Reactions Practice Quiz!

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

1. $CuSO_4 + AgNO_3$ ------> _____
2. $Al_2(CO_3)_3 + HI$ ------> _____
3. $Cu + AgNO_3$ ------> _____ (cupric)
4. $Cu + HCl$ ------> _____
5. $C_7H_{16} + O_2$ ------> _____
6. $Fe + O_2$ ------> _____ (ferric)
7. $Al(NO_3)_3 + Na_2SO_4$ ------> _____
8. $Al(NO_3)_3 + Na_2CO_3$ ------> _____
9. $Al + Zn(NO_3)_2$ ------> _____
10. $Li + H_2O$ ------> _____
11. $Li + H_2SO_4$ ------> _____
12. $C_8H_{16} + O_2$ ------> _____
13. $NaCl + F_2$ ------> _____
14. $Cl_2 + AlBr_3$ ------> _____
15. $O_2 + K$ ------> _____
16. $I_2 + KF$ ------> _____
17. $CuNO_3 + CuCl_2$ ------> _____ (not a NR!)
18. $HCl + NaOH$ ------> _____
19. $HCl + Na_2CO_3$ ------> _____
20. $(NH_4)_3PO_4 + BaCl_2$ ------> _____
21. $C_7H_{14} + O_2$ ------> _____
22. $H_2SO_4 + KOH$ ------> _____
23. $Cl_2 + NaI$ ------> _____
24. $Na + H_2O$ ------> _____
25. $Zn + H_2O$ ------> _____
26. $Al + FeSO_4$ ------> _____
27. $Rb + H_2O$ ------> _____ (Not a NR)
28. $Ba + HCl$ ------> _____
29. $BaCO_3 + HCl$ ------> _____
30. $BaCl_2 + H_2SO_4$ ------> _____
31. $Ba + H_2SO_4$ ------> _____
32. $Mg + HClO_4$ ------> _____
33. $Na + N_2$ ⟶ _____
34. $H_2O + Ca$ ⟶ _____
35. $Cl_2 + K$ ⟶ _____

Stoichiometry Practice!!!

$$3\ Cu_{(s)} + 8\ HNO_{3\ (aq)} \text{ -------> } 3\ Cu(NO_3)_{2\ (aq)} + 2\ NO_{(g)} + 4\ H_2O_{(l)}$$

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)?

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?
b. If 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?

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

$$Mg_{(s)} + 2\ HCl_{(aq)} \text{ -------> } MgCl_{2\ (aq)} + H_{2(g)}$$

6a. 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!!!

$3\ Cu_{(s)} + 8\ HNO_{3\ (aq)} \text{ ------> } 3\ Cu(NO_3)_{2\ (aq)} + 2\ NO_{(g)} + 4\ H_2O_{(l)}$

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

molar mass of HNO_3

$$(.10 \text{ moles Cu})\left(\frac{8 \text{ moles } HNO_3}{3 \text{ moles Cu}}\right)\left(\frac{63.0128 \text{ g}}{1 \text{ mole}}\right) = 16.80 \rightarrow \boxed{17 \text{ grams } HNO_3}$$

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

$$(0.500 \text{ mole } HNO_3)\left(\frac{2 \text{ mole NO}}{8 \text{ mole } HNO_3}\right)\left(\frac{6.02 \times 10^{23} \text{ molec.}}{1 \text{ mole}}\right) = 7.33 \times 10^{22} \text{ molecules}$$

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

Cu is the limiting reactant. Cu will be entirely consumed. (HNO_3 is the excess reactant. 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?

$$(39 \text{ g Cu})\left(\frac{1 \text{ mole}}{63.546 \text{ g}}\right)\left(\frac{3 \text{ mole } Cu(NO_3)_2}{3 \text{ mole Cu}}\right) = 0.61 \text{ moles } Cu(NO_3)_2$$

← 0.61373 before rounding

$$(2.0 \text{ mole } HNO_3)\left(\frac{3 \text{ moles } Cu(NO_3)_2}{8 \text{ moles } HNO_3}\right) = 0.75 \text{ moles } Cu(NO_3)_2$$

So $\boxed{0.61 \text{ moles } Cu(NO_3)_2 \text{ could form.}}$

b. If 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?

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

$\boxed{96\ \%\text{ yield}}$

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

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

$3\ Cu_{(s)} + 8\ HNO_{3\ (aq)} \text{ -------> } 3\ Cu(NO_3)_{2\ (aq)} + 2\ NO_{(g)} + 4\ H_2O_{(l)}$

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?

$$(5.0\times10^{22}\text{ Cu atoms})\left(\frac{1\text{ mole}}{6.02\times10^{23}\text{ atoms}}\right)\left(\frac{4\text{ moles }H_2O}{3\text{ moles Cu}}\right)\left(\frac{18.0152\text{g}}{1\text{ mole}}\right)=1.995$$

$2.0\text{ g }H_2O$

$$(5.0\text{ g }HNO_3)\left(\frac{1\text{ mole}}{63.0128\text{g}}\right)\left(\frac{4\text{ mole }H_2O}{8\text{ mole }HNO_3}\right)\left(\frac{18.0152\text{g}}{1\text{ mole}}\right)=0.71\text{ g }H_2O$$

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

Cu (it is the excess reactant)

$Mg_{(s)} + 2\ HCl_{(aq)} \text{ -------> } MgCl_{2\ (aq)} + H_{2(g)}$

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

$$(2.0\times10^{23}\text{ Mg atoms})\left(\frac{1\text{ mole}}{6.02\times10^{23}\text{ atoms}}\right)\left(\frac{1\text{ mole }H_2}{1\text{ mole Mg}}\right)\left(\frac{2.0158\text{g}}{1\text{ mole}}\right)=0.66970\text{g}$$

$0.67\text{ g }H_2$

$$(0.50\text{ mole HCl})\left(\frac{1\text{ mole }H_2}{2\text{ mole HCl}}\right)=0.25\text{ moles }H_2$$

$$(0.25\text{ mole }H_2)\left(\frac{2.0158\text{g}}{1\text{ mole}}\right)=0.50395\text{ grams }H_2 \rightarrow 0.50\text{ g }H_2$$

or all in one step $(0.50\text{ mole HCl})\left(\frac{1\text{ mole }H_2}{2\text{ mol HCl}}\right)\left(\frac{2.0158\text{g}}{\text{mole}}\right)=.50395\text{ g }H_2$

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

$$\%\text{ yield} = \frac{\text{actual}}{\text{expected}}\times100 = \frac{0.48\text{g}}{0.50395\text{g}}\times100 = 95.248\% \rightarrow 95\%\text{ yield}$$

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?

$$(0.20\text{ mole }H_2)\left(\frac{2\text{ mole HCl}}{1\text{ mole }H_2}\right)=0.40\text{ moles HCl}$$

1. $CuSO_4 + AgNO_3$ ------> ~~$Cu(NO_3)_{2(aq)} + Ag_2SO_{4(aq)}$~~ N.R.

2. $Al_2(CO_3)_3 + 6HI$ ------> $2AlI_{3(aq)} + 3H_2O_{(l)} + 3CO_{2(g)}$

3. $Cu + 2AgNO_3$ ------> $Cu(NO_3)_{2(aq)} + 2Ag_{(s)}$ (cupric)

4. $Cu + HCl$ ------> N.R.

5. $C_7H_{16} + 11\ O_2$ ------> $7CO_{2(g)} + 8H_2O_{(g)}$

6. $4\ Fe + 3O_2$ ------> $2Fe_2O_{3(s)}$ (ferric)

7. $Al(NO_3)_3 + Na_2SO_4$ ------> ~~$Al_2(SO_4)_{3(aq)} + NaNO_{3(aq)}$~~ N.R.

8. $2\ Al(NO_3)_3 + 3\ Na_2CO_3$ ------> $Al_2(CO_3)_{3(s)} + 6NaNO_{3(aq)}$

9. $2\ Al + 3\ Zn(NO_3)_2$ ------> $2Al(NO_3)_{3(aq)} + 3Zn_{(s)}$

10. $2\ Li + 2\ H_2O$ ------> $2LiOH_{(aq)} + H_{2(g)}$

11. $2\ Li + H_2SO_4$ ------> $Li_2SO_{4(aq)} + H_{2(g)}$

12. $C_8H_{16} + 12\ O_2$ ------> $8CO_{2(g)} + 8H_2O_{(g)}$

13. $2NaCl + F_2$ ------> $2NaF_{(aq)} + Cl_{2(g)}$

14. $3Cl_2 + 2AlBr_3$ ------> $2AlCl_{3(aq)} + 3Br_{2(l)}$

15. $O_2 + 4\ K$ ------> $2\ K_2O_{(s)}$ ← you don't need a solubility chart here.. why not?

16. $I_2 + KF$ ------> N.R.

17. $2CuNO_3 + CuCl_2$ (+1 −1, +2 −1) ------> $2CuCl_{(s)} + Cu(NO_3)_2$ (not a NR!)

18. $HCl + NaOH$ ------> $H_2O_{(l)} + NaCl_{(aq)}$

19. $2\ HCl + Na_2CO_3$ ------> $H_2O_{(l)} + CO_{2(g)} + 2NaCl_{(aq)}$

20. $2(NH_4)_3PO_4 + 3BaCl_2$ ------> $Ba_3(PO_4)_{2(s)} + 6NH_4Cl_{(aq)}$

21. $2C_7H_{14} + 21\ O_2$ ------> $14CO_{2(g)} + 14H_2O_{(g)}$

22. $H_2SO_4 + 2KOH$ ------> $2\ H_2O_{(l)} + K_2SO_{4(aq)}$

23. $Cl_2 + 2NaI$ ------> $2NaCl_{(aq)} + I_{2(s)}$

24. $2Na + 2H_2O$ ------> $2NaOH_{(aq)} + H_{2(g)}$

25. $Zn + H_2O$ ------> N.R.

26. $Al + FeSO_4$ ------> $Al_2(SO_4)_{3(aq)} + Fe_{(s)}$

27. $2Rb + 2H_2O$ ------> $2RbOH_{(aq)} + H_{2(g)}$ (Not a NR)

28. $Ba + 2HCl$ ------> $BaCl_{2(aq)} + H_{2(g)}$

29. $BaCO_3 + 2HCl$ ------> $BaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

30. $BaCl_2 + H_2SO_4$ ------> $BaSO_{4(s)} + 2HCl_{(aq)}$

31. $Ba + H_2SO_4$ ------> $BaSO_{4(s)} + H_{2(g)}$

32. $Mg + 2\ HClO_4$ ------> $Mg(ClO_4)_{2(aq)} + H_{2(g)}$

33. $6\ Na + N_2$ ------> $2\ Na_3N_{(s)}$

34. $2\ H_2O + Ca$ ------> $Ca(OH)_{2(s)} + H_{2(g)}$

35. $Cl_2 + 2\ K$ ------> $2\ KCl_{(s)}$