) ALL SUBSTANCES HAVE DIFFERENT BOILING POINTS. GASES CAN BE SEPARATED BY CONDENSING THE GAS WITH THE HIGHER BOLING POINT LEAVING THE OTHER SUBSTANCE STILL IN ITS GAS STATE.

) PARTICLES ARE MORE SPREAD OUT IN A GAS.

) $\frac{13.25\text{lbs}}{\text{gal}} \times \frac{1\text{gal}}{4\text{qts}} \times \frac{1.06\text{qt}}{1\text{L}} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{1\text{kg}}{2.2\text{lbs}} \times \frac{1000\text{g}}{1\text{kg}} = 1.596\ \text{g/mL}$

) 7.81% C = 7.81g C IN A 100g SAMPLE
92.19% Cl = 92.19g Cl

$\frac{7.81\text{g C}}{1} \times \frac{1\text{mole C}}{12.01\text{g C}} = 0.65029\ \text{mole C}$

$\frac{92.19\text{g Cl}}{1} \times \frac{1\text{mole Cl}}{35.45\text{g Cl}} = 2.60056\ \text{mole Cl}$

} DIVIDING BOTH BY SMALLEST (0.65029) GIVES A 1:4 RATIO

EMPIRICAL FORMULA
CCl_4
MASS = 153.81

EMPIRICAL MASS = $\frac{153.81}{1538}$ = 1:1 RATIO ∴ LIQUID IS CCl_4
MOLECULAR MASS (GIVEN) = 1538

5) HCl → DOESN'T CONTAIN C AND REACTS WITH METALS TO MAKE H_2 g)

6) $CH_4 + 4Cl_2 \rightarrow CCl_4 + 4HCl$
(METHANE)

7) CH_4 → $PV = nRT$

$(1.30\text{atm})(210.5\text{L}) = n\left(0.0821 \frac{\text{L·atm}}{\text{mole·K}}\right)(298\text{K}) = 11.18\ \text{mole}\ CH_4$

$Cl_2 \rightarrow \frac{1000.2\text{L}\ Cl_2}{1} \times \frac{1\text{mole}\ Cl_2}{22.4\text{L}\ Cl_2} = 44.65\ \text{mole}\ Cl_2$

SINCE I NEED CCl_4 TO ANSWER 8 I'LL GO THERE!

$11.18\text{mole}\ CH_4 \times \frac{1\text{mole}\ CCl_4}{1\text{mole}\ CH_4} = 11.18\ \text{mole}\ CCl_4$

$44.65\text{mole}\ Cl_2 \times \frac{1\text{mole}\ CCl_4}{4\text{mole}\ Cl_2} = \boxed{11.16\ \text{mole}\ CCl_4}$ ACTUAL AMOUNT

SO Cl_2 IS LIMITER!

8) $11.16\,mole\,CCl_4 \times \frac{153.8\,g}{1\,mole\,CCl_4} \times \frac{1\,mL}{1.596\,g} \times \frac{1\,L}{1000\,mL} = 1.075\,L\,CCl_4$

9) $11.18\,mole - 11.16\,mole = 0.02\,mole\,CCl_4 \times \frac{1\,mole\,CH_4}{1\,mole\,CCl_4} = 0.02\,mole\,CH_4$ EXCESS

NOT MADE

10) HESS' LAW

$CH_4 \rightarrow 2H_2 + C_{(GRAPHITE)}$ $\Delta H = +74.9$ (REVERSED)

$C_{(GRAPHITE)} + 2Cl_{2(g)} \rightarrow CCl_{4(g)}$ $\Delta H = -139\,kJ$ (LEFT ALONE)

$2H_2 + 2Cl_2 \rightarrow 4HCl$ $\Delta H = -369.2\,kJ$ (X4)

$CCl_{4(g)} \rightarrow CCl_{4(l)}$ $\Delta H = -32.54$ (REVERSED)

$CH_4 + 4Cl_2 \rightarrow CCl_4 + 4HCl$ $\Delta H = -465.8\,kJ$

11) $\frac{11.16\,mole\,CCl_4}{1} \times \frac{-465.8\,kJ}{1\,mole\,CCl_4} = -5198\,kJ$

12) $\Delta H_{H_2O} = +5198\,kJ$ $\Delta H = m\,c\,\Delta T$

$(5198\,kJ)\left(\frac{1000\,J}{1\,kJ}\right) = (1\times10^5\,g)\left(4.184\,\frac{J}{g\,^\circ C}\right)(T_f - 0\,^\circ C)$

$T_f = 12.42\,^\circ C$

13) NEED MOLES OF $HCl_{(g)}$ SO...

$\frac{44.65\,mole\,Cl_2}{1} \times \frac{4\,mole\,HCl}{4\,mole\,Cl_2} = \frac{44.65\,mole\,HCl + 0.02\,mole\,CH_4}{44.67\,mole\,TOTAL}$

$PV = nRT$

$P(200L) = (44.67\,mole)\left(0.0821\,\frac{L\,atm}{mole\,K}\right)($453

$P = 0.831\,atm$

14) $\frac{44.65\,mole\,HCl}{1\times10^4\,mL \times \frac{1\,L}{1000\,mL}} = 4.465M$

15) $\frac{4.13M}{4.465M} \times 100\% = 92.4\%$

16) $AgNO_3 + HCl \rightarrow AgCl + HNO_3$

$\frac{5130\,g\,AgNO_3}{1} \times \frac{1\,mole\,AgNO_3}{169.88\,g\,AgNO_3} \times \frac{1\,mole\,AgCl}{1\,mole\,AgNO_3} \times \frac{143.32\,g\,AgCl}{1\,mole\,AgCl} = \boxed{4328\,g\,AgCl}$

$\frac{4.13M\,HCl\,SOLN}{1} \times \frac{10L}{} \times \frac{1\,mole\,AgCl}{1\,mole\,HCl} \times \frac{143.32\,g\,AgCl}{1\,mole\,AgCl} = 5919\,g\,AgCl$

D) IONIC EQUATION

$$Ag^+ + NO_3^- + H^+ + Cl^- \rightarrow AgCl_{(s)} + H^+ + NO_3^-$$

SINCE $AgNO_3$ IS LIMITER AND ALL Ag IS IN AgCl, THEN THERE ARE ON SILVER IONS

ALL OF H^+ IONS FROM HCl IS IN HNO_3, SO H^+ CONCENTRATION DID NOT CHANGE.

$$\frac{4.13m\ HCl}{1} \times \frac{1\ mole\ H^+\ IONS}{1\ mole\ HCl} = 4.13M\ H^+$$

Cl^- IS EXCESS SO...

$5919g\ AgCl - 4328g\ AgCl = 1591g\ AgCl$ NOT MADE FROM HCl

$$\frac{1591g\ AgCl}{1} \times \frac{1\ mole\ AgCl}{143.32g\ AgCl} \times \frac{1\ mole\ HCl}{1\ mole\ AgCl} \times \frac{}{10L} = 1.11M\ HCl \times \frac{1\ mole\ Cl^-}{1\ mole\ HCl} = 1.11M\ C$$

↑ SOLUTION

NO_3^- CAME FROM $AgNO_3$

$$\frac{5130g\ AgNO_3}{1} \times \frac{1\ mole\ AgNO_3}{169.88g\ AgNO_3} \times \frac{1\ mole\ NO_3^-}{1\ mole\ AgNO_3} \times \frac{}{10L} = 3.02M\ NO_3^-$$