EQUILIBRIA (D)

1 Calculate the moles at equilibrium in each of the following.

a

	N_2 +	$3H_2$ ⇌	$2NH_3$
initial moles	1.0	2.0	0
change in moles	**–0.3**	**–0.9**	**+0.6**
equilibrium moles	**0.7**	1.1	**0.6**

b

	H_2 +	I_2 ⇌	2HI
initial mole	3.0	4.0	0
change in moles	**–1.4**	**–1.4**	**+2.8**
equilibrium moles	**1.6**	**2.6**	2.8

c

	$2SO_2$ +	O_2 ⇌	$2\ SO_3$
initial moles	5.0	2.0	0
change in moles	**–1.2**	**–0.6**	**+1.2**
equilibrium moles	**3.8**	1.4	**1.2**

d

	PCl_5 ⇌	PCl_3 +	Cl_2
initial mole	2.0	0	1.0
change in moles	**–0.4**	**+0.4**	**+0.4**
equilibrium moles	**1.6**	**0.4**	1.4

2 **A** and **B** react to form **C** and **D** in an equilibrium in a closed system. At temperature T, the equilibrium constant K_c has a value of 4.72. The forward reaction is exothermic.

$$\mathbf{A}(g) + \mathbf{B}(g) \rightleftharpoons \mathbf{C}(g) + \mathbf{D}(g) \qquad \Delta H = -57\ kJ\ mol^{-1}$$

a What would happen to the yield of **C** and K_c if the pressure was increased. Explain your answer.

equilibrium position does not move as there are same number of gas particles on each side

no effect on yield of C

no change in K_c

b What would happen to the yield of **C** and K_c if the temperature was increased. Explain your answer.

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

decreases yield of C

K_c decreases

c 2.0 moles of **A** and 2.0 moles of **B** were placed in a flask at temperature T. Calculate the number of moles of **C** in the equilibrium mixture.

	A(g) +	**B**(g) ⇌	**C**(g) +	**D**(g)
moles at start	**2.0**	**2.0**	**0**	**0**
change in moles	**–x**	**–x**	**x**	**x**
moles at equilibrium	**2–x**	**2–x**	**x**	**x**

$$K_c = \frac{[C]\,[D]}{[A]\,[B]} = \frac{\left(\frac{x}{V}\right)^2}{\left(\frac{2-x}{V}\right)^2} = 4.72$$

square rooting both sides and cancelling V:

$$\frac{x}{2-x} = 2.17$$

$$x = 2.17(2 - x)$$

$$x = 4.34 - 2.17x)$$

$$3.17x = 4.34 \qquad x = 1.37$$