KEY-HW: Mole Relationships

Friday, October 23, 2020 11:53 AM

Complete the following ICE charts to answer the questions below. LR = limiting reagent.

1) How much magnesium nitride will we produce if we start with 14 moles of magnesium and 25 moles of nitrogen? 4.67 moles

	3 Mg (s) + 1 N_2 (g) → 1 Mg_3N_2 (s)		
Initial	14	25	Ø
Change	- 14	- 4.67	+ 4.67
End	Ø (LR)	20.33	4.67

2) How much silver can we produce if we start with 65 moles of Cu and 50 moles of silver nitrate? 50 moles

	1 Cu (s) + 2 $AgNO_3$ (aq) → 2 Ag (s) + 1 $Cu(NO_3)_2$ (aq)			
Initial	65	50	Ø	Ø
Change	- 25	- 50	+ 50	+ 25
End	40	Ø	50	25

3) How much aluminum will we need to make 100 moles of H_2 gas assuming we have excess HCl? 66.7 moles

	2 Al (s) + 6 HCl (aq) → 2 $AlCl_3$ (aq) + 3 H_2 (g)			
Initial	66.7	X.S.	Ø	Ø
Change	- 66.7	- 200	+ 66.7	+ 100
End	Ø	X.S.	66.7	100

4) How much sodium nitrate decomposed if we produced 4.0 moles of oxygen? 8 moles

	2 $NaNO_3$ (s) → 2 $NaNO_2$ (s) + 1 O_2 (g)		
Initial	8	0	0
Change	- 8	+ 8	+ 4
End	Ø	8	4

5) How much $NaNO_2$ can we produce from 7.5 moles of sodium nitrate? 7.5 moles

	2 $NaNO_3$ (s) → 2 $NaNO_2$ (s) + 1 O_2 (g)

	2 $NaNO_3$ (s) → 2 $NaNO_2$ (s) + 1 O_2 (g)		
Initial	7.5	Ø	Ø
Change	-7.5	+7.5	+3.75
End	Ø	7.5	3.75

6) How much ammonia, NH_3, can be produced if we start with 50 moles of each reactant? 33.3 moles

	1 N_2 (g) + 3 H_2 (g) → 2 NH_3 (g)		
Initial	50	50	Ø
Change	-16.7	-50	+33.3
End	33.3	Ø (LR)	33.3

7) How much hydrogen gas do we need to make 100 moles of ammonia, NH_3, assuming excess nitrogen? 150 moles

	1 N_2 (g) + 3 H_2 (g) → 2 NH_3 (g)		
Initial	X.S.	150	Ø
Change	-50	-150	+100
End	X.S.	Ø	100

8) How much hydrogen gas can we produce from 37 mole of K and excess water? 18.5 moles

	2 K (s) + 2 H_2O (l) → 2 KOH (aq) + 1 H_2 (g)			
Initial	37	X.S.	Ø	Ø
Change	-37	-37	+37	+18.5
End	Ø	X.S.	37	18.5

9) How much KOH can we make from 17 moles of potassium and 25 moles of water? 17 moles

	2 K (s) + 2 H_2O (l) → 2 KOH (aq) + 1 H_2 (g)			
Initial	17	25	Ø	Ø
Change	-17	-17	+17	+8.5
End	Ø LR	8	17	8.5

10) How much carbon dioxide will be produced when 1.5 moles of sodium carbonate reacts with 2 moles of HCl? 1 mole CO_2

	1 Na_2CO_3 (s) + 2 HCl (aq) → 2 NaCl (aq) + 1 CO_2 (g) + 1 H_2O (l)

10) How much carbon dioxide will be produced when 1.5 moles of sodium carbonate reacts with 2 moles of HCl? 1 mole CO_2

	1 Na_2CO_3 (s) + 2 HCl (aq) → 2 NaCl (aq) + 1 CO_2 (g) + 1 H_2O (l)				
Initial	1.5	2	Ø	Ø	Ø
Change	−1	−2	+2	+1	+1
End	0.5	Ø	2	1	1

11) How much sodium carbonate was consumed when 0.125 moles of NaCl was produced assuming excess HCl. 0.0625 mole or 6.25×10^{-2} mole

	1 Na_2CO_3 (s) + 2 HCl (aq) → 2 NaCl (aq) + 1 CO_2 (g) + 1 H_2O (l)				
Initial	0.0625	X.S.	Ø	Ø	Ø
Change	−0.0625	−0.125	+0.125	0.0625	0.0625
End	Ø	X.S.	0.125		

12) How much carbon dioxide is released into the atmosphere when 46 moles of propane, C_3H_8, is burned in excess oxygen? 46 moles of propane is the average amount of propane burned per hour per household. 138 moles

	1 C_3H_8 (g) + 5 O_2 (g) → 3 CO_2 (g) + 4 H_2O (g			
Initial	46	X.S.	Ø	Ø
Change	−46	−230	+138	+184
End	Ø	X.S.	138	184

13) How much iron(III) oxide produced when reacting 0.45 moles of FeO with 0.50 moles of O_2?

	4 FeO (s) + 1 O_2 (g) → 2 Fe_2O_3 (s)		
Initial	0.45	0.50	Ø
Change	−0.45	−0.1125	+0.225
End	Ø (LR)	0.3875	0.225

14) Set up an ICE chart for the combustion of magnesium: Mg + O_2 --> MgO
Then answer the questions below:

A) How much MgO will be produced when you react 13 moles of Mg with excess oxygen?
B) How much MgO will be produced when you react 12 moles of Mg with 8 moles of oxygen?
C) How much Mg did you burn if you produced 25 moles of MgO in excess oxygen?

A)

	$2Mg$	+ O_2	→ $2MgO$
I	13	X.S	Ø
C	−13	−6.5	+13
E	Ø	X.S.	13

← answers are boxed

C	-13	-6.5	+13
E	∅	X.S.	13 ← answers are boxed

B) $2Mg + O_2 \rightarrow 2MgO$

I	12	8	∅
C	-12	-6	+12
E	∅ (LR)	2	12

C) $2Mg + O_2 \rightarrow 2MgO$

I	25	X.S	∅
C	-25	-12.5	+25
E	∅	X.S	25