
Organic Chemistry
Chemical Data and Calculations

Name:

The following substances will be discussed in the problems below.

<i>Name of substance</i>	<i>Formula of substance</i>	<i>Density (g/mL)</i>
ethanol	CH ₃ CH ₂ OH	0.790
phosphorus tribromide	PBr ₃	2.88
ethyl bromide	CH ₃ CH ₂ Br	1.460

1. Compute the formula weight (g/mol) for each of the substances. (hint: use our web site)

a. _____ g/mol, ethanol

b. _____ g/mol, phosphorus tribromide

c. _____ g/mol, ethyl bromide

2. *Conversion diversion.* Convert each of the following quantities in the units indicated.

a. 21 mL ethanol; convert to moles _____ mol

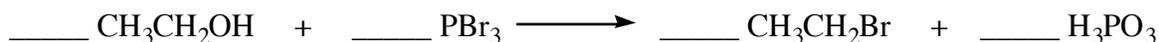
b. 45 mmol PBr₃; convert to grams _____ g
(hint: recall 1000 mmol = 1 mol)

c. 500 mg ethyl bromide; convert to mL _____ mL
(hint: recall 1000 mg = 1 g)

Questions 3-7 pertain to the unbalanced chemical reaction:



3. Provide the stoichiometric factors to balance this chemical reaction.



4. Suppose that we use 6.0 mL of ethanol to perform the reaction. Express this amount in the following units:

a. _____ g

b. _____ mol

c. _____ mmol

5. How much PBr_3 is required to react completely with 6.0 mL of ethanol? Express your answer in the following units:

a. _____ mmol

b. _____ g

c. _____ mL

6. Suppose we choose to perform the reaction on a much smaller scale. We will mix 300 μL of phosphorus tribromide with 600 μL of ethanol. (Recall that 1000 μL = 1 mL).

a. Which is the limiting reagent? $\text{CH}_3\text{CH}_2\text{OH}$ PBr_3

b. What is the theoretical (expected) yield of ethyl bromide? Express your answer in the following units:

i. _____ mmol

ii. _____ mg

iii. _____ g

iv. _____ mL

v. _____ μL

c. In practice, we seldom achieve the theoretical yield. The actual amount of material obtained from a reaction can be compared to the theoretical yield to give the percentage yield:

$$\text{Percentage yield} = \text{Actual amount obtained} \div \text{Theoretical amount possible} \times 100\%$$

In this reaction, suppose the actual yield is 0.905 g of ethyl bromide. Compute the percent yield.

7. Suppose we choose to perform the reaction on a scale to obtain 5 g ethyl bromide. Assuming that a normal percentage yield for this reaction is 85%, what minimum quantity of materials will be needed to give the desired product?

_____ mL ethanol

_____ mL phosphorus tribromide

8. Look up the GHS Signal Word, GHS pictograms, GHS H statements, and GHS P statements for phosphorus tribromide. What are they? (see the next page for a summary of GHS pictograms)

9. Consider the following situation. You are asked to neutralize 2 g of sodium hydroxide (NaOH) by adding the correct volume of 6 M HCl solution.

a. 2 g NaOH; convert to moles

b. 2 g NaOH; convert to mmoles

c. What volume of 6 M HCl is equivalent to the number of moles in 2 g NaOH?

Hint: recall that M is mol/L or mmol/mL

d. Concentrated HCl is a 12 M solution.
Concentrated HCl is a solution of HCl gas in water with a concentration of 37% HCl.

Suppose that there is no bottle of 6 M HCl but there is a bottle labelled "10% HCl".
What volume of 10% HCl is equivalent to the number of moles in 2 g NaOH?

GHS Pictograms and their meanings

Health Hazard



- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Flame



- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

Exclamation Mark



- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer

Gas Cylinder



- Gases Under Pressure

Corrosion



- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

Exploding Bomb



- Explosives
- Self-Reactives
- Organic Peroxides

Flame Over Circle



- Oxidizers

Environment



- Aquatic Toxicity

Skull and Crossbones



- Acute Toxicity (fatal or toxic)