KEY

Dilution Calculations

Name - _____

1.) If $20.0\ mL$ of $0.75\ M$ HBr is diluted to a total volume of $90.0\ mL$, what is the molar concentration of the HBr in the resulting solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.75)(0.020)}{(0.090)}$ $C_{dil} = 0.17\ M$

2.) What is the molar concentration of the KOH solution resulting from mixing $55\ mL$ of $0.15\ M$ KOH and $75\ mL$ of $0.25\ M$ KOH?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} + \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.15)(0.055)}{(0.055 + 0.075)} + \frac{(0.25)(0.075)}{(0.055 + 0.075)}$ $C_{dil} = 0.21\ M$

3.) If 1 drop ($0.050\ mL$) of $0.20\ M$ NaBr is added to $100.0\ mL$ of water, what is the molarity of the NaBr in the resulting solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.20)(0.000050)}{(0.100 + 0.00005)}$ $C_{dil} = 1.0 \times 10^{-4}\ M$

4.) What is the molar concentration of the HNO_3 solution resulting from mixing $5.0\ mL$ of $3.5\ M$ HNO_3 and $95\ mL$ of $0.20\ M$ HNO_3?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} + \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(3.5)(0.005)}{(0.095 + 0.005)} + \frac{(0.20)(0.095)}{(0.095 + 0.005)}$ $C_{dil} = 0.37\ M$

5.) Concentrated HNO_3 is $15.4\ M$. How would you prepare $2.50\ L$ of $0.375\ M$ HNO_3?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}}$ $V_{conc} = \frac{0.375 \times 2.50}{15.4}$ $V_{conc} = 0.0609\ L$ Mix $60.9\ mL$ with water to make $2.5\ L$.

6.) Concentrated H_3PO_4 is $14.6\ M$. How would you prepare $45.0\ L$ of $0.0600\ M$ H_3PO_4?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}}$ $V_{conc} = \frac{(0.0600)(45.0)}{14.6}$ $V_{conc} = 0.185\ L$ Mix $185\ mL$ with water to make $45.0\ L$.

7.) If $300.0\ mL$ of solution A contains $25.0\ g$ of KCl and $250.0\ mL$ of solution B contains $60.0\ g$ of KCl, what is the molarity of the KCl in the solution resulting from mixing solutions A and B?

Answer - $25.0\ g\ KCl \times \frac{1\ mol\ KCl}{74.55\ g\ KCl} = 0.335\ mol$ $60.0\ g\ KCl \times \frac{1\ mol\ KCl}{74.55\ g\ KCl} = 0.805\ mol$

$$\frac{(0.335\ mol + 0.805\ mol)}{(0.300\ L + 0.250\ L)} = 2.07\ M\ KCl$$

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8.) If $500.0\ mL$ of $0.750\ M$ NaCl is boiled down until the final volume is reduced to $300.0\ mL$, what is the final molarity of the NaCl? (assume no salt is lost).

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.750)(0.500)}{(0.300)}$ $C_{dil} = 1.25\ M$

9.) How would you prepare $250.0\ mL$ of $0.350\ M$ HCl, starting with $6.00\ M$ HCl?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}}$ $V_{conc} = \frac{0.350 \times 0.250}{6.00}$ $V_{conc} = 0.0146\ L$ Mix $14.6\ mL$ with water to make $250.0\ mL$

10.) What mass of NaCl is needed to prepare $500.0\ mL$ of $0.400\ M$ NaCl?

Answer - $0.500\ L\ NaCl \times \frac{0.400\ mol\ NaCl}{1\ L\ NaCl} \times \frac{58.44\ g\ NaCl}{1\ mol\ NaCl} = 11.7\ g\ NaCl$

11.) What is the concentration of the NaOH solution produced by mixing $125.0\ mL$ of $0.250\ M$ NaOH with $200.0\ mL$ of $0.175\ M$ NaOH?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} + \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.250)(0.125)}{(0.325)} + \frac{(0.175)(0.200)}{(0.325)}$ $C_{dil} = 0.204\ M$

12.) What volume of $12.0\ M$ NaOH is required in order to prepare $3.00\ L$ of $0.750\ M$ NaOH?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}}$ $V_{conc} = \frac{3.00 \times 0.750}{12.0}$ $V_{conc} = 0.188\ L$

1.) Add 50% of solution total as water to flask. 2.) Add $188\ mL$ of base. 3.) Top up to $3.00\ L$ flask mark.

13.) What is the concentration of $CaCl_2$ produced when $55.0\ mL$ of $0.300\ M$ HCl is mixed with $80.0\ mL$ of $0.550\ M$ $CaCl_2$?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.550)(0.080)}{(0.135)}$ $C_{dil} = 0.326\ M$

14.) When $350.0\ mL$ of $0.250\ M$ $MgCl_2$ is boiled down to a final volume of $275.0\ mL$, what is the molarity of the $MgCl_2$ in the resulting solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.250)(0.350)}{(0.275)}$ $C_{dil} = 0.318\ M$

15.) If $20.0\ mL$ of $0.350\ M$ NaCl and $75.0\ mL$ of $0.875\ M$ NaCl are mixed and the resulting solution is boiled down to a volume of $60.0\ mL$, what is the molarity of the NaCl in the final solution?

Answer - $C_{conc} = \frac{C_{dil} \times V_{dil}}{V_{conc}} + \frac{C_{dil} \times V_{dil}}{V_{conc}}$ $C_{conc} = \frac{(0.350)(0.020)}{(0.095)} + \frac{(0.875)(0.075)}{(0.095)}$ $C_{conc} = 0.76447\ M$

$C_{conc} = \frac{(0.76447)(0.095)}{(0.060)}$ $C_{conc} = 1.21\ M$

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16.) A solution is made by mixing $100.0\ mL$ of $0.200\ M$ $BaCl_2$ and $150\ mL$ of $0.400\ M$ NaCl. What is the concentration of sodium chloride in the final solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.400)(0.150)}{(0.250)}$ $C_{dil} = 0.240\ M$

17.) If $75.0\ mL$ of $0.200\ M$ Na_3PO_4 is added to $25.0\ mL$ of $0.800\ M$ K_3PO_4, what is the concentration of Na_3PO_4 in the mixture?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.200)(0.075)}{(0.100)}$ $C_{dil} = 0.150\ M$