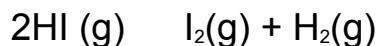


## Equilibrium: Hydrogen Iodide $\rightleftharpoons$ Hydrogen + Iodine

### Question

0.58 mol of hydrogen iodide was heated and the following equilibrium established:



The equilibrium mixture contained 0.040mol of hydrogen. Calculate  $K_c$ .

### Expression for $K_c$ and identify problem

$$K_c = [\text{H}_2] [\text{I}_2] / [\text{HI}]^2$$

...but we are only given the equilibrium amount of the  $\text{H}_2$

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

	$2\text{HI (g)}$	$\rightleftharpoons$	$\text{I}_2(\text{g})$	+	$\text{H}_2(\text{g})$
initial mol	0.58		0		0
equilibrium mol	_____		0.04		_____

### Working through the example

By what amounts has each substance *changed*?

	$2\text{HI (g)}$	$\rightleftharpoons$	$\text{I}_2(\text{g})$	+	$\text{H}_2(\text{g})$
ratio	2	:	1	:	1
initial mol	0.58		0		0
change	-0.08		+0.04		+0.04
equilibrium mol	<u>0.50</u>		0.04		<u>0.04</u>

$$K_c = [\text{H}_2] [\text{I}_2] / [\text{HI}]^2 \quad K_c = 0.04 \times 0.04 / 0.5^2 \quad = \underline{6.4 \times 10^{-3}} \text{ (no units)}$$

### Conclusions

1) If the ratio of reactants & products is not 1:1

**Change in number of moles must match the ratio**

2)  $K_c$  is defined in terms of concentrations (mol / V)

**However, if the V terms cancel we do not need to know the actual volume**

watch a video tutorial of this at: [www.chemistry.jamemsungall.co.uk](http://www.chemistry.jamemsungall.co.uk)

### Assessment

Work out the equilibrium amounts:

	A(g)	+	B(g)	⇌	C(g)
ratio	1	:	1	:	1
initial mol	0.4		0.6		0
<i>change</i>					
equilibrium mol	_____		_____		0.2_

Would you need the volume to work out  $K_c$ ?

**Answers**  $[A] = 0.3$ ,  $[B] = 0.5$ ,  $[C] = 0.2$      $K_c = [C]^2/[A][B]$     volumes cancel