

Reactions Practice Quiz!

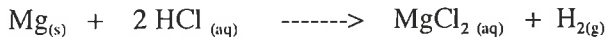
predict products for each rxn, write phase subscripts, and balance each equation. (Five of these are N.R.)

1. $\text{CuSO}_4 + \text{AgNO}_3$ -----> _____
2. $\text{Al}_2(\text{CO}_3)_3 + \text{HI}$ -----> _____
3. $\text{Cu} + \text{AgNO}_3$ -----> _____ (cupric)
4. $\text{Cu} + \text{HCl}$ -----> _____
5. $\text{C}_7\text{H}_{16} + \text{O}_2$ -----> _____
6. $\text{Fe} + \text{O}_2$ -----> _____ (ferric)
7. $\text{Al}(\text{NO}_3)_3 + \text{Na}_2\text{SO}_4$ -----> _____
8. $\text{Al}(\text{NO}_3)_3 + \text{Na}_2\text{CO}_3$ -----> _____
9. $\text{Al} + \text{Zn}(\text{NO}_3)_2$ -----> _____
10. $\text{Li} + \text{H}_2\text{O}$ -----> _____
11. $\text{Li} + \text{H}_2\text{SO}_4$ -----> _____
12. $\text{C}_8\text{H}_{16} + \text{O}_2$ -----> _____
13. $\text{NaCl} + \text{F}_2$ -----> _____
14. $\text{Cl}_2 + \text{AlBr}_3$ -----> _____
15. $\text{O}_2 + \text{K}$ -----> _____
16. $\text{I}_2 + \text{KF}$ -----> _____
17. $\text{CuNO}_3 + \text{CuCl}_2$ -----> _____ (not a NR!)
18. $\text{HCl} + \text{NaOH}$ -----> _____
19. $\text{HCl} + \text{Na}_2\text{CO}_3$ -----> _____
20. $(\text{NH}_4)_3\text{PO}_4 + \text{BaCl}_2$ -----> _____
21. $\text{C}_7\text{H}_{14} + \text{O}_2$ -----> _____
22. $\text{H}_2\text{SO}_4 + \text{KOH}$ -----> _____
23. $\text{Cl}_2 + \text{NaI}$ -----> _____
24. $\text{Na} + \text{H}_2\text{O}$ -----> _____
25. $\text{Zn} + \text{H}_2\text{O}$ -----> _____
26. $\text{Al} + \text{FeSO}_4$ -----> _____
27. $\text{Rb} + \text{H}_2\text{O}$ -----> _____ (Not a NR)
28. $\text{Ba} + \text{HCl}$ -----> _____
29. $\text{BaCO}_3 + \text{HCl}$ -----> _____
30. $\text{BaCl}_2 + \text{H}_2\text{SO}_4$ -----> _____
31. $\text{Ba} + \text{H}_2\text{SO}_4$ -----> _____
32. $\text{Mg} + \text{HClO}_4$ -----> _____
33. $\text{Na} + \text{N}_2$ \longrightarrow _____
34. $\text{H}_2\text{O} + \text{Ca}$ \longrightarrow _____
35. $\text{Cl}_2 + \text{K}$ \longrightarrow _____

Stoichiometry Practice!!!



1. What mass of nitric acid is needed to react with 0.10 moles of copper?
- 2.a. If 10.0 grams of copper are allowed to react with 0.500 moles of nitric acid, how many molecules of nitrogen monoxide should be able to form?
- b. Which reactant is the limiting reactant in part (a)?
- 3.a. If 39 grams of copper are allowed to react with 2.0 moles of nitric acid, how many moles of copper (II) nitrate should form?
- b. If 0.59 moles of copper (II) nitrate are actually collected when the reaction occurs (in part a), what was the percent yield for the reaction?
4. What mass of copper must react to produce 17 grams of nitrogen monoxide?
- 5.a. If a piece of copper containing 5.0×10^{22} atoms is dropped into a solution containing 5.0 grams of nitric acid, what mass of water should form?
- b. Which reactant will still remain once the reaction has gone to completion as far as possible?

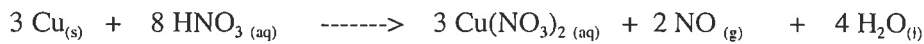


- 6.a. If 2.0×10^{23} Mg atoms react with 0.50 moles of hydrochloric acid, what mass of hydrogen gas could form?
- b. If 0.48 grams of hydrogen gas are actually collected in part (a), calculate the percent yield.
- c. Which reactant was the limiting reactant, and which was the excess reactant, in part (a)?
7. How many moles of hydrochloric acid are necessary to produce 0.20 moles of hydrogen gas?

Answers! 1. 17 grams 2. 6.32×10^{22} or 7.53×10^{22} molecules ; Cu was the limiting reactant.
3. 0.61 moles or 0.75 moles, 96% yield. 4. 54 grams Cu.
5. 2.0 grams or 0.71 grams water; some Cu will remain.
6. 0.67 g or 0.50 g, 95% yield, HCl was limiting and Mg was excess. 7. 0.40 moles HCl.

*(see the next two pages for the answer key,
with work shown)*

Stoichiometry Practice!!!



1. What mass of nitric acid is needed to react with 0.10 moles of copper?

$$(0.10 \text{ moles Cu}) \left(\frac{8 \text{ moles HNO}_3}{3 \text{ moles Cu}} \right) \left(\frac{63.0128 \text{ g}}{1 \text{ mole}} \right) = 16.80 \rightarrow \boxed{17 \text{ grams HNO}_3}$$

← molar mass of HNO₃

2.a. If 10.0 grams of copper are allowed to react with 0.500 moles of nitric acid, how many molecules of nitrogen monoxide should be able to form?

$$(10.0 \text{ g Cu}) \left(\frac{1 \text{ mole}}{63.546 \text{ g}} \right) \left(\frac{2 \text{ mole NO}}{3 \text{ mole Cu}} \right) \left(\frac{6.02 \times 10^{23} \text{ molec.}}{1 \text{ mole}} \right) = \boxed{6.32 \times 10^{22} \text{ molecules}}$$

molar mass of Cu

$$(0.500 \text{ mole HNO}_3) \left(\frac{2 \text{ mole NO}}{8 \text{ mole HNO}_3} \right) \left(\frac{6.02 \times 10^{23} \text{ molec.}}{1 \text{ mole}} \right) = \cancel{7.33 \times 10^{22} \text{ molecules}}$$

b. Which reactant is the limiting reactant in part (a)?

Cu is the limiting reactant. (HNO₃ is the excess reactant.
Cu will be entirely consumed. Some of it will remain after the rxn)

3a. If 39 grams of copper are allowed to react with 2.0 moles of nitric acid, how many moles of copper (II) nitrate should form?

$$(39 \text{ g Cu}) \left(\frac{1 \text{ mole}}{63.546 \text{ g}} \right) \left(\frac{3 \text{ mole Cu}(\text{NO}_3)_2}{3 \text{ mole Cu}} \right) = 0.61 \text{ moles Cu}(\text{NO}_3)_2$$

← 0.61373 before rounding

$$(2.0 \text{ mole HNO}_3) \left(\frac{3 \text{ moles Cu}(\text{NO}_3)_2}{8 \text{ moles HNO}_3} \right) = 0.75 \text{ moles Cu}(\text{NO}_3)_2$$

so 0.61 moles Cu(NO₃)₂ could form.

b. If 0.59 moles of copper (II) nitrate are actually collected when the reaction occurs (in part a), what was the percent yield for the reaction?

$$\% \text{ yield} = \frac{\text{actual}}{\text{expected}} \times 100 = \frac{0.59 \text{ moles}}{0.61373 \text{ moles}} \times 100 = 96.13 \%$$

96% yield

4. What mass of copper must react to produce 17 grams of nitrogen monoxide?

$$(17 \text{ g NO}) \left(\frac{1 \text{ mole}}{30.0061 \text{ g}} \right) \left(\frac{3 \text{ moles Cu}}{2 \text{ moles NO}} \right) \left(\frac{63.546 \text{ g}}{1 \text{ mole}} \right) = \boxed{54 \text{ grams Cu}}$$



5a. If a piece of copper containing 5.0×10^{22} atoms is dropped into a solution containing 5.0 grams of nitric acid, what mass of water should form?

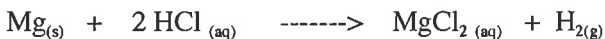
$$(5.0 \times 10^{22} \text{ Cu atoms}) \left(\frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ atoms}} \right) \left(\frac{4 \text{ moles H}_2\text{O}}{3 \text{ moles Cu}} \right) \left(\frac{18.0152 \text{ g}}{1 \text{ mole}} \right) = 1.995 \text{ g H}_2\text{O}$$

~~2.0 g H₂O~~

$$(5.0 \text{ g HNO}_3) \left(\frac{1 \text{ mole}}{63.0128 \text{ g}} \right) \left(\frac{4 \text{ mole H}_2\text{O}}{8 \text{ mole HNO}_3} \right) \left(\frac{18.0152 \text{ g}}{1 \text{ mole}} \right) = \boxed{0.71 \text{ g H}_2\text{O}}$$

b. Which reactant will still remain once the reaction has gone to completion as far as possible?

Cu (it is the excess reactant)



6a. If 2.0×10^{23} Mg atoms react with 0.50 moles of hydrochloric acid, what mass of hydrogen gas could form?

$$(2.0 \times 10^{23} \text{ Mg atoms}) \left(\frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ atoms}} \right) \left(\frac{1 \text{ mole H}_2}{1 \text{ mole Mg}} \right) \left(\frac{2.0158 \text{ g}}{1 \text{ mole}} \right) = 0.66970 \text{ g H}_2$$

~~0.67 g H₂~~

$$(0.50 \text{ mole HCl}) \left(\frac{1 \text{ mole H}_2}{2 \text{ mole HCl}} \right) = 0.25 \text{ moles H}_2$$

$$(0.25 \text{ mole H}_2) \left(\frac{2.0158 \text{ g}}{1 \text{ mole}} \right) = 0.50395 \text{ grams H}_2 \rightarrow \boxed{0.50 \text{ g H}_2}$$

or all in one step $(0.50 \text{ mole HCl}) \left(\frac{1 \text{ mole H}_2}{2 \text{ mole HCl}} \right) \left(\frac{2.0158 \text{ g}}{1 \text{ mole}} \right) = 0.50395 \text{ g H}_2$

b. If 0.48 grams of hydrogen gas are actually collected in part (a), calculate the percent yield.

$$\% \text{ yield} = \frac{\text{actual}}{\text{expected}} \times 100 = \frac{0.48 \text{ g}}{0.50395 \text{ g}} \times 100 = 95.248 \% \rightarrow \boxed{95 \% \text{ yield}}$$

c. Which reactant was the limiting reactant, and which was the excess reactant, in part (a)?

HCl was the limiting reactant. Mg was the excess reactant.

7. How many moles of hydrochloric acid are necessary to produce 0.20 moles of hydrogen gas?

$$(0.20 \text{ mole H}_2) \left(\frac{2 \text{ mole HCl}}{1 \text{ mole H}_2} \right) = \boxed{0.40 \text{ moles HCl}}$$

1. $\text{CuSO}_4 + \text{AgNO}_3$ -----> ~~$\text{Cu}(\text{NO}_3)_2(\text{aq}) + \text{Ag}_2\text{SO}_4(\text{aq})$~~ N.R.
2. $\text{Al}_2(\text{CO}_3)_3 + 6\text{HI}$ -----> $2\text{AlI}_3(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) + 3\text{CO}_2(\text{g})$
3. $\text{Cu} + 2\text{AgNO}_3$ -----> $\text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$ (cupric)
4. $\text{Cu} + \text{HCl}$ -----> N.R.
5. $\text{C}_7\text{H}_{16} + 11\text{O}_2$ -----> $7\text{CO}_2(\text{g}) + 8\text{H}_2\text{O}(\text{g})$
6. $4\text{Fe} + 3\text{O}_2$ -----> $2\text{Fe}_2\text{O}_3(\text{s})$ (ferric)
7. $\text{Al}(\text{NO}_3)_3 + \text{Na}_2\text{SO}_4$ -----> ~~$\text{Al}_2(\text{SO}_4)_3(\text{aq}) + \text{NaNO}_3(\text{aq})$~~ N.R.
8. $2\text{Al}(\text{NO}_3)_3 + 3\text{Na}_2\text{CO}_3$ -----> $\text{Al}_2(\text{CO}_3)_3(\text{s}) + 6\text{NaNO}_3(\text{aq})$
9. $2\text{Al} + 3\text{Zn}(\text{NO}_3)_2$ -----> $2\text{Al}(\text{NO}_3)_3(\text{aq}) + 3\text{Zn}(\text{s})$
10. $2\text{Li} + 2\text{H}_2\text{O}$ -----> $2\text{LiOH}(\text{aq}) + \text{H}_2(\text{g})$
11. $2\text{Li} + \text{H}_2\text{SO}_4$ -----> $\text{Li}_2\text{SO}_4(\text{aq}) + \text{H}_2(\text{g})$
12. $\text{C}_8\text{H}_{16} + 12\text{O}_2$ -----> $8\text{CO}_2(\text{g}) + 8\text{H}_2\text{O}(\text{g})$
13. $2\text{NaCl} + \text{F}_2$ -----> $2\text{NaF}(\text{aq}) + \text{Cl}_2(\text{g})$
14. $3\text{Cl}_2 + 2\text{AlBr}_3$ -----> $2\text{AlCl}_3(\text{aq}) + 3\text{Br}_2(\text{l})$
15. $\text{O}_2 + 4\text{K}$ -----> $2\text{K}_2\text{O}(\text{s})$ ← you don't need a solubility chart here... why not?
16. $\text{I}_2 + \text{KF}$ -----> N.R.
17. $2\text{CuNO}_3 + \text{CuCl}_2$ -----> $2\text{CuCl}(\text{s}) + \text{Cu}(\text{NO}_3)_2$ (not a NR!)
18. $\text{HCl} + \text{NaOH}$ -----> $\text{H}_2\text{O}(\text{l}) + \text{NaCl}(\text{aq})$
19. $2\text{HCl} + \text{Na}_2\text{CO}_3$ -----> $\text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + 2\text{NaCl}(\text{aq})$
20. $2(\text{NH}_4)_3\text{PO}_4 + 3\text{BaCl}_2$ -----> $\text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NH}_4\text{Cl}(\text{aq})$
21. $2\text{C}_7\text{H}_{14} + 21\text{O}_2$ -----> $14\text{CO}_2(\text{g}) + 14\text{H}_2\text{O}(\text{g})$
22. $\text{H}_2\text{SO}_4 + 2\text{KOH}$ -----> $2\text{H}_2\text{O}(\text{l}) + \text{K}_2\text{SO}_4(\text{aq})$
23. $\text{Cl}_2 + 2\text{NaI}$ -----> $2\text{NaCl}(\text{aq}) + \text{I}_2(\text{s})$
24. $2\text{Na} + 2\text{H}_2\text{O}$ -----> $2\text{NaOH}(\text{aq}) + \text{H}_2(\text{g})$
25. $\text{Zn} + \text{H}_2\text{O}$ -----> N.R.
26. $\text{Al} + \text{FeSO}_4$ -----> $\text{Al}_2(\text{SO}_4)_3(\text{aq}) + \text{Fe}(\text{s})$
27. $2\text{Rb} + 2\text{H}_2\text{O}$ -----> $2\text{RbOH}(\text{aq}) + \text{H}_2(\text{g})$ (Not a NR)
28. $\text{Ba} + 2\text{HCl}$ -----> $\text{BaCl}_2(\text{aq}) + \text{H}_2(\text{g})$
29. $\text{BaCO}_3 + 2\text{HCl}$ -----> $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
30. $\text{BaCl}_2 + \text{H}_2\text{SO}_4$ -----> $\text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
31. $\text{Ba} + \text{H}_2\text{SO}_4$ -----> $\text{BaSO}_4(\text{s}) + \text{H}_2(\text{g})$
32. $\text{Mg} + 2\text{HClO}_4$ -----> $\text{Mg}(\text{ClO}_4)_2(\text{aq}) + \text{H}_2(\text{g})$
33. $6\text{Na} + \text{N}_2$ -----> $2\text{Na}_3\text{N}(\text{s})$
34. $2\text{H}_2\text{O} + \text{Ca}$ -----> $\text{Ca}(\text{OH})_2(\text{s}) + \text{H}_2(\text{g})$
35. $\text{Cl}_2 + 2\text{K}$ -----> $2\text{KCl}(\text{s})$