

Assignment 1

How many mL of 1 M HCl do you need to add to 10 mL of 1 M NaOH to get a solution with pH = 12?

Important Steps:

- Open a “Virtual Chemistry labs” application window.
- From the File menu in the Load Homework option, select Default Lab Setup folder.
- Stockroom explorer opens with solutions of various acids and bases.
- Double-click on Strong-bases cabinet.

A list of basic solutions with various strengths opens.

Double-click to choose point one molar NaOH.

Click on the flask; observe the pH on the pH Meter.

Note that pH Meter reads 14.

Click on the radio button near Strong-bases cabinet to close the list.

- Next, from Stockroom explorer, double-click on Strong-acids cabinet.

A list of acidic solutions with various strengths opens.

Double-click to choose 1 M HCl.

Click on the flask; observe the pH on the pH Meter.

Note that pH meter reads 0.

Click on the radio button near Strong-acids cabinet, to close the list.

- Now, add the required apparatus to the workbench.
- Click on glassware icon.

Select Graduated Cylinders.

From the sub-menu, select 10 mL Graduated Cylinder to add to the workbench.

- For this experiment, we need two Graduated cylinders.

Right-click on the Graduated Cylinder.

From the context menu, select copy.

Place the cursor at a different place.

Right-click and choose Paste option from the menu.

- Click on glassware icon.

Select Erlenmeyers.

From the sub-menu, select 250 mL Erlenmeyer flask.

- Label the Graduated Cylinders as A and B.
Right-click on the Graduated Cylinder.
From the Context-menu, select Rename option.
A text box opens. Type A in the text box, and click on Ok button.
- Similarly, label the other Graduated Cylinder as B.
- Place each apparatus at a different position on the workbench.
Use A for acids and B for bases.
- To perform this experiment, we need to add 10 mL of 1 M NaOH solution to 250 mL Erlenmeyer flask.
- Drag 1 M NaOH flask over to the Graduated Cylinder B.
Change the transfer mode to Precision transfer.
In the Transfer amount input bar, type 10.
Click on Pour.
Move the flask aside.
- Place the Graduated Cylinder B over 250 mL Erlenmeyer flask.
Change the transfer mode to Realistic transfer.
Click on Pour button gradually.
Move the Graduated Cylinder B aside.
- From the calculation we need 9.8 mL 1 M HCl to bring the 10 mL 1 M NaOH solution's pH at 12 from 14.
- Drag 1 M HCl flask over to the Graduated Cylinder A.
Change the transfer mode to Precision transfer.
In the Transfer amount input bar, type 9.8.
Click on Pour.
Move the flask aside.
- Place the Graduated Cylinder A over 250 mL Erlenmeyer flask.
Change the transfer mode to Realistic transfer.
- Click on 250 mL Erlenmeyer flask, observe the pH on pH meter. The pH meter reads $11.98 \approx 12$.
- Hence, after addition of 9.8 mL of 1 M HCl to the 10 mL of 1 M NaOH, pH was found to be 12.

Calculation:

For HCl and NaOH normality = molarity

$$\text{pH} + \text{pOH} = 14$$

For pH = 12

$$\text{pOH} = 14 - \text{pH} = 14 - 12 = 2$$

$$\text{pOH} = -\log_{10}[\text{OH}^-]$$

$$2 = -\log_{10}[\text{OH}^-]$$

$$[\text{OH}^-] = 10^{-2} = 0.01$$

N_1 = Normality of 1 M NaOH = 1

V_1 = Volume of 1 M NaOH in mL = 10

N_2 = Normality of 1 M HCl = 1

V_2 = Volume of 1 M HCl in mL = v

N = Net normality of the solution = 0.01

V = Net volume of the solution = (10 + v)

$$NV = N_1V_1 - N_2V_2$$

$$0.01 \times (10 + v) = 1 \times 10 - 1 \times v$$

$$0.1 + 0.01v = 10 - v$$

$$v + 0.01v = 10 - 0.1$$

$$1.01v = 9.9$$

$$v = 9.8$$

9.8 mL of 1 M HCl required for the experiment.

Screen-shots of the ChemCollective Vlabs

IrYdium Chemistry Lab -- Default Lab Setup

File Edit Tools View Help

Stockroom Explorer

- IrYdium Solutions
 - Distilled H₂O
 - Stock Solutions
 - Strong-acids
 - Weak-acids
 - Conjugate-acids
 - Strong-bases
 - 1M NaOH**
 - 0.1M NaOH
 - 3M NaOH
 - 10M NaOH
 - Weak-bases
 - Conjugate-bases
 - Indicators
 - Solids

Workbench 1

1M NaOH

Solution Info

Name: 1M NaOH
Volume: 100.0 mL

☒ Aqueous ☐ Solid ☐ Spectrometer

log(Molarity)

Species	Molarity
H ⁺	1.010e-14
OH ⁻	1.000e0
Na ⁺	1.000e0

25.0°C

pH Meter

14.00

1M Sodium Hydroxide

Transfer amount (mL):

Pour from to

IrYdium Chemistry Lab -- Default Lab Setup

File Edit Tools View Help

Stockroom Explorer

- IrYdium Solutions
 - Distilled H₂O
 - Stock Solutions
 - Strong-acids
 - 10M HCl
 - 3M HCl
 - 10M HBr
 - 3M HBr
 - 3M H₂SO₄
 - 1M H₂SO₄
 - 10M H₂SO₄
 - 3M HNO₃
 - 10M HNO₃
 - 10M HClO₄
 - 3M HClO₄
 - 10M HI
 - 3M HI
 - 1M HCl**
 - 0.1M HCl
 - Weak-acids
 - Conjugate-acids
 - Strong-bases
 - Weak-bases
 - Conjugate-bases
 - Indicators
 - Solids

Workbench 1

1M NaOH 1M HCl

Solution Info

Name: 1M HCl
Volume: 100.0 mL

☒ Aqueous ☐ Solid ☐ Spectrometer

log(Molarity)

Species	Molarity
H ⁺	1.000e0
OH ⁻	1.010e-14
Cl ⁻	1.000e0

25.0°C

pH Meter

0.00

1 Molar Hydrochloric Acid

Transfer amount (mL):

Pour from to











