Chem 1062

Note Title 7/15/2008

* Exams Returned
* Lab Reports

From yesterday:

Find the b.p. of a solution that contains 50.0 g of $C_6H_{12}O_6$ in 1000 g H_2O.
Find its f.p.

$K_b = 0.512\,^\circ C/m$ $\quad K_f = 1.858\,^\circ C/m$

$\Delta T_b = i K_b c_m$ $\quad \Delta T_f = i K_f c_m$

$$c_m = 50.0\,\text{g}\,C_6H_{12}O_6 \times \frac{1\,\text{mol}\,C_6H_{12}O_6}{180.2\,\text{g}\,C_6H_{12}O_6} \times \frac{1}{1.000\,\text{kg}\,H_2O}$$

$$= 0.2775\ m\ C_6H_{12}O_6$$

$$\Delta T_b = i\,(0.512\,^\circ C/m)(0.2775\,m)$$

$$= 0.142\,^\circ C$$

b.p. $= 100.000\,^\circ C + 0.142\,^\circ C =$ **100.142 °C**

$$\Delta T_f = i\,(1.858\,^\circ C/m)(0.2775\,m)$$

$$= 0.516\,^\circ C$$

f.p. $= 0.000\,^\circ C - 0.516\,^\circ C =$ **−0.516 °C**

Find the f.p. of a 0.10 m $CaCl_2$ solution.

$$\Delta T_f = i K_f c_m = (3)(1.858\,^\circ C/m)(0.10\,m)$$
$$= 0.56\,^\circ C$$

f.p. = −0.56 °C

12.69 2.39 mg safrole in 103.0 mg diphenyl ether

$K_f = 8.00\,^\circ C/m$

$T_f = 26.84\,^\circ C$ (pure)
$T_f = 25.70\,^\circ C$ (soln) $> 1.14\,^\circ C$

MW of safrole? (amu)

$M_m = \frac{g\ \text{safrole}}{\text{mol safrole}}$

$$2.39\ mg\ \text{safrole} \times \frac{1\ g}{1000\ mg} = \frac{2.39\times10^{-3}\ g\ \text{safrole}}{1.468\times10^{-5}\ \text{mol safrole}} = 163\ \frac{g}{mol}$$

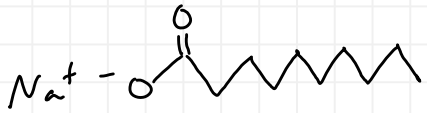
$$\frac{\Delta T_f}{K_f} = \frac{K_f\, c_m}{K_f} = \frac{1.14\,^\circ C}{8.00\,^\circ C/m} = 0.1425\ m = 0.1425\ \frac{\text{mol safrole}}{\text{kg di eth}}$$

$$\frac{0.1425\ \text{mol saf}}{\text{kg di eth}} \times 103.0\ mg\ \text{di eth} \times \frac{1\ g}{1000\ mg} \times \frac{1\ kg}{1000\ g} = 1.468\times10^{-5}\ \text{mol saf}$$

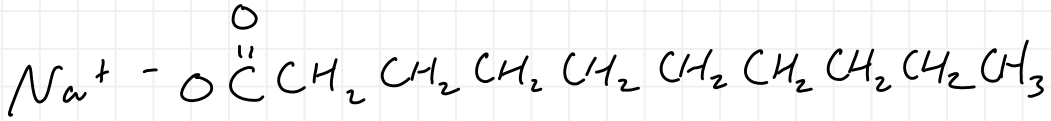
$163\ g/mol \Rightarrow$ **163 amu**

Colloids

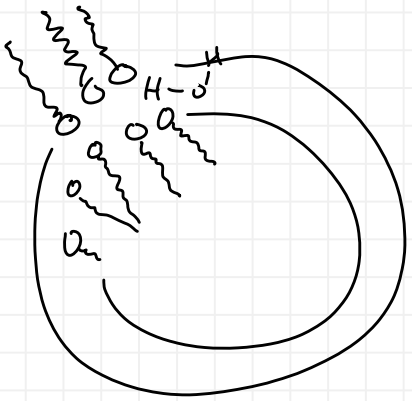
Tyndall effect

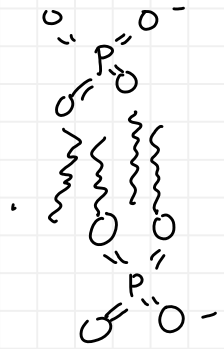


typical soap:



Bubble





I need 6 volunteers for a demo 

Chemical Kinetics - study of reaction rates and the factors that affect reaction rates

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

Factors that affect Reaction Rate

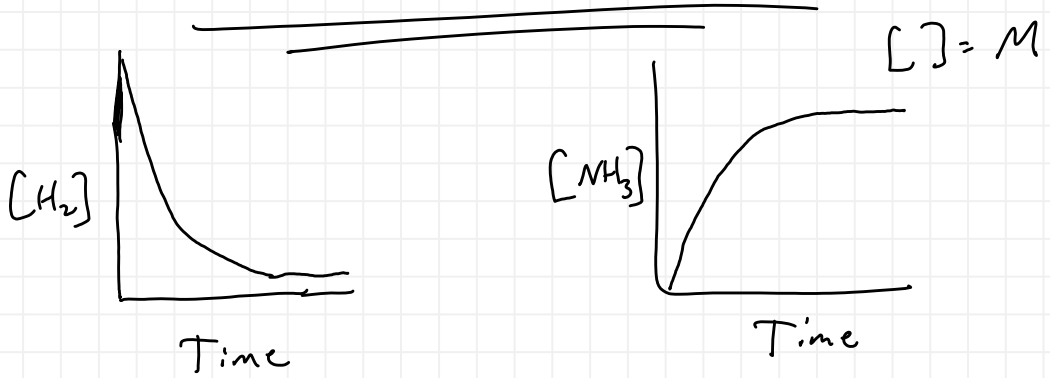
1) Surface Area of Reactants
2) Concentration " "
3) Temperature " "
4) Catalyst

↓ Rate vs. Time ↓ => inverse proportion

Reaction Rate - rate at which the molar concentration of a reactant or product changes per unit of time

by convention, reaction rates always have positive (+) values

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$



Rate of formation of NH_3 $= \dfrac{\Delta[NH_3]}{\Delta t} = \dfrac{M}{s} = \dfrac{\frac{mol}{L}}{s} = \dfrac{mol}{L \cdot s}$

$M \cdot s^{-1}$ $\qquad$ $mol \cdot L^{-1} \cdot s^{-1}$

Rate of reaction of H_2 $= -\dfrac{\Delta[H_2]}{\Delta t}$ $\qquad$ $N_2 + 3H_2 \rightarrow 2NH_3$

What is relation between the rate of formation of NH_3 and the rate of reaction of H_2?

Rate of reaction of H_2 $= -\dfrac{\Delta[H_2]}{\Delta t} = -\left(\dfrac{3}{2}\right)\dfrac{\Delta[NH_3]}{\Delta t} = (-3)\dfrac{\Delta[N_2]}{\Delta t}$

Consider this generic equation:

$$aA + bB \xrightarrow{C} dD + eE$$

Rate Law ~~expression~~:

$$Rate = K[A]^x[B]^y[C]^z$$

Rate Constant → remains constant as long as the temperature remains constant

$x, y, z \Rightarrow$ reaction orders (determined experimentally)

$x + y + z =$ overall reaction order

If first order with respect to [A], then $x = 1$.

If second order with respect to [B], then $y = 2$.

Example: finding the units of K

$$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$$

Rate Law:

$$\text{Rate} = K[N_2][H_2]$$

$$\frac{L^x}{mol^x}\frac{mol}{K \cdot s} = K\left(\frac{mol}{L}\right)^2\left(\frac{L}{mol}\right)^2 = \boxed{\frac{L}{mol \cdot s}}$$

14.45 $CH_3NNCH_3(g) \rightarrow C_2H_6(g) + N_2(g)$

Trial	$[Azo]_0$	Rate_0
1	1.13×10^{-2} M	2.8×10^{-6} M/s
2	2.26×10^{-2} M	5.6×10^{-6} M/s

Rate Law? K?

$$\frac{2.26 \times 10^{-2}}{1.13 \times 10^{-2}} = 2$$

$$\frac{5.6 \times 10^{-6}}{2.8 \times 10^{-6}} = 2$$

$$\boxed{\text{Rate} = K[Azo]}$$

$x = 1$ (first order with respect to Azo)

$$\frac{\text{Rate}}{[Azo]} = \frac{K[Azo]}{[Azo]} = \frac{2.8 \times 10^{-6}\ M/s}{1.13 \times 10^{-2}\ M} = \boxed{2.5 \times 10^{-4}\ s^{-1}}$$

$$\boxed{\text{Rate} = 2.5 \times 10^{-4}\ s^{-1}[Azo]}$$