Equilibrium: Dinitrogen tetroxide ⇌ Nitrogen Dioxide

Question

2 mol of N_2O_4 was heated in a container of volume 12.0 dm^3 and the following equilibrium established:

$$N_2O_4\ (g) \quad 2NO_2(g)$$

At equilibrium, 35% of the N_2O_4 had dissociated. Calculate K_c.

Expression for K_c and rewrite problem

$$K_c = [NO_2]^2 / [N_2O_4]$$

...so we need to know the equilibrium concentrations

Let's have a look at the data we're given...

	$N_2O_4\ (g)$	⇌	$2NO_2(g)$
initial mol	2.0		0
% remaining			
equilibrium mol	_____		_____

watch a video tutorial on this at www.chemistry.jamesmungall.co.uk

Working through the example

By what amounts has each substance *changed*?

	N_2O_4 (g)	⇌	$2NO_2$(g)
ratio	1	:	2
initial mol	2.0		0
% remaining	*65%*		
change			
equilibrium mol	1.3		_____

Working through the example

By what amounts has each substance *changed*?

	N_2O_4 (g)	⇌	$2NO_2$(g)
ratio	1	:	2
initial mol	2.0		0
	65% remains		
change	*-0.7*		*+1.4*
equilibrium mol	1.3		1.4
equilibrium [ ]	1.3 / 12dm^3		1.4 / 12dm^3
	0.108 moldm^{-3}		0.117 moldm^{-3}

$K_c = [NO_2]^2 / [N_2O_4]$ $K_c = 0.117^2 / 0.108 = 0.13$ moldm^{-3}

Conclusions

1) Work out the **amount** of N_2O_4 which has reacted

2) Using the ratio, work out the amount of NO_2 which has formed

3) Divide by the volume to get

concentration.

Assessment

Work out the equilibrium amounts:

	A(g)	⇌	B(g)	+	C(g)
ratio	1	:	1	:	1
initial mol	0.4		0		0
80% of A reacts					
equilibrium mol	_____		_____		_____

Would you need the volume to work out K_c?

Answers [A] = 0.05, [B] = 3.5, [C] = 3.5 $K_c = [B][C]/[A]$ volumes do not cancel and would need volume to work out K_c.