There are only so many ways these calculations can work. So, we will preview a few different versions

(#11-2)

ISE Table Calculations

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1. $A(aq) + B(aq) \rightarrow 2C(aq)$ In an equilibrium mixture, [A] = 0.25M [B] = 1.1M and [C] = 0.1M.
    a. Write out the equilibrium expression.

    $Kc = \frac{[C]^2}{[A][B]}$

    b. Write out an ISE table and solve the equilibrium constant.

	A	+ B	⇌ 2C
I			
S			
E	0.25	1.1	0.1

$K = \frac{[0.1]^2}{[.25][1.1]}$ = 0.0364M

Version 1: Notice they give you all the concentrations at equilibrium. Simply plug into the expression and solve for K.

2. Given the reaction above at an alternate temperature has a K value = 250. When at equilibrium, A and B were both shown to have a concentration of 0.5M.
    a. Write out an equilibrium expression, and calculate the concentration of C at equilibrium?

	A +	B	⇌ 2C
I			
S			
E	0.5	0.5	?

$Kc = \frac{[C]^2}{[A][B]}$

$250 = \frac{[?]^2}{(0.5)(0.5)}$

C = 7.9M

Version 2: How is this different then version 1? Why is temperature mentioned here?

    b. Is this reaction product or reactant favored, how do you know?

    K > 1

3. $A(aq) + B(aq) \rightarrow 2C(aq)$ at an alternate temperature. A solution is containing 0.5M concentrations of each substance. At equilibrium the concentration of C = 0.1M.
    a. Determine the equilibrium concentration of A and B.
    b. Determine K at this temperature.

Version 3: Very common problem. Notice how the ISE table is unlocked

	A +	B	→ 2C
I	0.5	0.5	0.5
S	+x	+x	−2x
E	0.7	0.7	0.1

2x = .4

x = .2

sub in to "x"

$\frac{(.1)^2}{(.7)(.7)}$ = 0.0204 = K

Version 4: This is an example where the K is given, we then solve for "x" in the ISE table.

Short Cut rule: Since reaction has a very small K value there will be very little loss and therefore gain of product in order to achieve equilibrium. Therefore "x" is very tiny.

4. $X(aq) + 2Y(aq) \Leftrightarrow Z(aq)$ K = 1.5E-5 In a reaction beaker 0.5M X and 0.5M Y are placed in a beaker and allowed to come to equilibrium.
   a. Write out the equilibrium expression.
   b. Fill out an ISE table, what is the concentration of each substance at equilibrium?

	X	+ 2Y ⇌	Z
I	.5	.5	0
S	-x	-2x	+x
E	.5-x	.5-2x	x
	↓ .5	↓ .5	↓

$$K = \frac{[Z]}{[X][2Y]^2}$$

subin →

$$1.5E\text{-}5 = \frac{x}{[.5-x][.5-2x]^2}$$

$$1.5E\text{-}5 = \frac{x}{[.5][.5]^2}$$ ← use shortcut Rule

$x = 1.87E\text{-}6M$ → subin

How does the short-cut rule work, and when can I use this process?

5. $X(aq) + 2Y(aq) \Leftrightarrow Z(aq)$ K = 5,000,000.
   [0.5]   [0.5]   [0 M]
   Set up the ISE table and substitute into the equilibrium expression. Determine the concentration of each substance at equilibrium.

Version 5 alternate: The K in this reaction is very large, how can you solve this question?

$X + 2Y \rightleftharpoons Z$ K = 5.0 E6

	X	2Y	Z
I	.5	.5	0
S	-x	-2x	+x ← x = .25
E	.25	0	+.25

went to completion