

PSC – 4012 Dilution Problems

e.g. # 1 A chemistry teacher needs 5 litres of 3 mol/L hydrochloric acid for her students' lab. She has a 4-L bottle of 18 mol/L HCl (the *stock solution*) in her acid cabinet. How much of the stock solution must be used to make the 5 litres of 3 M HCl? Describe the procedure involved in making the solution.

e.g. # 2 A janitor working in an adult education center realizes that he has no more cleaning solution. He must prepare 850 mL of 0.6 mol/L solution for his spray bottle. He uses 35 mL of concentrated solution taken from a 4 L container. What is the concentration of the solution used to prepare the dilution?

e.g. # 3 How would you prepare 500.0 mL of 0.350 M sodium hydroxide solution starting from a concentration of 1.00 M NaOH?

Now you try these...

- 1.** A chemist decides that he wants to prepare eight 400-mL jars of pickled beets. Unfortunately, he has no vinegar at home. The next day, he decides to prepare it by using a concentrated solution (15 M) of acetic acid (CH_3COOH). He uses 1 cup of this (237 mL), then adds water until he obtains 3 L.

What is the concentration of the diluted solution of acetic acid?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

2. A gardener for a large estate wants to spray the grounds with a liquid herbicide. The concentration of herbicide in a 850 mL-bottle is 14 mol/L. The gardener has to spray the weeds with a solution whose concentration is 0.15 mol/L, using a spray bottle with a capacity of 15 litres.

How much undiluted herbicide should he put in his spray bottle?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

3. Fred works in a greenhouse on weekends. His boss asks him to prepare 5 litres of a 2 M NaNO_3 solution from a 5.4 mol/L commercial solution. To do so, Fred will have to take a certain quantity of the stock solution and add small amounts of water at a time until he obtains 5 L of solution. What volume of the stock solution should Fred use to prepare the 5 L of diluted solution?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

4. You want to spray your bathtub with a liquid cleaner. The concentration of the cleaner in a 300 mL bottle is 15 mol/L. You have to spray your sink with a solution whose concentration is 0.2 mol/L, using a spray bottle with a capacity of 10 litres.

How much undiluted cleaner should you put in your spray bottle?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

5. You use 800 mL of a concentrated acetic acid solution (CH_3COOH) to prepare a 2.0-L solution diluted to 1.4 mol/L. What is the concentration of the stock solution used?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

6. If you dilute 600 mL of a 0.75 mol/L HCl solution to produce a 0.25 mol/L solution, what is the volume of the solution you have prepared?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

7. Samantha, a lab attendant in an adult education center, must prepare enough 0.80 M HCl solution to pour 250 mL in each of five 500-mL beakers to be used in an experiment. She has a 2-L container of 4 M HCl. Describe how she should prepare the required solution.

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

8. Albert and some of his friends are co-owners of a pet shop. Unfortunately, Albert has noticed that several of his fish are suffering from gyrodactylitis. Albert must therefore prepare a dilute potassium permanganate solution to treat the fish. He has a 0.25M KMnO_4 solution. He will use 40 mL of this to prepare 10 L of a diluted solution in which he will place the ailing fish for a half hour.

What is the molar concentration of the KMnO_4 solution that Albert will use to treat the fish?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

9. A homeowner uses 24 litres of 8 mol/L chlorine solution to prepare a 30 000 litre swimming pool. What is the concentration of chlorine in the prepared pool?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

10. A horticulturalist requires a diluted solution of fertilizer to spray her plants. The concentration of fertilizer in a 750 mL-bottle is 16 mol/L. The horticulturalist has to spray the plants with a solution whose concentration is 0.25 mol/L, using a spray machine with a capacity of 40 litres. How much undiluted herbicide should she put in her spray machine?

Your answer must include the formula used and all of the calculations, including a clear indication of the units of measure.

11. Suppose you have certain commercial solutions whose concentrations you know, and you have to use them to prepare solutions with different concentrations.

What volume of commercial solution do you have to use to obtain each solution with the volume and concentration indicated in the right-hand column of the table below?

Commercial solution		Diluted solution	
Volume	Concentration	Volume	Concentration
a)	15 M	350 ml	5 M
b)	10 M	550 ml	2.37 M
c)	8 M	1.5 L	4 M
d)	10 M	3500 ml	2 M
e)	8 M	15 ml	1.5 M
f)	5 M	250 ml	2.5 M
g)	15 M	4.32 L	1 M
h)	8.5 M	5.5 L	0.2 M
i)	15 M	3456 ml	0.75 M