with no working scores 1 mark only.

1

[15]

- M2.** (a) (i) **M1** iodine **OR** I_2 **OR** I_3^-
Ignore state symbols
Credit M1 for "iodine solution"



OR



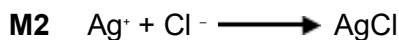
Penalise multiples in M2 except those shown

M2 accept correct use of I_3^-

M3 redox or reduction-oxidation or displacement

3

- (ii) **M1** (the white precipitate is) silver chloride
M1 *must be named* and for this mark ignore incorrect formula



For M2 ignore state symbols

Penalise multiples

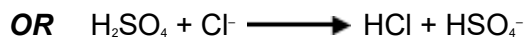
M3 (white) precipitate / it dissolves

OR colourless solution

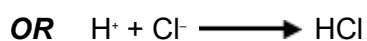
Ignore references to "clear" alone

3

- (b) (i) **M1** $\text{H}_2\text{SO}_4 + 2\text{Cl}^- \longrightarrow 2\text{HCl} + \text{SO}_4^{2-}$
For M1 ignore state symbols



Penalise multiples for equations and apply the list principle



M2 hydrogen chloride **OR** HCl **OR** hydrochloric acid

2

(ii) M1 and M2 in either order

For M1 and M2, ignore state symbols and credit multiples

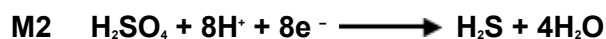


OR

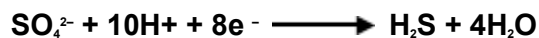


Do not penalise absence of charge on the electron

Credit electrons shown correctly on the other side of each equation



OR



Additional equations should not contradict

M3 oxidising agent / oxidises the iodide (ions)

OR

electron acceptor

M4 sulfur **OR** S **OR** S₂ **OR** S₈ **OR** sulphur

4

(iii) M1 The NaOH / OH⁻ / (sodium) hydroxide reacts with / neutralises the H⁺ / acid / HBr (lowering its concentration)

OR a correct neutralisation equation for H⁺ or HBr with NaOH or with hydroxide ion

Ignore reference to NaOH reacting with bromide ions

Ignore reference to NaOH reacting with HBrO alone

M2 Requires a correct statement for M1

The (position of) equilibrium moves / shifts(from L to R)

- to replace the H⁺ / acid / HBr that has been removed / lost
- **OR** to increase the H⁺ / acid / HBr concentration
- **OR** to make more H⁺ / acid / HBr / product(s)
- **OR** to oppose the loss of H⁺ / loss of product(s)

- **OR to oppose the decrease in concentration of product(s)**
In M2, answers must refer to the (position of) equilibrium shifts / moves and is not enough to state simply that it / the system / the reaction shifts to oppose the change.

M3 The (health) benefit outweighs the risk or wtte

OR

a clear statement that once it has done its job, little of it remains

OR

used in (very) dilute concentrations / small amounts / low doses

3

[15]



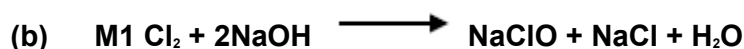
Accept a correct equation using $\frac{1}{2} \text{Cl}_2$ but no other multiples

M2 solution goes orange / yellow (from colourless)

Ignore reference to brown colour

Penalise incorrect observations eg fumes, precipitates

2



(NaOCl)

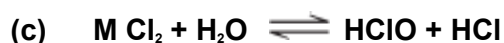
Or a correct ionic equation

Ignore reference to “swimming pools” and to “disinfectant”

M2 bleach or kills bacteria / bacteriacide / micro-organisms / microbes

M3 sodium chlorate(I) ONLY

3



(HOCl)

Equilibrium symbol required in M1

Accept ionic RHS

M2

The (health) benefit outweighs the risk or wtte

OR

a clear statement that once it has done its job, little of it remains

OR

used in (very) dilute concentrations / small amounts / low doses

2

(d) **M1 Silver nitrate OR AgNO₃ (with or without nitric acid)**

For M1

If only the formula is written then it must be correct

If both the formula and the name are written then ignore incorrect attempt at the formula, but penalise an incorrect name

M2 (depends on M1)

white precipitate / white solid

If the reagent is incomplete eg Ag⁺ ions, penalise M1 and mark on

M3 Ag⁺ + Cl⁻ → AgCl

Penalise both M1 and M2 for alkaline AgNO₃, OR for the use of HCl to acidify the silver nitrate OR for Tollens' reagent

3

[10]

M4.M1 and M2 (either order)

Any two from

- purple vapour / gas
- (white solid goes to) black or black / grey or black / purple solid
- bad egg smell or words to this effect
Ignore misty white fumes
Ignore yellow solid
Ignore purple solid

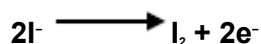
Ignore "goes (dark) brown"

M3

Or multiples for possible equation in M3

The iodide ion(s) / they lose (an) electron(s)

OR

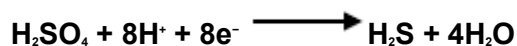


M4

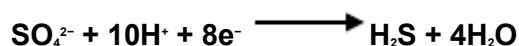
Accept "changes by - 8"

Oxidation state of S changes from +6 to -2 or changes by 8

M5



OR



[5]

M5.Test

silver nitrate (solution) (M1)

Allow an alternative soluble silver salt eg fluoride, sulfate.

Do not allow 'silver ions' but can access second mark.

Incorrect formula loses this mark but can access second mark.

Do not allow 'silver' or an insoluble silver salt and cannot access second mark.

Ignore references to acidification of the silver nitrate.

If an acid is specified it should be nitric acid, but allow sulfuric acid in this case as there are no metal ions present.

If hydrochloric acid is used, CE = 0 / 2.

Do not allow 'add water'.

1

Observation

white precipitate (M2)

Ignore 'cloudy'.

Do not allow 'white fumes' or 'effervescence'.

Do not allow this mark if test reagent is incorrect or

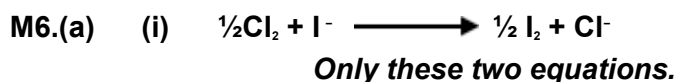
missing.

Allow named indicator paper or named indicator solution for M1.

Allow correct colour change for M2.

1

[2]



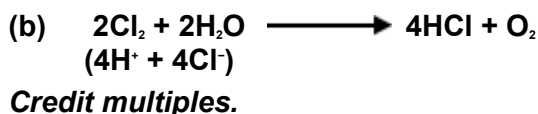
OR



1

- (ii) (Solution turns from colourless to) brown / red-brown solution
Allow grey / black solid.
Ignore "purple".

1



1

- (c) M1 The relative size (of the molecules / atoms)
Chlorine is smaller than bromine OR has fewer electrons / electron shells
OR It is smaller / It has a smaller atomic radius / it is a smaller molecule /
or has smaller M.
(or converse for bromine)

Ignore general Group 7 statements.

For M1 ignore whether it refers to molecules or atoms.

- M2 How size of the intermolecular force affects energy needed
The forces between chlorine / Cl_2 molecules are weaker (than the forces
between bromine / Br_2 molecules leading to less energy needed to
separate the molecules)
(or converse for bromine)
OR chlorine / Cl_2 has weaker / less / fewer forces between molecules OR
chlorine / Cl_2 has weaker / less / fewer intermolecular forces
(or converse for bromine)

CE=0 for reference to (halide) ions.

QoL for clear reference to the difference in size of the force between molecules.

Penalise M2 if (covalent) bonds are broken.

2

[5]