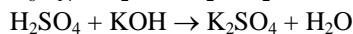
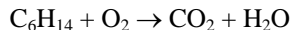
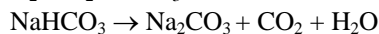
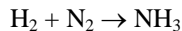
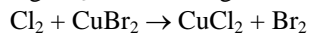
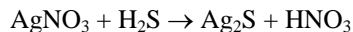


## Unit 2 Practice Problems (with answers at end)

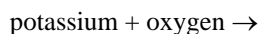
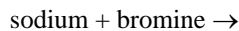
The gods too are fond of a joke. --Aristotle

### Balancing chemical reactions

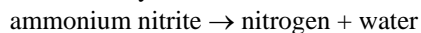
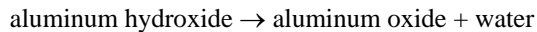
1. Balance each equation below and tell which of the three types of reactions is involved.



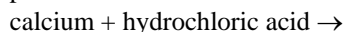
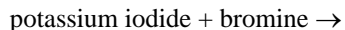
2. The following are the beginnings of *combination* reactions. Write balanced reactions for them.



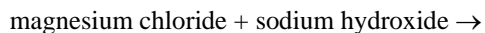
3. The following are *decomposition* reactions. Write balanced reactions for them.



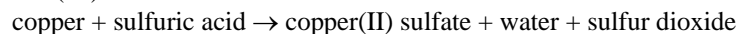
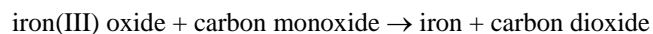
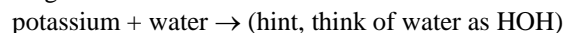
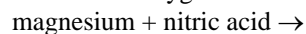
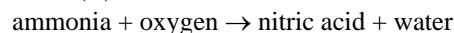
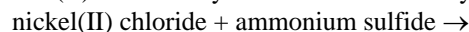
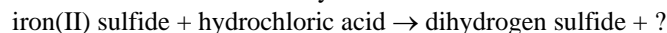
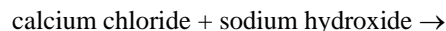
4. The following are the beginnings of *redox displacement* reactions. Write the balanced equations for them.



5. The following are the beginnings of *precipitation* reactions. Write balanced equations for them.



6. Where the word equation is complete, write and balance the chemical equation. Where the word equation is incomplete, complete it and write and balance a chemical equation.



7. If the reactions above are known to occur in water solution, write net-ionic equations that represent the reactions.

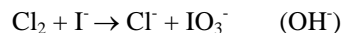
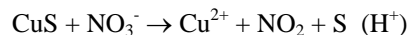
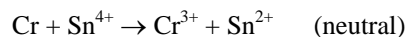
[insoluble substances are:  $\text{Ca}(\text{OH})_2$ ,  $\text{FeS}$ ,  $\text{NiS}$ ,  $\text{Mg}$ ,  $\text{K}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{Fe}$ ,  $\text{Cu}$ ]

[gases include:  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ ,  $\text{H}_2$ ,  $\text{Cl}_2$ ,  $\text{CO}_2$ ,  $\text{SO}_2$ ]

Innovators are inevitably controversial.  
--Eva LeGallienne

### Balancing redox reactions

8. Balance the following redox reactions.



### Oxidation numbers and definitions

9. Return to the previous problem and for each reaction, label the oxidizing agent (OA) and the reducing agent (RA) [hint: look for atoms which have obviously lost or gained electrons].

## Predicting when a reaction will occur

10. In each case below use solubility rules or the activity series to predict if a reaction will occur or not.

- $\text{NaCl} + \text{AgNO}_3 \rightarrow ?$
- $\text{K}_2\text{SO}_4 + \text{NH}_4\text{Cl} \rightarrow ?$
- $\text{Cu} + \text{AgNO}_3 \rightarrow ?$
- $\text{Zn} + \text{MgSO}_4 \rightarrow ?$
- $\text{Br}_2 + \text{FeCl}_3 \rightarrow ?$
- $\text{Ag} + \text{SnCl}_2 \rightarrow ?$
- $\text{Ba}(\text{NO}_3)_2 + \text{Li}_2\text{SO}_4 \rightarrow ?$

## Answers

### 1. 2,1,1,2 precipitation

1,1,1,1 halogen displacement (redox)

3,1,2 combination

2,1,1,1 decomposition

2,19,12,14 combustion

1,2,1,2 acid/base

2.  $2 \text{Na} + \text{Br}_2 \rightarrow 2 \text{NaBr}$

$4 \text{K} + \text{O}_2 \rightarrow 2 \text{K}_2\text{O}$

3.  $2 \text{Al}(\text{OH})_3 \rightarrow \text{Al}_2\text{O}_3 + 3 \text{H}_2\text{O}$

$\text{NH}_4\text{NO}_2 \rightarrow \text{N}_2 + 2 \text{H}_2\text{O}$

4.  $2 \text{KI} + \text{Br}_2 \rightarrow \text{I}_2 + 2 \text{KBr}$

$\text{Ca} + 2 \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$

5.  $\text{MgCl}_2 + 2 \text{NaOH} \rightarrow \text{Mg}(\text{OH})_2 + 2 \text{NaCl}$

$\text{FeSO}_4 + (\text{NH}_4)_2\text{S} \rightarrow \text{FeS} + (\text{NH}_4)_2\text{SO}_4$

6.  $\text{CaCl}_2 + 2 \text{NaOH} \rightarrow \text{Ca}(\text{OH})_2 + 2 \text{NaCl}$

$\text{FeS} + 2 \text{HCl} \rightarrow \text{H}_2\text{S} + \text{FeCl}_2$

$\text{NiCl}_2 + (\text{NH}_4)_2\text{S} \rightarrow \text{NiS} + 2 \text{NH}_4\text{Cl}$

$\text{NH}_3 + 2 \text{O}_2 \rightarrow \text{HNO}_3 + \text{H}_2\text{O}$

$\text{Mg} + 2 \text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2$

$2 \text{K} + 2 \text{H}_2\text{O} \rightarrow 2 \text{KOH} + \text{H}_2$

$2 \text{NaBr} + \text{Cl}_2 \rightarrow 2 \text{NaCl} + \text{Br}_2$

$\text{Fe}_2\text{O}_3 + 3 \text{CO} \rightarrow 2 \text{Fe} + 3 \text{CO}_2$

$\text{Cu} + 2 \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2 \text{H}_2\text{O} + \text{SO}_2$

7.  $\text{Ca}^{2+}(\text{aq}) + 2 \text{OH}^{-}(\text{aq}) \rightarrow \text{Ca}(\text{OH})_2(\text{s})$

$\text{FeS}(\text{s}) + 2 \text{H}^{+}(\text{aq}) \rightarrow \text{H}_2\text{S}(\text{g}) + \text{Fe}^{2+}(\text{aq})$

$\text{Ni}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{NiS}(\text{s})$

$\text{NH}_3(\text{g}) + 2 \text{O}_2(\text{g}) \rightarrow \text{H}^{+}(\text{aq}) + \text{NO}_3^{-}(\text{aq}) + \text{H}_2\text{O}(\ell)$

$\text{Mg}(\text{s}) + 2 \text{H}^{+}(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{H}_2(\text{g})$

$2 \text{K}(\text{s}) + 2 \text{H}_2\text{O}(\ell) \rightarrow 2 \text{K}^{+}(\text{aq}) + 2 \text{OH}^{-}(\text{aq}) + \text{H}_2(\text{g})$

$2 \text{Br}^{-}(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{Cl}^{-}(\text{aq}) + \text{Br}_2(\text{aq})$

$\text{Fe}_2\text{O}_3(\text{s}) + 3 \text{CO}(\text{g}) \rightarrow 2 \text{Fe}(\text{s}) + 3 \text{CO}_2(\text{g})$

$\text{Cu}(\text{s}) + 4 \text{H}^{+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{SO}_2(\text{g}) + 2 \text{H}_2\text{O}(\ell)$

8.  $2 \text{Cr} + 3 \text{Sn}^{4+} \rightarrow 2 \text{Cr}^{3+} + 3 \text{Sn}^{2+}$

$\text{H}_2\text{O} + \text{Br}_2 + \text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-} + 2 \text{Br}^{-} + 2 \text{H}^{+}$

$4 \text{H}^{+} + \text{CuS} + 2 \text{NO}_3^{-} \rightarrow \text{Cu}^{2+} + \text{S} + 2 \text{NO}_2 + 2 \text{H}_2\text{O}$

$3 \text{Cl}_2 + 6 \text{OH}^{-} + \text{I}^{-} \rightarrow 6 \text{Cl}^{-} + \text{IO}_3^{-} + 3 \text{H}_2\text{O}$

9.  $2 \text{Cr} + 3 \text{Sn}^{4+} \rightarrow 2 \text{Cr}^{3+} + 3 \text{Sn}^{2+}$

RA OA

$\text{H}_2\text{O} + \text{Br}_2 + \text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-} + 2 \text{Br}^{-} + 2 \text{H}^{+}$

OA RA

$4 \text{H}^{+} + \text{CuS} + 2 \text{NO}_3^{-} \rightarrow \text{Cu}^{2+} + \text{S} + 2 \text{NO}_2 + 2 \text{H}_2\text{O}$

RA OA

$3 \text{Cl}_2 + 6 \text{OH}^{-} + \text{I}^{-} \rightarrow 6 \text{Cl}^{-} + \text{IO}_3^{-} + 3 \text{H}_2\text{O}$

OA RA

10. a. yes, ppt b. no c. yes d. no e. no f. no g. yes, ppt