I. R. E. ANALYSIS also known as "ICE grids"

1. 12 M of A^{3+} (aq) are reacted with 14 M of B^{-} (aq) as shown in the following equation. At equilibrium, 20 M of C^{+} (aq) are measured.
How much of the A^{3+} (aq) and B^{-} (aq) reacted? How much of the A^{3+} (aq) and B^{-} (aq) and D^{2-} (aq) are present at equilibrium?

$$2A^{3+}(aq) + 3B^{-}(aq) \rightleftarrows 5C^{+}(aq) + 1D^{2-}(aq)$$

INITIAL	**12 M**		**14 M**		----------		---------
REACTION	**-8M**		~~**-12M**~~ **-10M**		**+20M**		**+4M**
EQUILIBRIUM	**-4M**		~~**2M**~~ **4M**		**20 M**		**4M**

We start with the **+ 20 M** in the REACTION row, because this is the chemical for which we know two pieces of information.
We know that we started with no C^{+}(aq) (0 M) initially and ended with 20 M of C^{+}(aq) at equilibrium.
The second step is the **+ 4 M** in the REACTION row. Using the 5 to **1**ratio of C^{+}(aq) to D^{2-}(aq) we know that 4 M of D^{2-}(aq) are produced during the reaction and will be present at equilibrium. Note that 20 M was 1 significant figure, as is 4 M. We are retaining sig figs throughout our calculations.
Next, using the ratio of 5 C^{+}(aq) to $3B^{-}$ (aq) we can ascertain that if 20 M of C^{+}(aq) is formed, then 12 M of B^{-} (aq) is consumed during the reaction. 14-12 is 2 M. The rules of adding and subtracting are that we retain the number of placeholders (in this case, report the answer to the ones column).
Technically, according to sig fig rules, we should say that the 5:3 ratio of 20:12 should suggest that our 12 M should be reported as 10 M (1 sig fig only), leaving us 4 M of B^{-} (aq) at equilibrium. Tricky sig fig rules.
Finally, using the ratio of 5 C^{+}(aq) to $2A^{3+}$ (aq) we can ascertain
That in a 2:5 ratio, 20 M of C^{+}(aq) produced would mean 8 M of A^{3+} (aq) is consumed.
Note that we used the 20M of C^{+}(aq) to determine each of the M of the other chemical species. (Always start with the given value to ensure no errors are transferred and sig figs rules are maintained throughout).

2. $1X(g) + 3Y(g) \rightleftarrows 6Z(g)$

	X		Y		Z
I	1.6 M		2.4 M		2.1 M
R	+ 0.2 M		+ 0.6 M THIS IS OUR STARTING POINT. Report to one decimal place (adding rules)		-1.2M
E	1.8 M Note that our +0.2 was correctly 1 sig fig, but then when adding, we report to one decimal place		3.0 M		0.9M Report to one decimal place (subtracting rules)

ICE grids

3. $3H_2(g) + N_2(g) \rightleftarrows 2NH_3(g)$

	H_2		N_2		NH_3
I	5.0 M		3.0 M		2.0 M
C	-4.5M		-1.5M		+3.0M THIS IS OUR STARTING POINT.
E	0.5M		1.5M		5.0 M

2.1 ESSENTIAL EQUILIBRIUM EXERCISE

1. CH_4 (g) + $2O_2$ (g) ⇄ CO_2 (g) + $2H_2O$ (g)

I	8.0 M		11.0 M		-----------		----------
C	**-3.0M**		**-6.0M**		**+3.0M**		**+6.0M**
E	**5.0M**		**5.0M**		3.0 M		**6.0M**

2. Cr^{+5} (aq) + $3Pb^{+2}$ (aq) ⇄ $3Pb^{+4}$ (aq) + $2Cr^{+2}$ (aq)

I	0.84 M		0.75 M		--------------		---------------
R	**-0.24M**		**-0.36M**		**+0.36M**		**+0.24M**
E	0.60 M		**0.39M**		**0.36M**		**0.24M**

3. $2MnO_4^-$ (aq) + $5H_2$ (g) ⇄ $2Mn^{+2}$ (aq) + $6OH^-$ (aq) + $2H_2O$ (g)

1	5.50 M	7.00 M		4.00 M	1.50 M	6.00 M
C	**+0.32M**	**+0.80M**		**-0.32M**	**-0.96M**	**-0.32M**
E	**5.82M**	**7.80M**		**3.68 M**	0.54 M	**5.68 M**