

- M1.(a)** (i)  $1.08 \times 10^{-2}$   
*Do not penalise precision but must be to at least 2 significant figures.*  
*Do not accept  $1 \times 10^{-2}$*  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 =  $5.4(0) \times 10^{-3} \times 266.6 = 1.44$  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  $\text{CO}_2$  / 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

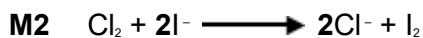


Correct answer with no working scores 1 mark only.

1

[15]

- M2.** (a) (i) **M1** iodine **OR**  $\text{I}_2$  **OR**  $\text{I}_3^-$   
Ignore state symbols  
Credit **M1** for "iodine solution"



**OR**



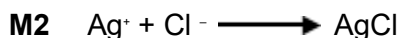
Penalise multiples in M2 except those shown

**M2** accept correct use of  $\text{I}_3^-$

**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

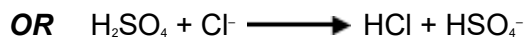
**M3** (white) precipitate / it dissolves

**OR** colourless solution

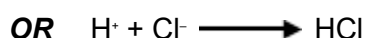
Ignore references to "clear" alone

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*

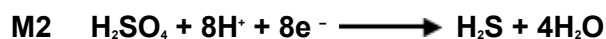


OR

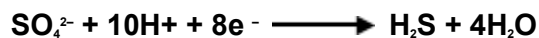


*Do not penalise absence of charge on the electron*

*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** S<sub>2</sub> **OR** S<sub>8</sub> **OR** sulphur

4

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

OR a correct neutralisation equation for H<sup>+</sup> 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<sup>+</sup> / acid / HBr that has been removed / lost
- **OR** to increase the H<sup>+</sup> / acid / HBr concentration
- **OR** to make more H<sup>+</sup> / acid / HBr / product(s)
- **OR** to oppose the loss of H<sup>+</sup> / 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]



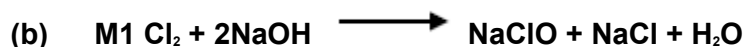
***Accept a correct equation using  $\frac{1}{2} \text{Cl}_2$  but no other multiples***

**M2 solution goes orange / yellow ( from colourless)**

***Ignore reference to brown colour***

***Penalise incorrect observations eg fumes, precipitates***

2



**(NaOCl)**

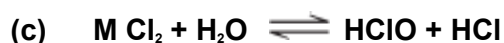
***Or a correct ionic equation***

***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 AgNO<sub>3</sub> (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<sup>+</sup> ions, penalise M1 and mark on*

**M3 Ag<sup>+</sup> + Cl<sup>-</sup> → AgCl**

*Penalise both M1 and M2 for alkaline AgNO<sub>3</sub>, 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*

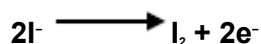
*Ignore "goes (dark) brown"*

M3

*Or multiples for possible equation in M3*

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

OR

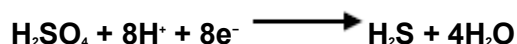


M4

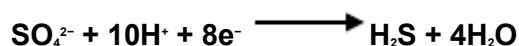
*Accept "changes by - 8"*

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*

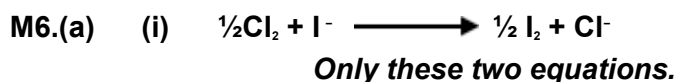
missing.

Allow named indicator paper or named indicator solution for M1.

Allow correct colour change for M2.

1

[2]



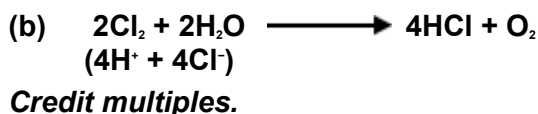
OR



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 /  $\text{Cl}_2$  molecules are weaker (than the forces  
between bromine /  $\text{Br}_2$  molecules leading to less energy needed to  
separate the molecules)  
(or converse for bromine)  
OR chlorine /  $\text{Cl}_2$  has weaker / less / fewer forces between molecules OR  
chlorine /  $\text{Cl}_2$  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]