Chemistry 11.
Dilution problems. $c = \frac{n}{V}$ Answer Key

1. Calculate the new concentration when the following solutions are mixed together:

a) 25.0 mL of 3.00 M HCl is diluted to a final volume of 100.0 mL.

$n = (0.025L)(3.00M) = 0.075\ mol$ $c = \frac{n}{V} = \frac{0.075mol}{0.100L} = 0.75\ mol/L$

b) 25.0 mL of water is added to 110.0 mL of a 3.00 M HCl

$(3.00M)(0.1100L) = 0.330\ mol$ $\frac{0.330\ mol}{0.135L} = 2.44\ mol/L$

c) 1.0 L of 0.33 M NaOH and 0.50 L of 0.22 M NaOH

$(1.0L)(0.33M) = 0.33\ mol$
$(0.5L)(0.22M) = 0.11\ mol$ $c = \frac{n}{V} = \frac{0.44\ mol}{1.5L} = 0.29\ mol/L$

d) 15.00 mL of 0.0500 M LiOH is mixed with 35.00 mL of 0.040 M LiOH.

$(0.01500L)(0.0500M) = 0.000750\ mol$
$(0.03500L)(0.040M) = 0.0014\ mol$ $c = \frac{n}{V} = \frac{0.000750 + 0.0014\ mol}{0.05000L} = 0.043\ mol/L$

e) 15.00 mL of 0.0500 M LiOH is mixed with 45.00 mL of water.

$(0.01500L)(0.0500M) = 0.000750\ mol$

$c = \frac{n}{V} = \frac{0.000750\ mol}{0.0600L} = 0.0125\ mol/L$

2. What is the molarity of the solution produced when 500.0 mL of a 0.65 M solution of KBr is boiled down to a final volume of 125.0 mL

$n = c \cdot V = (0.65M)(0.500L) = 0.325\ mol$

$c = \frac{n}{V} = \frac{0.325\ mol}{0.1250L} = 2.6\ mol/L$

3. 45.0 mL of a 1.25M solution of HCl has some water added to it changing the concentration of the acid to 0.800 M. What volume of water was added?

$n = c \cdot V = (1.25M)(0.0450L) = 0.05625\ mol$

$V = \frac{n}{c} = \frac{0.05625\ mol}{0.800M} = 0.0703L$ vol $H_2O = 0.0703 - .0450 = 0.0253L$

4. What volume of a 3.0 M HCl is needed to make 500.0 mL of 0.20 M HCl solution?

$n = c \cdot V = (0.20M)(0.500L) = 0.100\ mol$

$V = \frac{n}{c} = \frac{0.100\ mol}{3.0\ M} = 0.33L$

5. What volume of a 6.0 M KOH is needed to make 200.0 mL of a 0.10 M solution?

$n = C \cdot V = (0.10\ M)(0.2000\ L) = 0.020\ mol$

$V = \frac{n}{C} = \frac{0.020\ mol}{6.0\ M} = 0.0033\ L = 3.3\ mL$

6. Determine the final concentration of LiOH when 75 mL of 0.23M LiOH is mixed with 27 mL of 0.11M LiOH.

$n = C \cdot V = (0.23\ M)(0.075\ L) = 0.01725\ mol$

$n = C \cdot V = (0.11\ M)(0.027\ L) = 0.00297\ mol$

$C = \frac{(0.01725 + 0.00297)}{(0.075 + 0.027)} = \frac{0.2022}{0.102} = 1.98\ M$

7. Determine the final concentration of LiOH when 45mL of 0.222 M LiOH is mixed with 65 mL of 0.100M of KCl.

$n = C \cdot V = (0.222)(0.045) = 0.00999\ mol$

KCl - has no effect, just adds volume

$C = \frac{n}{V} = \frac{0.00999\ mol}{0.110\ L} = 0.091\ mol/L$

8. Determine the final concentration of NaCl when 75 mL of 0.110 M NaCl is mixed with 45 mL of water.

$n = C \cdot V = (0.110\ M)(0.075\ L) = 0.008250\ mol$

$C = \frac{n}{V} = \frac{0.008250\ mol}{0.12\ L} = 0.069\ mol/L$

9. A 1.0L of 0.50 M NaOH is allowed to evaporate to a final volume of 0.200 L. What is the concentration of this new solution?

$n = C \cdot V = (0.50\ M)(1.0\ L) = 0.50\ mol$

$C = \frac{n}{V} = \frac{0.50\ mol}{0.200\ L} = 2.5\ mol/L$

10. What is the concentration of KCl when equal volumes of a 0.35M and 0.45 M solutions are added together?

$n = C \cdot V = (0.35)(V)$ $\quad n = C \cdot V = (0.45)(V)$

$C = \frac{n}{V} = \frac{(0.35 + 0.45)V}{2V} = 0.40\ mol/L$