EQUILIBRIA (B)

The reaction of **A** with **B** to form **C** reaches a state of dynamic equilibrium in a closed system. The forward reaction is exothermic.

$$A(g) + 2B(g) \rightleftharpoons 2C(g)$$

At temperature **T**, in a container of volume 5.0 dm^3, 2.00 moles of **A** is mixed with 3.00 moles of **B**. At equilibrium, it is found that there are 0.50 moles of **C**.

a What is happening when the system is in dynamic equilibrium?

both reactions are taking place simultaneously
and at the same rate

b Write an expression for the equilibrium constant K_c, and state its units.

$$K_c = \frac{[C]^2}{[A]\,[B]^2}$$ **$mol^{-1}\ dm^3$**

c Calculate the value of the equilibrium constant K_c at this temperature.

	A(g)	+ 2B(g)	⇌ 2C(g)
moles at start	2.0	3.0	0
change in moles	–0.25	–0.5	+0.5
moles at equilibrium	1.75	2.5	0.5

$$K_c = \frac{[C]^2}{[A]\,[B]^2} = \frac{\left(\frac{0.5}{5.0}\right)^2}{\left(\frac{1.75}{5.0}\right)\left(\frac{2.5}{5.0}\right)^2} = 0.11\ mol^{-1}\ dm^3$$

d What happens to the yield of **C** and the value of K_c if the pressure is increased? Explain your answer.

equilibrium position moves right to side with fewer gas molecules to oppose increase in pressure

increases yield of C

no change in K_c

e What happens to the yield of **C** and the value of K_c if the temperature is increased? Explain your answer.

equilibrium position moves left in endothermic direction to oppose increase in temperature

decreases yield of C

K_c decreases

f What happens to the yield of **C** and the value of K_c if a catalyst is used? Explain your answer.

catalyst increases rate of both reactions equally

no effect on yield of C

no change in K_c