

Workbook



Table of Contents

Chemical Reactions.....	שגיאה! הסימניה אינה מוגדרת.
Stoichiometry	שגיאה! הסימניה אינה מוגדרת.
Reactions.....	8

Chemical Reactions

Stoichiometry

Questions

1) Balance the following equations:

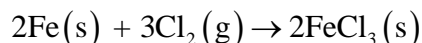
- $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$
- $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$
- $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- $\text{PbO} + \text{NH}_3 \rightarrow \text{Pb} + \text{N}_2 + \text{H}_2\text{O}$

2) Balance the following equations:

- $\text{H}_3\text{PO}_4 + \text{CaO} \rightarrow \text{Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{O}$
- $\text{NO} + \text{O}_2 \rightarrow \text{NO}_2$
- $\text{AgNO}_3 + \text{K}_2\text{CrO}_4 \rightarrow \text{Ag}_2\text{CrO}_4 + \text{KNO}_3$
- $\text{Ag}_2\text{SO}_4 + \text{BaI}_2 \rightarrow \text{BaSO}_4 + \text{AgI}$

3) Iron metal reacts with chlorine gas.

How many moles of FeCl_3 are obtained when 6.78 mol Cl_2 reacts, with an excess Fe?



4) The following equation is given:



- Determine the number of moles of $\text{O}_2(g)$ that are produced, by the decomposition of 30.5 g of KClO_3 ?
- How many grams of KCl are formed together with 25.6 g O_2 in the decomposition of KClO_3 ?

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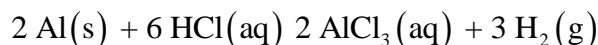
- 5) How many grams of Ag_2CO_3 are decomposed to yield 83.4 g Ag, in the following reaction:



- 6) $\text{CaH}_2(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{s}) + \text{H}_2(\text{g})$ (not balanced)
- How many moles of $\text{H}_2(\text{g})$ result from the reaction of 130 g CaH_2 , with an excess of water?
 - How many grams of water are consumed in the reaction of 65.2 g CaH_2 ?
 - What mass of $\text{CaH}_2(\text{s})$ must react with an excess of water to produce, $6.5 \cdot 10^{24}$ molecules of H_2 ?

- 7) A piece of aluminum foil measuring 10.60 cm X 5.20 cm X 0.375 mm is dissolved, in excess HCl (aq).

What mass of $\text{H}_2(\text{g})$ is produced? The density of Al is $2.70 \frac{\text{g}}{\text{cm}^3}$.



- 8) What are the molarities of the following solutes when dissolved in water?
- 3.11 mol CH_3OH in 6.45 L of solution.
 - 8.26 mmol $\text{C}_2\text{H}_5\text{OH}$ in 45.00 mL of solution.
 - 23.5 g $\text{CO}(\text{NH}_2)_2$ in 311 mL of solution.

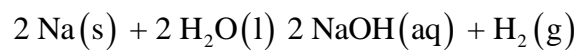
- 9) What is the molarity of
- sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) if 250.0 g of sucrose is dissolved per 350.0 mL, of water solution?
 - Urea, $\text{CO}(\text{NH}_2)_2$, if 95.5 mg of the 97% pure solid is dissolved in 4.00 mL, of aqueous solution?

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- 10) What is the molarity of methanol (CH_3OH , $d = 0.792 \frac{\text{g}}{\text{mL}}$) if 150.0 mL of methanol, is dissolved per 20 L of water solution?
- 11) How much:
- glucose ($\text{C}_6\text{H}_{12}\text{O}_6$), in grams, must be dissolved in water to produce 80.0 mL, of 0.250 M $\text{C}_6\text{H}_{12}\text{O}_6$?
 - Methanol, CH_3OH ($d = 0.790 \text{ g/mL}$), in mL, must be dissolved in water, to produce 3.15 L of 0.375 M CH_3OH ?
- 12) Which has the higher concentration of sucrose:
a 42% sucrose solution by mass ($d = 1.21 \text{ g/mL}$), or 1.40 M $\text{C}_{12}\text{H}_{22}\text{O}_{11}$? Explain.
- 13) A 15.0 mL sample of 3.05 M KNO_3 is diluted to a volume of 260.0 mL.
What is the concentration of the diluted sample?
- 14) A 30.0 mL sample of HCl (aq) is diluted to a volume of 700.0 mL.
If the concentration of the diluted sample is 0.080 M HCl ,
what was the concentration of the original solution?
- 15) $2\text{AgNO}_3(\text{aq}) + \text{Na}_2\text{S}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s}) + 2\text{NaNO}_3(\text{aq})$
How many grams of $\text{Na}_2\text{S}(\text{s})$ are required to react completely,
with 35 mL of 0.145 M AgNO_3 ?
- 16) How many milliliters of 0.560 M K_2CrO_4 are needed to precipitate all of the silver ion in, 385 mL of 0.156 M AgNO_3 as $\text{Ag}_2\text{CrO}_4(\text{s})$?
 $2\text{AgNO}_3(\text{aq}) + \text{K}_2\text{CrO}_4(\text{aq}) \rightarrow \text{Ag}_2\text{CrO}_4(\text{s}) + 2\text{KNO}_3(\text{aq})$

17) How many grams of sodium must react with 200 mL H_2O to produce a solution,

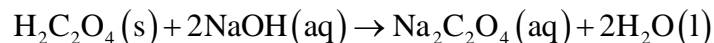
that is 0.160 M NaOH ? (Assume a final solution volume of 200 mL.)



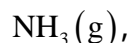
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- 18) A 0.4261 g sample of oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, requires 35.45 mL of a particular concentration of $\text{NaOH}(\text{aq})$ to complete the following reaction.

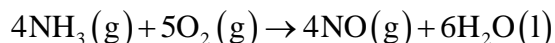
What is the molarity of the $\text{NaOH}(\text{aq})$?



- 19) How many moles of $\text{NO}(\text{g})$ can be produced in the reaction of 5.0 mol

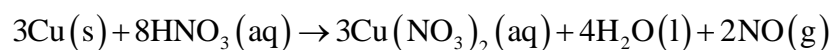


and 6.0 mol $\text{O}_2(\text{g})$?



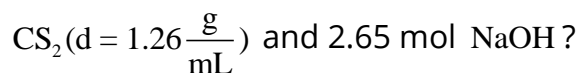
- 20) A 0.76 mol sample of Cu is added to 150 mL of 5.0 M $\text{HNO}_3(\text{aq})$.

Assuming the following reaction is the only one that occurs, will the Cu react completely?

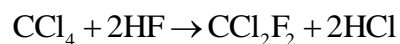


- 21) $3\text{CS}_2 + 6\text{NaOH} \rightarrow 2\text{Na}_2\text{CS}_3 + \text{Na}_2\text{CO}_3 + 3\text{H}_2\text{O}$

How many grams of Na_2CS_3 are produced in the reaction of 95 mL of liquid,



- 22) In the reaction of 1.95 mol CCl_4 with an excess of HF , 1.45 mol CCl_2F_2 is obtained. What are the theoretical, actual and percent yields of this reaction?



Answer Key

- 1) a. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ b. $2\text{NH}_3 + \frac{7}{2}\text{O}_2 \rightarrow 2\text{NO}_2 + 3\text{H}_2\text{O}$
- c. $\text{C}_2\text{H}_6 + \frac{7}{2}\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ d. $3\text{PbO} + 2\text{NH}_3 \rightarrow 3\text{Pb} + \text{N}_2 + 3\text{H}_2\text{O}$
- 2) a. $2\text{H}_3\text{PO}_4 + 3\text{CaO} \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O}$ b. $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$
- c. $2\text{AgNO}_3 + \text{K}_2\text{CrO}_4 \rightarrow \text{Ag}_2\text{CrO}_4 + 2\text{KNO}_3$ d. $\text{Ag}_2\text{SO}_4 + \text{BaI}_2 \rightarrow \text{BaSO}_4 + 2\text{AgI}$
- 3) 4.52 mol.
- 4) a. 0.375 mol O_2
- b. In the notebook I left it in moles, I have to check the recording
- 5) 107.54 g
- 6) a. 6.19 mol b. 55.87 g c. 219.82 g
- 7) 0.62 g
- 8) a. 0.482 M b. 0.184 M c. 1.26 M
- 9) a. 2.09 M b. 0.386 M
- 10) 0.171 M
- 11) a. 3.6 g b. 47.8 mL
- 12) 42% sucrose solution
- 13) 0.18 M
- 14) 1.87 M
- 15) 0.2 g
- 16) 54 mL
- 17) 0.736 g
- 18) 0.267 M
- 19) 4.8 mol
- 20) The Cu will react completely.

21) 0.88 mol

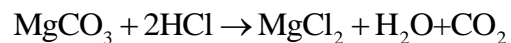
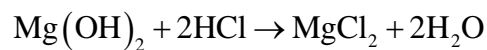
22) Theoretical yield = 1.95 mol CCl_2F_2

Actual yield = 1.45 mol CCl_2F_2

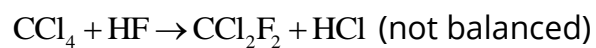
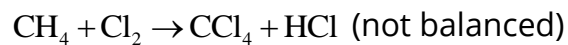
Percent yield = 74.36 %

Reactions

- 1) How many grams of HCl are consumed in the reaction of 415 g, of a mixture containing 33.5% MgCO₃ and 66.5% Mg(OH)₂, by mass?



- 2) How many moles of Cl₂ must be consumed in the first reaction to produce, 3.15 kg CCl₂F₂ in the second? Assume that all the CCl₄ produced, in the first reaction is consumed in the second.



Answer Key

- 1) 465.23 g
- 2) 26.05 mol