

Equations in Chemistry and Algebra - Worksheet Answer Key

Fill in the missing blanks to illustrate correspondence

- ^a Excepting x , all variables are assumed to be constant in each algebraic equation
^b Excepting the unknown, all variables are assumed to be constant in each chemistry equation
^c List the correspondence between the algebraic constants and the chemistry-equation constants.

Algebra ^a		Chemistry ^b				Correspondence between constants ^c	
No.	Equation	Solve for x	Topic	Equation	Unknown		Solve for Unknown
1	$ax = b$	$x = \frac{b}{a}$	Boyle's Law	$P_1V_1 = P_2V_2$	P_1	$P_1 = \frac{P_2V_2}{V_1}$	$a = V_1, b = P_2V_2$
					V_1	$V_1 = \frac{P_2V_2}{P_1}$	$a = P_1, b = P_2V_2$
					P_2	$P_2 = \frac{P_1V_1}{V_2}$	$a = V_2, b = P_1V_1$
					V_2	$V_2 = \frac{P_1V_1}{P_2}$	$a = P_2, b = P_1V_1$
2a	$\frac{x}{a} = b$	$x = ab$	Charles' Law	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	V_1	$V_1 = \frac{T_1V_2}{T_2}$	$a = T_1, b = \frac{V_2}{T_2}$
					V_2	$V_2 = \frac{T_2V_1}{T_1}$	$a = T_2, b = \frac{V_1}{T_1}$
2b	$\frac{a}{x} = b$	$x = \frac{a}{b}$			T_1	$T_1 = \frac{T_2V_1}{V_2}$	$a = V_1, b = \frac{V_2}{T_2}$
					T_2	$T_2 = \frac{T_1V_2}{V_1}$	$a = V_2, b = \frac{V_1}{T_1}$

Algebra ^a			Chemistry ^b				Correspondence between constants ^c		
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown			
3a	$\frac{x}{a} = b$	$x = ab$	Gay-Lussac's Law	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$	P_1	$P_1 = \frac{T_1 P_2}{T_2}$	$a = T_1, b = \frac{P_2}{T_2}$		
					P_2	$P_2 = \frac{T_2 P_1}{T_1}$	$a = T_2, b = \frac{P_1}{T_1}$		
3b	$\frac{a}{x} = b$	$x = \frac{a}{b}$			T_1	$T_1 = \frac{P_1 T_2}{P_2}$	$a = P_1, b = \frac{P_2}{T_2}$		
					T_2	$T_2 = \frac{P_2 T_1}{P_1}$	$a = P_2, b = \frac{P_1}{T_1}$		
4a	$\frac{x}{a} = b$	$x = ab$			Avogadro's Law	$\frac{V_1}{n_1} = \frac{V_2}{n_2}$	V_1	$V_1 = \frac{n_1 V_2}{n_2}$	$a = n_1, b = \frac{V_2}{n_2}$
							V_2	$V_2 = \frac{n_2 V_1}{n_1}$	$a = n_2, b = \frac{V_1}{n_1}$
4b	$\frac{a}{x} = b$	$x = \frac{a}{b}$	n_1	$n_1 = \frac{V_1 n_2}{V_2}$			$a = V_1, b = \frac{V_2}{n_2}$		
			n_2	$n_2 = \frac{V_2 n_1}{V_1}$			$a = V_2, b = \frac{V_1}{n_1}$		

Algebra ^a			Chemistry ^b				Correspondence between constants ^c		
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown			
5a	$ax = b$	$x = \frac{b}{a}$	Combined Gas Law	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	P_1	$P_1 = \frac{V_2T_1P_2}{V_1T_2}$	$a = \frac{V_1}{T_1}, b = \frac{P_2V_2}{T_2}$		
					P_2	$P_2 = \frac{V_1T_2P_1}{V_2T_1}$	$a = \frac{V_2}{T_2}, b = \frac{P_1V_1}{T_1}$		
5b					V_1	$V_1 = \frac{P_2T_1V_2}{P_1T_2}$	$a = \frac{P_1}{T_1}, b = \frac{P_2V_2}{T_2}$		
	V_2	$V_2 = \frac{P_1T_2V_1}{P_2T_1}$			$a = \frac{P_2}{T_2}, b = \frac{P_1V_1}{T_1}$				
5c	$\frac{a}{x} = b$	$x = \frac{a}{b}$				T_1	$T_1 = \frac{P_1V_1T_2}{P_2V_2}$	$a = P_1V_1, b = \frac{P_2V_2}{T_2}$	
					T_2	$T_2 = \frac{P_2V_2T_1}{P_1V_1}$	$a = P_2V_2, b = \frac{P_1V_1}{T_1}$		
6	$ax = b$	$x = \frac{b}{a}$			Ideal Gas Law	$PV = nRT$	P	$P = \frac{nRT}{V}$	$a = V, b = nRT$
							V	$V = \frac{nRT}{P}$	$a = P, b = nRT$
			n	$n = \frac{PV}{RT}$			$a = RT, b = PV$		
			T	$T = \frac{PV}{nR}$			$a = nR, b = PV$		

Algebra ^a			Chemistry ^b				Correspondence between constants ^c
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown	
7a	$\frac{x}{a} = b$	$x = ab$	Graham's Law	$\frac{v_2}{v_1} = \sqrt{\frac{M_1}{M_2}}$	n_2	$v_2 = v_1 \sqrt{\frac{M_1}{M_2}}$	$a = n_1, b = \sqrt{\frac{M_1}{M_2}}$
7b	$\frac{a}{x} = b$	$x = \frac{a}{b}$			n_1	$v_1 = v_2 \sqrt{\frac{M_2}{M_1}}$	$a = n_2, b = \sqrt{\frac{M_1}{M_2}}$
7c	$\sqrt{\frac{x}{a}} = b$	$x = ab^2$			M_1	$M_1 = M_2 \left(\frac{v_2}{v_1} \right)^2$	$a = M_2, b = \frac{n_2}{n_1}$
7d	$\sqrt{\frac{a}{x}} = b$	$x = \frac{a}{b^2}$			M_2	$M_2 = M_1 \left(\frac{v_1}{v_2} \right)^2$	$a = M_1, b = \frac{n_1}{n_2}$

Algebra ^a			Chemistry ^b				Correspondence between constants ^c
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown	
8a	$ax = b$	$x = \frac{b}{a}$	Thermodynamics	$Q = mC_p\Delta T,$ where $\Delta T = T_f - T_i$	m	$m = \frac{Q}{C_p\Delta T}$	$a = C_p\Delta T, b = Q$
8b					C_p	$C_p = \frac{Q}{m\Delta T}$	$a = m\Delta T, b = Q$
8c					ΔT	$\Delta T = \frac{Q}{mC_p}$	$a = mC_p, b = Q$
8d					T_f	$T_f = T_i + \frac{Q}{mC_p}$	$a = mC_p, b = T_i, c = Q$
8e					T_i	$T_i = T_f - \frac{Q}{mC_p}$	$a = mC_p, b = T_f, c = Q$

	Algebra ^a		Chemistry ^b				Correspondence between constants ^c
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown	
9a	$\frac{x}{a} = b$	$x = ab$	Molarity	$M = \frac{n}{V}$	n	$n = MV$	$a = V, b = M$
9b	$\frac{a}{x} = b$	$x = \frac{a}{b}$			V	$V = \frac{n}{M}$	$a = n, b = M$
10a	$\frac{ax}{x+b} = c$	$x = \frac{bc}{a-c}$	Percent by Mass	$P = 100 \frac{s}{s+S}$ where $s = \text{mass solute}$ $S = \text{mass solvent}$	s	$s = \frac{SP}{100-P}$	$a = 100, b = S, c = P$
10b	$\frac{a}{b+x} = c$	$x = \frac{a}{c} - b$			S	$S = s \left(\frac{100}{P} - 1 \right)$	$a = 100s, b = s, c = P$

	Algebra ^a		Chemistry ^b				Correspondence between constants ^c
No.	Equation	Solve for x	Topic	Equation	Unknown	Solve for Unknown	
11a	$b = a \log(x)$	$x = 10^{\frac{b}{a}}$	Acidity	$pH = -\log([H^+]),$ where $[H^+]$ is the molarity of H^+	$[H^+]$	$[H^+] = 10^{-pH}$	$a = -1, b = pH$
11b							
12a	$\frac{x^2}{a} = b$	$x = \sqrt{ab}$	Equilibria: Mass Action Fraction	$\frac{[C][D]}{[A][B]} = K$ where $A + B \rightarrow C + D,$ and little of C and D is formed.	[C], assume [D] = [C]	$[C] = \sqrt{K[A][B]}$	$a = [A][B], b = K$
12b	$\frac{a}{x^2} = b$	$x = \sqrt{\frac{a}{b}}$					

12c	$\frac{(x)(2x)^2}{a} = b$	$x = \left(\frac{ab}{4}\right)^{\frac{1}{3}}$	Equilibria: Mass Action Fraction	$\frac{[C][D]^2}{[A][B]} = K$ <p>where $A + B$ $\rightarrow C + 2D$ and <i>little of C</i> and <i>D is formed</i></p>	[C], assume [D] = 2[C]	$[C] = \left(\frac{K[A][B]}{4}\right)^{\frac{1}{3}}$	$a = [A][B], b = K$
12d	$\frac{(x)^2 \left(\frac{3}{2}x\right)^3}{a} = b$	$x = \left(\frac{8ab}{27}\right)^{\frac{1}{5}}$	Equilibria: Mass Action Fraction	$\frac{[C]^2[D]^3}{[A][B]} = K$ <p>where $A + B$ $\rightarrow 2C + 3D$ and <i>little of C</i> and <i>D is formed</i></p>	[C], assume [D] = $\frac{3}{2}$ [C]	$[C] = \left(\frac{8K[A][B]}{27}\right)^{\frac{1}{5}}$	$a = [A][B], b = K$