

1. (i) O goes from -2 to 0 ✓

Oxidation numbers may be seen with equation

N goes from +5 to +4 ✓

N is reduced **AND** O is oxidised ✓

Third mark is dependent upon seeing a reduction in oxidation number of N and an increase in oxidation number of O

ALLOW ECF for third mark for N is oxidised **and** O is reduced if incorrect oxidation numbers support this

IGNORE references to strontium

IGNORE references to electron loss **OR** gain

DO NOT ALLOW 'One increases and one decreases'

3

- (ii) Calculates correctly:

$$\text{Mol of Sr(NO}_3)_2 = \frac{5.29}{211.6} = 0.0250 \quad \checkmark$$

ALLOW 0.025

Calculates correctly:

$$\text{Mol of gas} = 5/2 \times 0.0250 = 0.0625 \quad \checkmark$$

ALLOW ECF for first answer $\times 2.5$ as calculator value or correct rounding to 2 significant figures or more but ignore trailing zeroes

Calculates correctly:

$$\text{Volume of gas} = 24.0 \times 0.0625 = 1.50 \text{ dm}^3 \quad \checkmark$$

ALLOW ECF for second answer $\times 24(.0)$ as calculator value or correct rounding to 2 significant figures or more but ignore trailing zeroes

DO NOT ALLOW ECF of first answer $\times 24(.0)$ (which gives $0.6(0) \text{ dm}^3$) as this has not measured the volume of any gas, simply 0.0250 mol of solid $\text{Sr(NO}_3)_2$ converted into a gas
i.e. This answer would give **one** mark

ALLOW 1.5 dm^3

ALLOW ECF producing correct volume of NO_2 only

i.e. $1.2(0) \text{ dm}^3$ would give **two** marks

OR

ALLOW ECF producing correct volume of O_2 only

i.e. $0.3(0) \text{ dm}^3$ would give **two** marks

3

[6]

2. (i) Mg ✓
 oxidation number changes from 0 to (+)2
OR oxidation number increases by 2 ✓
ALLOW correct oxidation numbers shown in equation
2nd mark is dependent on identification of Mg
IGNORE electrons 2
- (ii) Mg/solid dissolves **OR** Mg/solid disappears
OR (Mg/solid) forms a solution ✓
 bubbles **OR** fizzes **OR** effervesces **OR** gas produced ✓
IGNORE metal reacts
IGNORE temperature change
IGNORE steam produced
DO NOT ALLOW carbon dioxide gas produced
DO NOT ALLOW hydrogen produced without gas 2
- [4]
3. (i) because Ca has changed from 0 to +2 (1)
 and H has changed from +1 to 0 (1) 2
- (ii) Calcium reacts with water producing
 hydrogen/H₂/calcium/hydroxide/Ca(OH)₂ (1) (i.e. one product)
 Ca(s) + H₂O(l) → Ca(OH)₂(aq) + H₂(g) (1) (i.e. full equation)
 Equation would subsume both two marks 2
- [4]
4. (a) (i) $12 \times 50/1000 = 0.600 \text{ mol}$ ✓ 1
- (ii) $4 \text{ mol HCl} \rightarrow 1 \text{ mol Cl}_2$ / moles $\text{Cl}_2 = 0.15 \text{ mol}$ ✓
 $\text{vol of Cl}_2 = 0.15 \times 24 = 3.60 \text{ dm}^3$ ✓ 2
2nd mark is consequential on molar ratio given
- (b) Evidence that the oxidation number of Mn has reduced
and one of the oxidation numbers correct (ie MnO₂: ox no
 of Mn = +4 or MnCl₂: ox no of Mn = +2 ✓
 The **other** oxidation number of Mn is correct,
 ie in MnO₂: ox no of Mn = +4
or in MnCl₂: ox no of Mn = +2 ✓ 2
- [5]

5. (i) loss (of electrons) ✓ 1
- (ii) Ba ✓ 2
- $0 \rightarrow (+)2$ ✓ (accept 2+) [3]
-
6. (i) Oxidation state goes from 0 in O_2 ✓
 $\rightarrow -2$ in MgO ✓ 2
- (ii)
- $\left[\begin{array}{c} \text{Mg} \end{array} \right]^{2+}$

$\left[\begin{array}{c} \text{O} \end{array} \right]^{2-}$
- or with Mg full shell.
 correct dot and cross ✓; correct charges ✓ 2
- [4]
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7. (a) (i) Amount of substance that has the same number of particles as there are atoms in 12 g of ^{12}C /
 6×10^{23} / Avogadro's Number ✓ 1
- (ii) moles = $\frac{0.275 \times 120}{1000} = 0.0330 \text{ mol}$ ✓
 moles $Cl_2 = \frac{0.0330}{2} = 0.0165 \text{ mol}$ ✓ 1
- (iii) volume $Cl_2 = 0.0165 \times 24000 = 396 \text{ cm}^3$ ✓ / 0.396 dm^3
 792 cm^3 worth 1 mark (no molar ratio)
 1584 cm^3 worth 1 mark (x 2)
 units needed. 2
- (iv) bleach / disinfectant /sterilising /killing germs ✓ 1
- (b) $NaClO_3$ ✓ 1
- [6]
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8. (a) Ca(s) + ...2 ✓ HCl(aq) CaCl₂(aq) + .H₂(g). ✓ 2
- (g) not required for H₂

- (b) In Ca, oxidation state = 0 ✓ and 2
 In CaCl_2 , oxidation state = +2 ✓
 Oxidation number increases from Ca to CaCl_2

[4]

9. (a) RaCl_2 ✓ 1

- (b) Reduction is gain of electrons/decrease in oxidation number

✓

Ra^{2+} gains 2 electrons $\rightarrow \text{Ra}/$

Oxidation state goes from +2 in $\text{RaCl}_2 \rightarrow 0$ in Ra ✓

2

[3]