

Balancing Equations

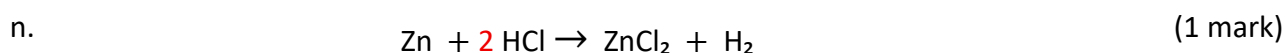
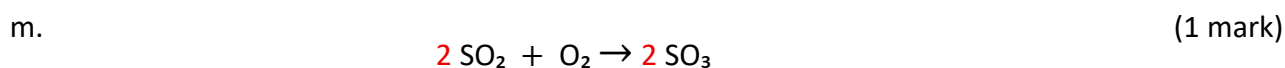
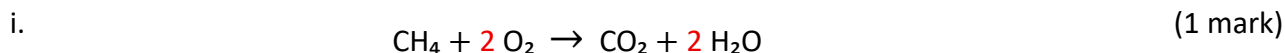
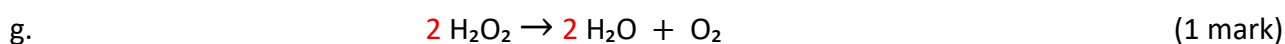
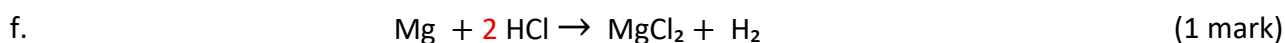
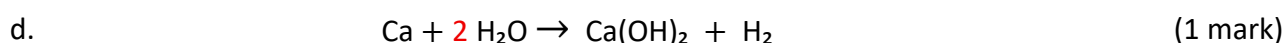
Mark Scheme



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Section 1: Introduction To Balancing Equations.

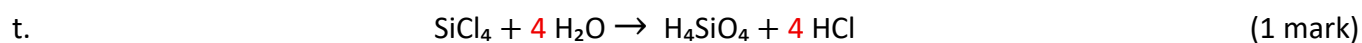
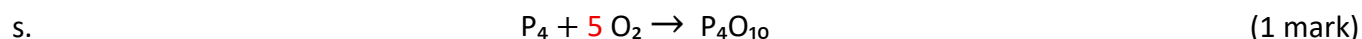
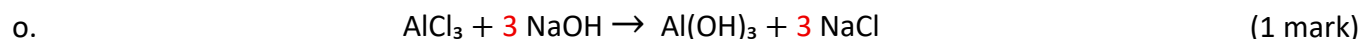
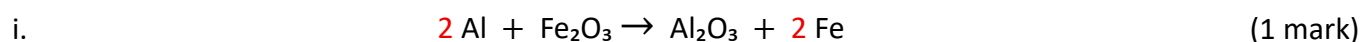
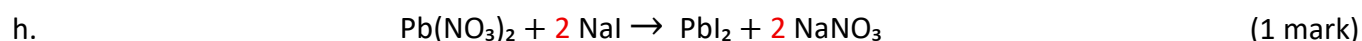
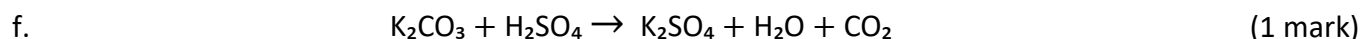
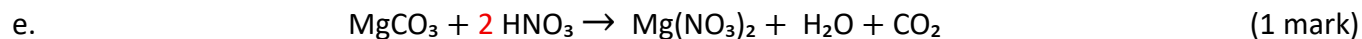
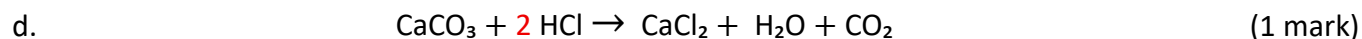
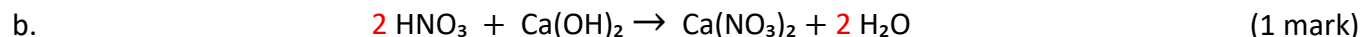
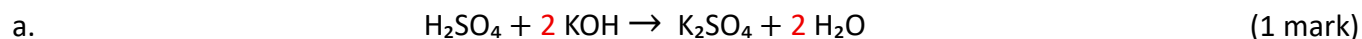
1. Balance the following equations.



Total for Question 1 = 14 marks

Section 2: Moderate Balancing Equations

2. Balance the following equations. Read each carefully before you attempt to balance.



- w. $\text{Ca}_3(\text{PO}_4)_2 + 3 \text{SiO}_2 + 5 \text{C} \rightarrow 3 \text{CaSiO}_3 + 5 \text{CO} + 2 \text{P}$ (1 mark)
- x. $4 \text{FeS}_2 + 11 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3 + 8 \text{SO}_2$ (1 mark)
- y. $\text{Cu} + 4 \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2 \text{NO}_2 + 2 \text{H}_2\text{O}$ (1 mark)
- z. $\text{Fe}(\text{NO}_3)_3 + 3 \text{NaOH} \rightarrow \text{Fe}(\text{OH})_3 + 3 \text{NaNO}_3$ (1 mark)

Total for Question 2 = 26 marks

Section 3: A bit more challenging...

3. Balance the following equations. Read each carefully before you attempt to balance.

Note: feel free to do them in pencil first if you like 😊

- a. $\text{C}_5\text{H}_{12} + 8 \text{O}_2 \rightarrow 5 \text{CO}_2 + 6 \text{H}_2\text{O}$ (1 mark)
- b. $\text{Fe}_2\text{O}_3 + 3 \text{CO} \rightarrow 2 \text{Fe} + 3 \text{CO}_2$ (1 mark)
- c. $2 \text{C}_6\text{H}_{14} + 19 \text{O}_2 \rightarrow 12 \text{CO}_2 + 14 \text{H}_2\text{O}$ (1 mark)
- d. $4 \text{FeS}_2 + 11 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3 + 8 \text{SO}_2$ (1 mark)
- e. $\text{C}_2\text{H}_5\text{OH} + 3 \text{O}_2 \rightarrow 2 \text{CO}_2 + 3 \text{H}_2\text{O}$ (1 mark)
- f. $4 \text{NH}_3 + 7 \text{O}_2 \rightarrow 4 \text{NO}_2 + 6 \text{H}_2\text{O}$ (1 mark)
- g. $2 \text{C}_3\text{H}_7\text{OH} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 8 \text{H}_2\text{O}$ (1 mark)
- h. $\text{PCl}_5 + 4 \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + 5 \text{HCl}$ (1 mark)
- i. $\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \rightarrow 6 \text{CO}_2 + 6 \text{H}_2\text{O}$ (1 mark)
- j. $\text{SiO}_2 + 4 \text{HF} \rightarrow \text{SiF}_4 + 2 \text{H}_2\text{O}$ (1 mark)
- k. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{Cr}_2\text{O}_3 + \text{N}_2 + 4 \text{H}_2\text{O}$ (1 mark)
- l. $2 \text{N}_2\text{H}_4 + \text{N}_2\text{O}_4 \rightarrow 3 \text{N}_2 + 4 \text{H}_2\text{O}$ (1 mark)
- m. $\text{UO}_2 + 4 \text{HF} \rightarrow \text{UF}_4 + 2 \text{H}_2\text{O}$ (1 mark)
- n. $\text{Ca}_3(\text{PO}_4)_2 + 3 \text{H}_2\text{SO}_4 \rightarrow 3 \text{CaSO}_4 + 2 \text{H}_3\text{PO}_4$ (1 mark)

- o. $\text{Al}_2(\text{SO}_4)_3 + 3 \text{Ca}(\text{OH})_2 \rightarrow 2 \text{Al}(\text{OH})_3 + 3 \text{CaSO}_4$ (1 mark)
- p. $3 \text{Cu} + 8 \text{HNO}_3 \rightarrow 3 \text{Cu}(\text{NO}_3)_2 + 2 \text{NO} + 4 \text{H}_2\text{O}$ (1 mark)
- q. $\text{K}_4\text{Fe}(\text{CN})_6 + 6 \text{H}_2\text{SO}_4 + 6 \text{H}_2\text{O} \rightarrow 2 \text{K}_2\text{SO}_4 + \text{FeSO}_4 + 3 (\text{NH}_4)_2\text{SO}_4 + 6 \text{CO}$ (1 mark)
- r. $3 \text{Cl}_2 + 6 \text{NaOH} \rightarrow 5 \text{NaCl} + 1 \text{NaClO}_3 + 3 \text{H}_2\text{O}$ (1 mark)
- s. $2 \text{KMnO}_4 + 5 \text{H}_2\text{O}_2 + 3 \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{MnSO}_4 + 5 \text{O}_2 + 8 \text{H}_2\text{O}$ (1 mark)
- t. $4 \text{C}_7\text{H}_5\text{N}_3\text{O}_6 + 21 \text{O}_2 \rightarrow 28 \text{CO}_2 + 10 \text{H}_2\text{O} + 6 \text{N}_2$ (1 mark)
- u. $2 \text{KMnO}_4 + 16 \text{HCl} \rightarrow 2 \text{KCl} + 2 \text{MnCl}_2 + 8 \text{H}_2\text{O} + 5 \text{Cl}_2$ (1 mark)
- v. $\text{K}_2\text{Cr}_2\text{O}_7 + 14 \text{HCl} \rightarrow 2 \text{KCl} + 2 \text{CrCl}_3 + 7 \text{H}_2\text{O} + 3 \text{Cl}_2$ (1 mark)
- w. $\text{I}_2 + 2 \text{Na}_2\text{S}_2\text{O}_3 \rightarrow 2 \text{NaI} + \text{Na}_2\text{S}_4\text{O}_6$ (1 mark)
- x. $\text{As}_2\text{O}_3 + 6 \text{KI} + 6 \text{HCl} \rightarrow 2 \text{AsI}_3 + 6 \text{KCl} + 3 \text{H}_2\text{O}$ (1 mark)
- y. $4 \text{CuSCN} + 7 \text{KIO}_3 + 14 \text{HCl} \rightarrow 4 \text{CuSO}_4 + 4 \text{HCN} + 7 \text{KCl} + 7 \text{ICI} + 5 \text{H}_2\text{O}$ (1 mark)
- z. $\text{H}_3\text{PO}_4 + 12 (\text{NH}_4)_2\text{MoO}_4 + 21 \text{HNO}_3 \rightarrow (\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3 + 21 \text{NH}_4\text{NO}_3 + 12 \text{H}_2\text{O}$ (1 mark)

Total for Question 3 = 26 marks

Section 4: The ultimate challenge 😊

Have a go at this balancing equation problem... It may take you a few attempts. This is more difficult than anything you would see in the GCSE exam but let's see if you can crack it! It is possible by the way.

Proustite, also known as '**ruby silver**', is a mineral with the chemical formula Ag_3AsS_3 .

When it is heated with concentrated nitric acid (HNO_3), a complex reaction occurs where the silver, arsenic, and sulfur atoms are all oxidised.

Your challenge is to balance the monster equation that describes this reaction.

$3 \text{Ag}_3\text{AsS}_3 + 35 \text{HNO}_3 \rightarrow 9 \text{AgNO}_3 + 3 \text{H}_3\text{AsO}_4 + 9 \text{H}_2\text{SO}_4 + 26 \text{NO} + 4 \text{H}_2\text{O}$	7 marks
Award 1 mark for each correct value on each reactant and product. Allow correct multiples.	

Total for Question 4 = 7 marks