AP Chem Unit 2

22.99
16.00
1.008
39.998 ↑

ex 1 Find:

M = ?

11.5g NaOH

1.50 L

Soln: $M = \frac{moles}{L}$

$$\left(\frac{11.5g\ NaOH}{1}\right)\left(\frac{1 mole\ NaOH}{40.00g\ NaOH}\right)\left(\frac{1}{1.50L}\right)$$

$$\boxed{= .192\ M\ NaOH}$$

1.008
35.45
36.458 ↑

Ex 2 Find:

M = ?

1.56 g HCl

26.8 ml = .0268 L

$M = \frac{moles}{L}$

$$\left(\frac{1.56g\ HCl}{1}\right)\left(\frac{1 mole\ HCl}{36.46g\ HCl}\right)\left(\frac{1}{.0268L}\right)$$

$$= 1.596 = \boxed{1.60\ M\ HCl}$$

Ex 3 ? concentraition of Co^{+2} & NO_3^- in .50M $Co(NO_3)_2$

$$\left(\frac{.50\ moles\ Co(NO_3)_2}{1L}\right)\left(\frac{1 mole\ Co^{+2}}{1 mole\ Co(NO_3)_2}\right) = \boxed{.50\ M\ Co^{-2}}$$

$$\left(\frac{.50\ moles\ Co(NO_3)_2}{1L}\right)\left(\frac{2 mole\ NO_3^-}{1 mole\ Co(NO_3)_2}\right) = \boxed{1.0\ M\ NO_3^{-1}}$$

? concentration of Fe^{+3} & ClO_4^- in 1M

$$\left(\frac{1 mole\ Fe(ClO_4)_3}{1L}\right)\left(\frac{1 mole\ Fe^{+3}}{1 mole\ Fe(ClO_4)_3}\right) = \boxed{1 M\ Fe^{+3}}$$

$$\left(\frac{1 mole\ Fe(ClO_4)_3}{1L}\right)\left(\frac{3 mole\ ClO_4^-}{1 mole\ Fe(ClO_4)_3}\right) = \boxed{3 M\ ClO_4^-}$$

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Ex4/ ? # moles of Cl^- in 1.75L of 1.0×10^{-3} M $ZnCl_2$

$$\left(\frac{1.0 \times 10^{-3} \text{ moles } ZnCl_2}{L}\right)\left(\frac{1.75L}{1}\right)\left(\frac{2 \text{ moles } Cl^-}{1 \text{ mole } ZnCl_2}\right) = \boxed{3.5 \times 10^{-3} \text{ moles } Cl^-}$$

Ex 5/ Given:

.14M NaCl in Blood Serum

?V of Blood contains 1.0mg NaCl

$$\left(\frac{1.0\text{mg NaCl}}{1}\right)\left(\frac{1g}{1000mg}\right) = 1.0 \times 10^{-4} g \text{ NaCl}$$

$M = \frac{moles}{L}$ $L = \frac{moles}{M}$

$$\left(\frac{1.0 \times 10^{-4} g \text{ NaCl}}{1}\right)\left(\frac{1 \text{ mole NaCl}}{58.44g \text{ NaCl}}\right)\left(\frac{1 \text{ L Blood}}{.14 \text{ moles NaCl}}\right)$$

$$\boxed{\begin{gathered} = 1.2 \times 10^{-5} \text{ L Blood} \\ \text{or} \\ .12\text{mL Blood} \end{gathered}}$$

Ex 6/ Given:

$2 \times 39.10 = 78.20$ 1.00L $K_2Cr_2O_7$

$2 \times 52.00 = 104.0$ .200M $K_2Cr_2O_7$

$7 \times 16.00 = 112.0$?g $K_2Cr_2O_7$

294.2g

Soln: $M = \frac{moles}{L}$

$$\left(\frac{.200 \text{ moles } K_2Cr_2O_7}{1L}\right)\left(\frac{1.00L}{1}\right)\left(\frac{294.2 \text{ g } K_2Cr_2O_7}{1 \text{mole } K_2Cr_2O_7}\right)$$

$$= 58.\overset{\downarrow}{8}4g$$

$$\boxed{= 58.8g \; K_2Cr_2O_7}$$

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Ex 7/ Given:

$V_1 = ?$

$M_1 = 16M\ H_2SO_4$

$V_2 = 1.5L$

$M_2 = .10M\ H_2SO_4$

Soln:

$M_1V_1 = M_2V_2$

$$V_2 = \frac{M_2V_2}{M_1} = \frac{(.10M\ H_2SO_4)(1.5L)}{(16M\ H_2SO_4)}$$

$$\boxed{V_2 = .0094L \text{ or } 9.4ml\ H_2SO_4}$$

Ex 8/ A) $2KNO_{3(aq)} + BaCl_{2(aq)} \rightarrow 2KCl_{(aq)} + Ba(NO_3)_{2(aq)}$

No ppt

B) $Na_2SO_{4(aq)} + Pb(NO_3)_{2(aq)} \rightarrow 2NaNO_{3(aq)} + PbSO_{4(s)}$

$PbSO_4$ P↓

C) $3KOH_{(aq)} + Fe(NO_3)_{3(aq)} \rightarrow KNO_{3(aq)} + Fe(OH$

$Fe(OH)_3$ P↓

Ex 9/ Ⓐ molecular $KCl_{(aq)} + AgNO_{3(aq)} \rightarrow AgCl_{(s)} + KNO_{3(aq)}$

Complete $K^+_{(aq)} + Cl^-_{(aq)} + Ag^+_{(aq)} + NO_3^-{}_{(aq)} \rightarrow AgCl_{(s)} + K^+_{(aq)} + NO_3^-{}_{(aq)}$

Net $Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl_{(s)}$

Ⓑ molecular $3KOH_{(aq)} + Fe(NO_3)_{3(aq)} \rightarrow Fe(OH)_{3(s)} + 3KNO_{3(aq)}$

Complete $3K^+_{(aq)} + 3OH^-_{(aq)} + Fe^{+3}_{(aq)} + 3NO_3^-{}_{(aq)} \rightarrow Fe(OH)_{3(s)} + 3K^+_{(aq)} + 3NO_3^-{}_{(aq)}$

Net $Fe^{+3}_{(aq)} + 3OH^-_{(aq)} \rightarrow Fe(OH)_{3(s)}$

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ex 10 $NaCl_{(s)} + AgNO_{3(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$

?g 1.50L 0.100M Need a Complete Rxn

Na 22.99
Cl 35.45
58.44

$$\left(\frac{0.100 \text{ moles } AgNO_3}{1L}\right)\left(\frac{1.50L}{1}\right)\left(\frac{1 \text{ mole } NaCl}{1 \text{ mole } AgNO_3}\right)\left(\frac{58.44g \text{ } NaCl}{1 \text{ mole } NaCl}\right) = \boxed{8.77g \text{ } NaCl}$$

ex 1 $Na_2SO_{4(aq)} + Pb(NO_3)_{2(aq)} \rightarrow PbSO_{4(s)} + 2NaNO_{3(aq)}$

2.00L 0.0250 M 1.25L 0.0500M ?g

$$\left(\frac{0.0250 \text{ Moles } Na_2SO_4}{1}\right)\left(\frac{2.00L}{1}\right) = \begin{matrix}.0500 \text{ moles} \\ Na_2SO_4\end{matrix}$$

$$\left(\frac{0.0500 \text{ moles } Pb(NO_3)_2}{1}\right)\left(\frac{1.25L}{1}\right) = .0625 \text{ moles } Pb(NO_3)_2$$

	Na_2SO_4	$Pb(NO_3)_2$	$PbSO_4$
I	.0500 moles	.0625 moles	0
C	−X	−X	X
	−.0500 moles	−.0500 moles	.0500 moles
E	0	.0125 moles	.0500 moles
	Limiting	Excess	Produced

Pb 207.2
S 32.06
O 4×16.00 64.00
303.3

$$\left(\frac{.0500 \text{ moles } Pb(NO_3)_2}{1}\right)\left(\frac{303.3g \text{ } PbSO_4}{1 \text{ mole } PbSO_4}\right) = \boxed{15.2g \text{ } PbSO_4}$$

AP Chem Unit 2

ex12/ $HCl_{(aq)} + NaOH_{(aq)} \longrightarrow HOH_{(l)} + NaCl_{(aq)}$

.100 M .350 M

? ml 25.0 ml → .0250 L

Net Ionic $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow HOH_{(l)}$

? ml

* Neutralization moles Acid = moles BASE

$$\left(\frac{0.350 \text{ moles } OH^-}{1L}\right)\left(\frac{.0250 L}{1}\right) = .00875 \text{ moles } OH^-$$

$$\left(\frac{.00875 \text{ moles } OH^-}{1}\right)\underbrace{\left(\frac{1 \text{ mole } H^+}{1 \text{ mole } OH^-}\right)}_{\text{molar Ratio}}\left(\frac{L}{.100 \text{ moles } H^+}\right) = \boxed{\begin{array}{c} .0875 L\ H^+ \\ \text{or} \\ 87.5 \text{ ml } H^+ \end{array}}$$

ex13/ $HNO_{3(aq)} + KOH_{(aq)} \longrightarrow HOH_{(l)} + KNO_{3(aq)}$

.250 M .320 M

28.0 ml 53.0 ml

? M of Ion's In Excess

* Need moles of each Rxn
* Which is Limiting?

1st moles of each Reactant $\left(\frac{.250 \text{ moles } HNO_3}{1L}\right)\left(\frac{28.0 ml}{1}\right)\left(\frac{1 L}{1000 ml}\right) = .00700 \text{ m } HNO_3$

$$\left(\frac{.320 \text{ moles } KOH}{1 L}\right)\left(\frac{53.0 ml}{1}\right)\left(\frac{1 L}{1000 ml}\right) = .0170 \text{ moles } KOH$$

	H^+	OH^-	HOH
I	.00700 m	.0170 m	0
C	−X	−X	X
	−.00700	−.00700	.00700
E	0 Limiting	.0100 moles Excess OH^-	.00700 m HOH produced

28.0 ml
53.0 mL
81.0 ml Total V
↓

$$\text{Excess} \left(\frac{.0100 \text{ moles } OH^-}{1}\right)\left(\frac{1}{81.0 ml}\right)\left(\frac{1 L}{1000 ml}\right) = \boxed{\begin{array}{c} .123 M \\ OH^- \\ \text{Excess} \end{array}}$$

AP Chem Unit 2

14ex) **Key**

$KHC_8H_4O_4$ 1.3009g mm = 204.22 g/mole, gives Away 1 acidic Hydrogen
is titrated with 41.20 ml NaOH

? M NaOH

① student dissolves KHP in water, so is aq

write Ionic Eqn

$K^+_{(aq)} + HC_8H_4O^-_{4(aq)} + Na^+_{(aq)} + OH^- \rightarrow H_2O_{(l)} + K^+_{(aq)} + Na^+ + OH^-$
$+ C_8H_4O^-_{4(aq)}$

↑ gives this Hydrogen away

Take away Spectors ions

$HC_3H_4O_4^- + OH^- \rightarrow H_2O_{(l)} + C_8H_4O^-_{4\,(aq)}$

.0063701 mole ? M 41.20ml

$$\left(\frac{1.3009g\ KHP}{1}\right)\left(\frac{1\,mole\ KHP}{204.22g\ KHP}\right) = .0063701\ mole\ KHP$$

Stoich H^+ + OH^- 1:1 Ratio

i.e. 42.20 ml NaOH (OH^-) must contain just as many (H^+) in 1.3009g $KHC_8H_4O_4$ (.0063701 mole)

* Neutralization w/ Phenolphthalein

$$M = \frac{moles}{L}\left(\frac{.0063701\ mole\ NaOH}{.04120L}\right) = \boxed{.1546\ M\ NaOH}$$

AP Chem Unit 2

15ex / Given:

Solid $CCl_4 : HC_7H_5O_2$ ⇒ effluent = .3518g

$HC_7H_5O_2$ → weak Acid, 1 H^+ acidic (donor)

Effluent (aq) Neutralized w/ 10.59ml of .1546M NaOH

* CCl_4 wont dissolve in water

Net Ionic Rxn

$$H^+_{(aq)} + C_7H_5O_2^-{}_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)} + C_7H_5O_2^-{}_{(aq)}$$

.1546M

10.59ml = .01059L

$$\left(\frac{.1546 \text{ moles } OH^-}{1L}\right)\left(\frac{.01059L}{1}\right) = .00163 \text{ moles } OH^-$$

1:1 Stoich Ratio Btwn H^+ OH^- for neutralization

∴ .00163 moles H^+ to Neutralize .00163 moles OH^-

$$\left(\frac{.00163 \overset{\text{mole}}{} HC_7H_5O_2}{1}\right)\left(\frac{122.12g\ HC_7H_5O_2}{1 \text{mole } HC_7H_5O_2}\right) = .199\ g\ HC_7H_5O_2$$

H: 6x 1.008 = 6.048

C: 7x 12.01 = 84.07

O: 2x 16.00 = 32.00

122.12g

$$\frac{.199g\ HC_7H_5O_2}{.3518g \text{ Effluent}} \times 100\%$$

$$\boxed{= 56.6\%\ HC_7H_5O_2}$$

AP Chem Unit 2

16ex/ A) $\overset{+4}{C}\overset{-2}{O}_2$ B) $\overset{+6}{S}\overset{-1}{F}_6$ C) $\overset{+5}{N}\overset{-6}{\overset{-2}{O}}{}_3^-$

17ex/ $2\overset{0}{Al}_{(s)} + 3\overset{0}{I}_{2(s)} \rightarrow 2\overset{+3}{Al}\overset{-3}{\overset{-1}{I}}{}_{3(s)}$

$\overset{0}{Al} \rightarrow \overset{+3}{Al}I_3$ LEO ⇒ Oxidation

$\overset{0}{I}_2 \rightarrow Al\overset{-1}{I}_3$ GER ⇒ Reduction

18ex/ $2\overset{+2}{Pb}\overset{-2}{S}_{(s)} + 3O_{2(g)} \rightarrow 2\overset{+2}{Pb}\overset{-2}{O}_{(s)} + 2\overset{+4}{S}\overset{-4}{O}_{2(g)}$

$Pb\overset{-2}{S} \rightarrow 2\overset{+4}{S}\overset{-4}{O}_2$ LEO 6ē Oxidation

$3\overset{0}{O}_2 \rightarrow 2Pb\overset{-2}{O}$ GER 2e Reduction

$\overset{+2}{Pb}\overset{-2}{O}_{(s)} + \overset{+2}{C}\overset{-2}{O}_{(g)} \rightarrow \overset{0}{Pb}_{(s)} + \overset{+4}{C}\overset{-4}{O}_{2(g)}$

$\overset{+2}{Pb}O_{(s)} \rightarrow \overset{0}{Pb}_{(s)}$ GER $2e^-$ Reduction

$\overset{+2}{C}O \rightarrow \overset{+4}{C}O_2$ LEO $2e^-$ Oxidation

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ex R/

+1 +6 $\overset{+12}{\cancel{\to 14}}$ -2 -2 -2 +5 +4 -2 +1 +3 +4.

$H^+_{(aq)} + Cr_2O_7^{-2}{}_{(aq)} + C_2H_5OH \to Cr^{+3} + CO_{2(g)} + H_2O_{\ell}$

Balance R $\overset{+6}{Cr_2}O_7^{-2} \to 2Cr^{+3}$ GAin 3e⁻ 6ER

O $\overset{-2}{C_2}H_5OH \to 2\overset{+4}{C}O_2$

Balance O w/H₂O R $Cr_2O_7^{-2} \to 2Cr^{+3} + 7H_2O$

O : $C_2H_5OH + 3H_2O \to 2CO_2$

Balance H w/H⁺ R $14H^+ + Cr_2O_7^{-2} \to 2Cr^{+3} + 7H_2O$

O $C_2H_5OH + 3H_2O \to 2CO_2 + 12H^+$

14+ $\overset{6}{(+12)}$ -2 12 6 +6

Balance Charge w/e⁻ R $14H^+ + Cr_2O_7^{-2} + 6e^- \to 2Cr^{+3} + 7H_2O$

O $C_2H_5OH + 3H_2O \to 2CO_2 + 12H^+ + 12e^-$

Balance e⁻ R 2x $\overset{14}{28}H^+ + 2Cr_2O_7^{-2} + \cancel{12e^-} \to 4Cr^{+3} + \overset{11}{\cancel{14}}H_2O$

O $C_2H_5OH + 3H_2O \to 2CO_2 + \cancel{12H^+} + \cancel{12e^-}$

Combine $16H^+ + 2Cr_2O_7^{-2} + C_2H_5OH \to 2CO_2 + 4Cr^{+3} + 11H_2O$