

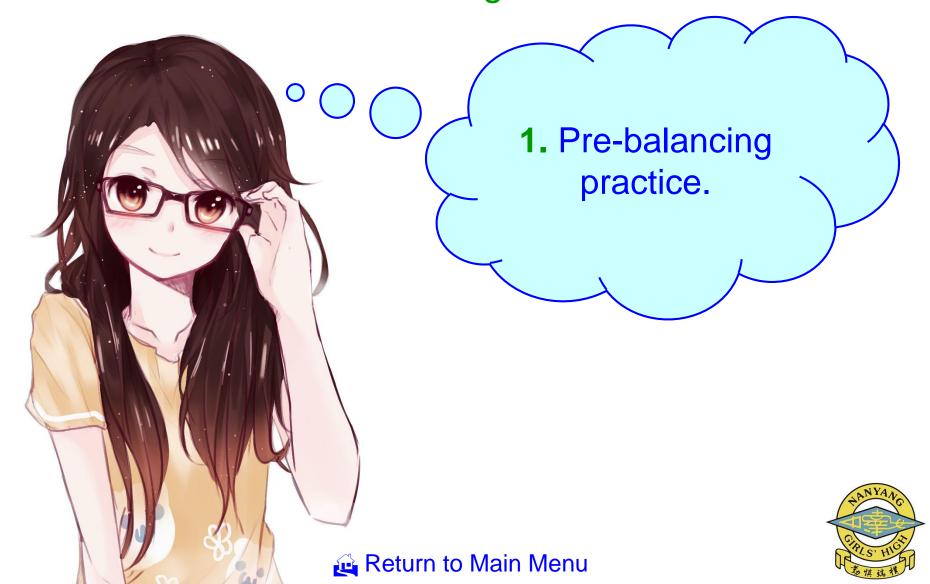
Writing Chemical Formulae And Balanced Chemical Equations

Writing Chemical Formulae and Equations Menu – Click to Link



- 1. Pre-balancing Practice
- 2. Balancing Basic Chemical Equations with Three Terms or Less
 - 3. Balancing Basic Chemical Equations with Four Terms
- **4.** Balancing Intermediate Chemical Equations with Three Terms
- 5. Balancing Intermediate Chemical Equations with Four Terms
 - **6.** Balancing Advanced Chemical Equations with Four Terms
 - 7. Balancing Advanced Chemical Equations with Five Terms
 - **8.** Balancing Advanced Chemical Equations with Six Terms or More





1. How many atoms of each kind are there in the following expression?

 Cl_2



1. How many atoms of each kind are there in the following expression?

 Cl_2

There are 2 atoms of chlorine – Cl



2. How many atoms of each kind are there in the following expression?

CH₄



2. How many atoms of each kind are there in the following expression?

CH₄

- There is 1 atom of carbon C
- There are 4 atoms of hydrogen H



$$Al_2O_3$$



$$Al_2O_3$$

- There are 2 atoms of aluminium Al
 - There are 3 atoms of oxygen O





- There are 2 atoms of carbon C
- There are 5 + 1 = 6 atoms of hydrogen H
 - There is 1 atom of oxygen O



$$Pb(NO_3)_2$$



$$Pb(NO_3)_2$$

- There is 1 atom of lead Pb
- There are 2 atoms of nitrogen N
- There are $2 \times 3 = 6$ atoms of oxygen O



$$Hg_{3}(PO_{4})_{2}$$



$$Hg_3(PO_4)_2$$

- There are 3 atoms of mercury Hg
- There are 2 atoms of phosphorus P
- There are $2 \times 4 = 8$ atoms of oxygen O



$$(NH_4)_2SO_4$$



$$(NH_4)_2SO_4$$

- There are 2 atoms of nitrogen N
- There are $2 \times 4 = 8$ atoms of hydrogen H
 - There is 1 atom of sulfur S
 - There are 4 atoms of oxygen O



8. How many atoms of each kind are there in the following expression?

 $3N_2$



8. How many atoms of each kind are there in the following expression?

 $3N_2$

• There are $3 \times 2 = 6$ atoms of nitrogen – N



9. How many atoms of each kind are there in the following expression?

4Na₂O



- There are $4 \times 2 = 8$ atoms of sodium Na
 - There are 4 atoms of oxygen O





- There are $6 \times 2 = 12$ atoms of hydrogen H
 - There are 6 atoms of sulfur S
 - There are $6 \times 4 = 24$ atoms of oxygen O



$$5C_{12}H_{22}O_{11}$$



$$5C_{12}H_{22}O_{11}$$

- There are $5 \times 12 = 60$ atoms of carbon C
- There are $5 \times 22 = 110$ atoms of hydrogen H
 - There are $5 \times 11 = 55$ atoms of oxygen O



$$2Al_2(CO_3)_3$$



$$2Al_2(CO_3)_3$$

- There are $2 \times 2 = 4$ atoms of aluminium -Al
 - There are $2 \times 3 = 6$ atoms of carbon C
- There are $2 \times 3 \times 3 = 18$ atoms of oxygen O



$$4Sn(NO_3)_2$$



$$4Sn(NO_3)_2$$

- There are 4 atoms of tin Sn
- There are $4 \times 2 = 8$ atoms of nitrogen N
- There are $4 \times 2 \times 3 = 24$ atoms of oxygen O



$$5(NH_4)_2S$$



$$5(NH_4)_2S$$

- There are $5 \times 2 = 10$ atoms of nitrogen N
- There are $5 \times 2 \times 4 = 40$ atoms of hydrogen H
 - There are 5 atoms of sulfur S



$$2Fe + 3Cl_2$$



$$2Fe + 3Cl_2$$

- There are 2 atoms of iron Fe
- There are $3 \times 2 = 6$ atoms of chlorine Cl



$$2C_6H_{14} + 19O_2$$



$$2C_6H_{14} + 19O_2$$

- There are $2 \times 6 = 12$ atoms of carbon C
- There are $2 \times 14 = 28$ atoms of hydrogen H
 - There are $19 \times 2 = 38$ atoms of oxygen O



$$Al_2(SO_4)_3 + 3Ca(OH)_2$$



Writing Chemical Formulae and Equations Pre-balancing Practice

17. How many atoms of each kind are there in the following expression?

$$Al_2(SO_4)_3 + 3Ca(OH)_2$$

- There are 2 atoms of aluminium Al
 - There are 3 atoms of sulfur S
- There are $(4 \times 3) + (3 \times 2) = 18$ atoms of oxygen O
 - There are 3 atoms of calcium Ca
 - There are $3 \times 2 = 6$ atoms of Hydrogen H



Writing Chemical Formulae and Equations Pre-balancing Practice

18. How many atoms of each kind are there in the following expression?

$$4Pb(CH_3COO)_2 + 4H_2S$$

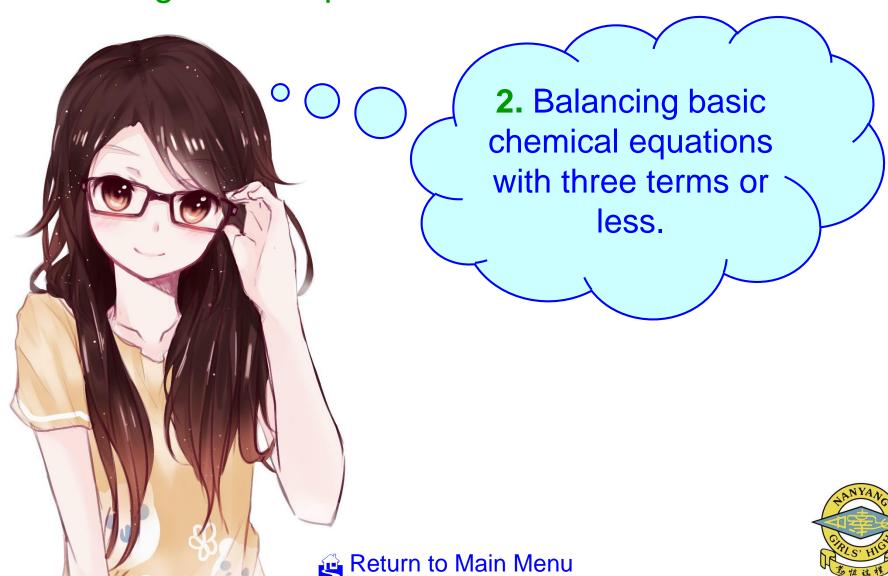


Writing Chemical Formulae and Equations Pre-balancing Practice

18. How many atoms of each kind are there in the following expression?

$$4Pb(CH_3COO)_2 + 4H_2S$$

- There are 4 atoms of lead Pb
- There are $4 \times 2 \times 2 = 16$ atoms of carbon C
- There are $(4 \times 3 \times 2) + (4 \times 2) = 32$ atoms of hydrogen H
 - There are $4 \times 2 \times 2 = 16$ atoms of oxygen O
 - There are 4 atoms of sulfur S



$$N_2O_4 \rightarrow NO_2$$



1. Balance the following reaction.

$$N_2O_4 \rightarrow NO_2$$

$$N_2O_4 \rightarrow 2NO_2$$



$$O_2 \rightarrow O_3$$



2. Balance the following reaction.

$$O_2 \rightarrow O_3$$

$$3O_2 \rightarrow 2O_3$$



$$C_6H_6 \rightarrow C_2H_2$$



3. Balance the following reaction.

$$C_6H_6 \rightarrow C_2H_2$$

$$C_6H_6 \rightarrow 3C_2H_2$$



$$C_6H_{12}O_6 \rightarrow CH_2O$$



4. Balance the following reaction.

$$C_6H_{12}O_6 \rightarrow CH_2O$$

$$C_6H_{12}O_6 \rightarrow 6CH_2O$$



$$C + O_2 \rightarrow CO$$



5. Balance the following reaction.

$$C + O_2 \rightarrow CO$$

$$2C + O_2 \rightarrow 2CO$$



$$H_2 + F_2 \rightarrow HF$$



6. Balance the following reaction.

$$H_2 + F_2 \rightarrow HF$$

$$H_2 + F_2 \rightarrow 2HF$$



$$Xe + F_2 \rightarrow XeF_6$$



7. Balance the following reaction.

$$Xe + F_2 \rightarrow XeF_6$$

$$Xe + 3F_2 \rightarrow XeF_6$$



Fe +
$$O_2 \rightarrow FeO$$



8. Balance the following reaction.

Fe +
$$O_2 \rightarrow FeO$$

2Fe +
$$O_2 \rightarrow 2FeO$$



$$C + F_2 \rightarrow CF_4$$



9. Balance the following reaction.

$$C + F_2 \rightarrow CF_4$$

$$C + 2F_2 \rightarrow CF_4$$



$$U + F_2 \rightarrow UF_6$$

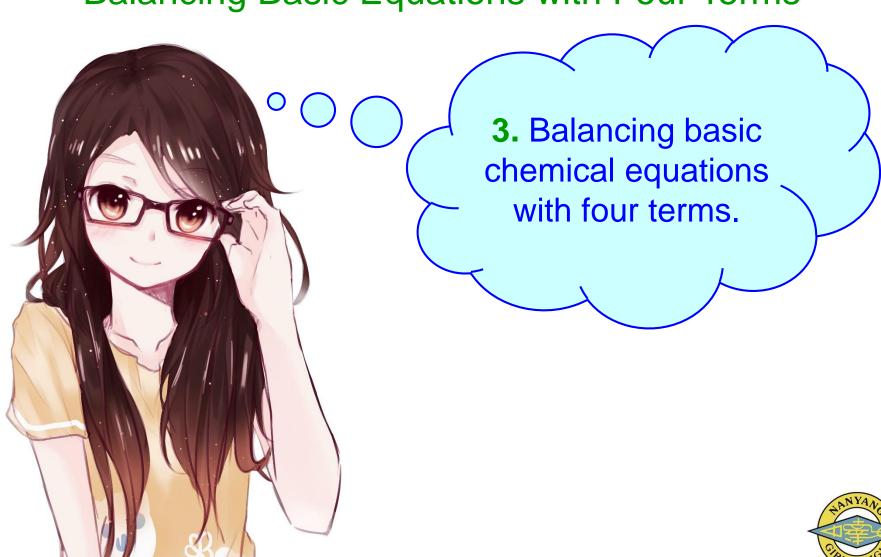


10. Balance the following reaction.

$$U + F_2 \rightarrow UF_6$$

$$U + 3F_2 \rightarrow UF_6$$





Return to Main Menu

$$Zn + HCl \rightarrow ZnCl_2 + H_2$$



1. Balance the following reaction.

$$Zn + HCl \rightarrow ZnCl_2 + H_2$$

$$Zn + 2HCl \rightarrow ZnCl_2 + 2H_2$$



$$CH_4 + H_2O \rightarrow CO + H_2$$



2. Balance the following reaction.

$$CH_4 + H_2O \rightarrow CO + H_2$$

$$CH_4 + H_2O \rightarrow CO + 3H_2$$



$$C + H_2O \rightarrow CH_4 + CO_2$$



3. Balance the following reaction.

$$C + H_2O \rightarrow CH_4 + CO_2$$

$$2C + 2H_2O \rightarrow CH_4 + CO_2$$



$$KBr + Cl_2 \rightarrow KCl + Br_2$$



4. Balance the following reaction.

$$KBr + Cl_2 \rightarrow KCl + Br_2$$

$$2KBr + Cl_2 \rightarrow 2KCl + Br_2$$



$$CS_2 + O_2 \rightarrow CO_2 + SO_2$$



5. Balance the following reaction.

$$CS_2 + O_2 \rightarrow CO_2 + SO_2$$

$$CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$$



$$WO_3 + H_2 \rightarrow W + H_2O$$



6. Balance the following reaction.

$$WO_3 + H_2 \rightarrow W + H_2O$$

$$WO_3 + 3H_2 \rightarrow W + 3H_2O$$



$$CH_4 + O_2 \rightarrow CO_2 + H_2O$$



7. Balance the following reaction.

$$CH_4 + O_2 \rightarrow CO_2 + H_2O$$

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$



$$CH_4 + Cl_2 \rightarrow CCl_4 + HCl$$



8. Balance the following reaction.

$$CH_4 + Cl_2 \rightarrow CCl_4 + HCl$$

$$CH_4 + 4Cl_2 \rightarrow CCl_4 + 4HCl$$



$$Al + ZnCl_2 \rightarrow AlCl_3 + Zn$$



9. Balance the following reaction.

$$Al + ZnCl_2 \rightarrow AlCl_3 + Zn$$

$$2Al + 3ZnCl_2 \rightarrow 2AlCl_3 + 3Zn$$



$$CuS + O_2 \rightarrow CuO + SO_2$$



10. Balance the following reaction.

$$CuS + O_2 \rightarrow CuO + SO_2$$

$$2CuS + 3O_2 \rightarrow 2CuO + 2SO_2$$





$$N_2O + NO_2 \rightarrow NO$$



1. Balance the following reaction.

$$N_2O + NO_2 \rightarrow NO$$

$$N_2O + NO_2 \rightarrow 3NO$$



$$C + H_2 \rightarrow C_5H_{12}$$



2. Balance the following reaction.

$$C + H_2 \rightarrow C_5 H_{12}$$

$$5C + 6H_2 \rightarrow C_5H_{12}$$



$$K_2O + H_2O \rightarrow KOH$$



3. Balance the following reaction.

$$K_2O + H_2O \rightarrow KOH$$

$$K_2O + H_2O \rightarrow 2KOH$$



$$KClO_3 \rightarrow KCl + O_2$$



4. Balance the following reaction.

$$KClO_3 \rightarrow KCl + O_2$$

$$2KClO_3 \rightarrow 2KCl + 3O_2$$



$$Na + H_2O \rightarrow NaOH + H_2$$



5. Balance the following reaction.

$$Na + H_2O \rightarrow NaOH + H_2$$

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$



$$P_4O_{10} + H_2O \rightarrow H_3PO_4$$



6. Balance the following reaction.

$$P_4O_{10} + H_2O \rightarrow H_3PO_4$$

$$P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$$



$$Ni(CO)_4 \rightarrow Ni + CO$$



7. Balance the following reaction.

$$Ni(CO)_4 \rightarrow Ni + CO$$

$$Ni(CO)_4 \rightarrow Ni + 4CO$$



CaO +
$$P_2O_5 \rightarrow Ca_3(PO_4)_2$$



8. Balance the following reaction.

CaO +
$$P_2O_5 \rightarrow Ca_3(PO_4)_2$$

$$3CaO + P2O5 \rightarrow Ca3(PO4)2$$



$$Ca_3(PO_4)_2 + H_3PO_4 \rightarrow Ca(H_2PO_4)_2$$



9. Balance the following reaction.

$$Ca_3(PO_4)_2 + H_3PO_4 \rightarrow Ca(H_2PO_4)_2$$

$$Ca_3(PO_4)_2 + 4H_3PO_4 \rightarrow 3Ca(H_2PO_4)_2$$



$$C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$$

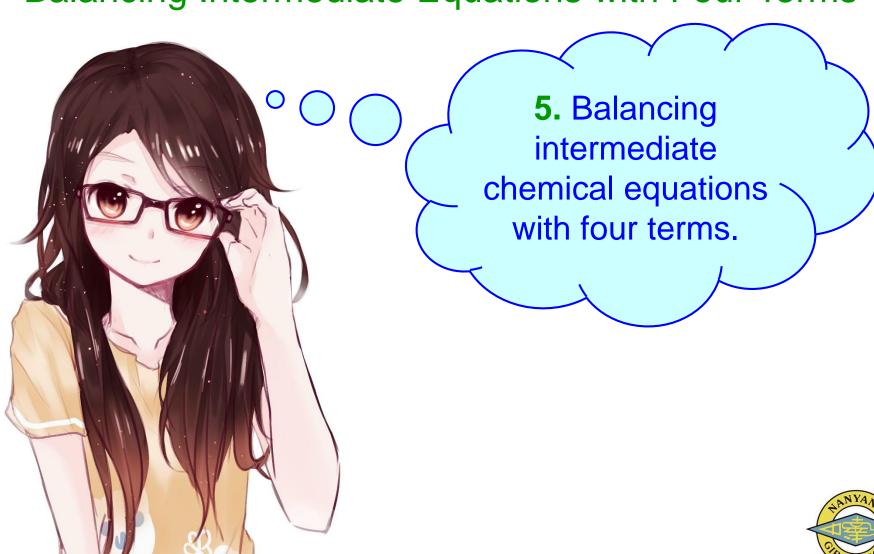


10. Balance the following reaction.

$$C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$$

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$





Return to Main Menu

$$NO_2 + O_3 \rightarrow N_2O_5 + O_2$$



1. Balance the following reaction.

$$NO_2 + O_3 \rightarrow N_2O_5 + O_2$$

$$2NO_2 + O_3 \rightarrow N_2O_5 + O_2$$



$$Fe_2O_3 + CO \rightarrow Fe + CO_2$$



2. Balance the following reaction.

$$Fe_2O_3 + CO \rightarrow Fe + CO_2$$

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$



$$N_2H_4 + N_2O_4 \rightarrow N_2 + H_2O_4$$



3. Balance the following reaction.

$$N_2H_4 + N_2O_4 \rightarrow N_2 + H_2O_4$$

$$2N_2H_4 + N_2O_4 \rightarrow 3N_2 + 4H_2O$$



$$SiCl_4 + H_2O \rightarrow SiO_2 + HCl$$



4. Balance the following reaction.

$$SiCl_4 + H_2O \rightarrow SiO_2 + HCl$$

$$SiCl_4 + 2H_2O \rightarrow SiO_2 + 4HCl$$



$$C + As_2O_3 \rightarrow CO_2 + As$$



5. Balance the following reaction.

$$C + As_2O_3 \rightarrow CO_2 + As$$

$$3C + 2As_2O_3 \rightarrow 3CO_2 + 4As$$



$$Fe_2O_3 + S \rightarrow Fe + SO_2$$



6. Balance the following reaction.

$$Fe_2O_3 + S \rightarrow Fe + SO_2$$

$$2Fe_2O_3 + 3S \rightarrow 4Fe + 3SO_2$$



Fe + CuSO₄
$$\rightarrow$$
 Fe₂(SO₄)₃ + Cu



7. Balance the following reaction.

Fe + CuSO₄
$$\rightarrow$$
 Fe₂(SO₄)₃ + Cu

2Fe +
$$3CuSO_4 \rightarrow Fe_2(SO_4)_3 + 3Cu$$



$$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$$



8. Balance the following reaction.

$$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$$

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$



$$Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$$



9. Balance the following reaction.

$$Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$$

$$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$$



$$Fe_2O_3 + Cl_2 \rightarrow FeCl_3 + O_2$$

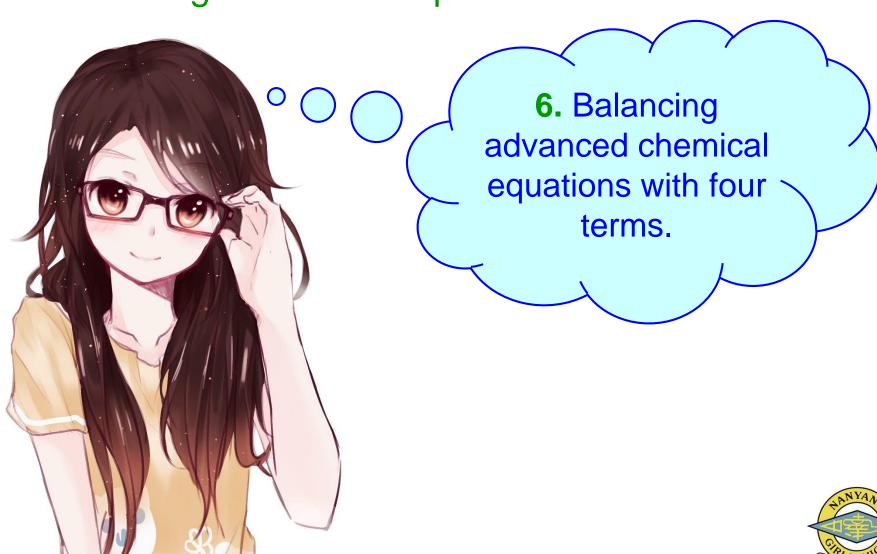


10. Balance the following reaction.

$$Fe_2O_3 + Cl_2 \rightarrow FeCl_3 + O_2$$

$$2Fe_2O_3 + 6Cl_2 \rightarrow 4FeCl_3 + 3O_2$$





Return to Main Menu

$$PBr_3 + H_2O \rightarrow H_3PO_3 + HBr$$



1. Balance the following reaction.

$$PBr_3 + H_2O \rightarrow H_3PO_3 + HBr$$

$$PBr_3 + 3H_2O \rightarrow H_3PO_3 + 3HBr$$



$$Al_2O_3 + HCl \rightarrow AlCl_3 + H_2O$$



2. Balance the following reaction.

$$Al_2O_3 + HCl \rightarrow AlCl_3 + H_2O$$

$$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$$



$$PbS + H_2O_2 \rightarrow PbSO_4 + H_2O_4$$



3. Balance the following reaction.

$$PbS + H_2O_2 \rightarrow PbSO_4 + H_2O_4$$

$$PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O_3$$



$$N_2H_4 + H_2O_2 \rightarrow NO_2 + H_2O_3$$



4. Balance the following reaction.

$$N_2H_4 + H_2O_2 \rightarrow NO_2 + H_2O_3$$

$$N_2H_4 + 6H_2O_2 \rightarrow 2NO_2 + 8H_2O_3$$



$$Mg_3N_2 + H_2SO_4 \rightarrow MgSO_4 + (NH_4)_2SO_4$$



5. Balance the following reaction.

$$Mg_3N_2 + H_2SO_4 \rightarrow MgSO_4 + (NH_4)_2SO_4$$

$$Mg_3N_2 + 4H_2SO_4 \rightarrow 3MgSO_4 + (NH_4)_2SO_4$$



$$Ca_3P_2 + H_2O \rightarrow Ca(OH)_2 + PH_3$$



6. Balance the following reaction.

$$Ca_3P_2 + H_2O \rightarrow Ca(OH)_2 + PH_3$$

$$Ca_3P_2 + 6H_2O \rightarrow 3Ca(OH)_2 + 2PH_3$$



$$Al_2S_3 + H_2O \rightarrow Al(OH)_3 + H_2S$$



7. Balance the following reaction.

$$Al_2S_3 + H_2O \rightarrow Al(OH)_3 + H_2S$$

$$Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$$



$$NH_4NO_3 \rightarrow H_2O + N_2 + O_2$$



8. Balance the following reaction.

$$NH_4NO_3 \rightarrow H_2O + N_2 + O_2$$

$$2NH_4NO_3 \rightarrow 4H_2O + 2N_2 + O_2$$



$$Al_4C_3 + H_2O \rightarrow Al(OH)_3 + CH_4$$



9. Balance the following reaction.

$$Al_4C_3 + H_2O \rightarrow Al(OH)_3 + CH_4$$

$$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$$



$$C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$$

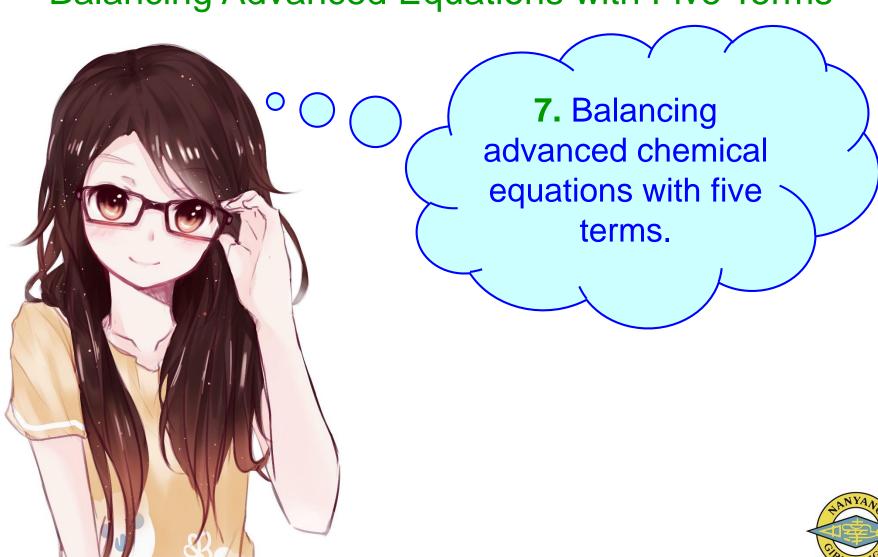


10. Balance the following reaction.

$$C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$$

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$





Return to Main Menu

$$MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$$



1. Balance the following reaction.

$$MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$$

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$



$$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$$



2. Balance the following reaction.

$$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$$

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$



$$Al + NaOH + H_2O \rightarrow NaAl(OH)_4 + H_2$$



3. Balance the following reaction.

$$Al + NaOH + H_2O \rightarrow NaAl(OH)_4 + H_2$$

$$2Al + 2NaOH + 6H2O \rightarrow 2NaAl(OH)4 + 3H2$$



$$FeCl_2 + H_2O \rightarrow Fe_3O_4 + HCl + H_2$$



4. Balance the following reaction.

$$FeCl_2 + H_2O \rightarrow Fe_3O_4 + HCl + H_2$$

$$3FeCl_2 + 4H_2O \rightarrow Fe_3O_4 + 6HCl + H_2$$



$$C_2H_5NO_2 + O_2 \rightarrow CO_2 + H_2O + N_2$$



5. Balance the following reaction.

$$C_2H_5NO_2 + O_2 \rightarrow CO_2 + H_2O + N_2$$

$$4C_2H_5NO_2 + 9O_2 \rightarrow 8CO_2 + 10H_2O + 2N_2$$





$$KNO_3 + C + S_8 \rightarrow K_2S + CO_2 + N_2$$



1. Balance the following reaction.

$$KNO_3 + C + S_8 \rightarrow K_2S + CO_2 + N_2$$

$$16KNO_3 + 24C + S_8 \rightarrow 8K_2S + 24CO_2 + 8N_2$$



$$KMnO_4 + HCl \rightarrow KCl + MnCl_2 + H_2O + Cl_2$$



2. Balance the following reaction.

$$KMnO_4 + HCl \rightarrow KCl + MnCl_2 + H_2O + Cl_2$$

$$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$$



$$Al + NH_4ClO_4 \rightarrow Al_2O_3 + AlCl_3 + NO + H_2O$$



3. Balance the following reaction.

$$Al + NH_4ClO_4 \rightarrow Al_2O_3 + AlCl_3 + NO + H_2O$$

$$3Al + 3NH_4ClO_4 \rightarrow Al_2O_3 + AlCl_3 + 3NO + 6H_2O$$



AgBr + NaOH +
$$C_6H_6O_2 \rightarrow Ag + NaBr + C_6H_4O_2 + H_2O$$



4. Balance the following reaction.

AgBr + NaOH +
$$C_6H_6O_2 \rightarrow Ag + NaBr + C_6H_4O_2 + H_2O$$

2AgBr + 2NaOH +
$$C_6H_6O_2$$

 \downarrow
2Ag + 2NaBr + $C_6H_4O_2$ + 2 H_2O



$$KMnO_4 + H_2C_2O_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + CO_2 + H_2O_4$$



5. Balance the following reaction.

$$KMnO_4 + H_2C_2O_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + CO_2 + H_2O_4$$

$$2KMnO_{4} + 5H_{2}C_{2}O_{4} + 3H_{2}SO_{4}$$

$$\downarrow$$

$$K_{2}SO_{4} + 2MnSO_{4} + 10CO_{2} + 8H_{2}O$$



Writing Chemical Formulae and Equations



Presentation on
Writing Chemical Formulae
and Equations
by Dr. Chris Slatter
christopher_john_slatter@nygh.edu.sg

Nanyang Girls' High School

2 Linden Drive Singapore 288683

12th August 2018

