Solutions

Each answer shows the steps, then the **result**.

2.1

- the forward and reverse rates are equal; the concentrations of reactants and products stay constant

2.2

- $K_c = \dfrac{[\mathrm{NH_3}]^2}{[\mathrm{N_2}][\mathrm{H_2}]^3}$

2.3

- $K_p = \dfrac{p(\mathrm{NO_2})^2}{p(\mathrm{N_2O_4})}$

2.4

- the equilibrium moves to the right, making more ammonia
- because there are fewer moles of gas on the right (2) than on the left (4)

3.1 B

- Raising T shifts an exothermic equilibrium towards the reactants (endothermic direction)

3.2 C

- A catalyst speeds both directions equally – no shift

3.3

(a)

- $K_c = \dfrac{[\mathrm{NO_2}]^2}{[\mathrm{N_2O_4}]} = \dfrac{0.20^2}{0.10} = 0.40\ \mathrm{mol\ dm^{-3}}$

(b)

- no change – only temperature changes K_c

3.4

- total moles = 4.0; mole fraction of $\mathrm{SO_2}$ = 3.0/4.0 = 0.75; $p(\mathrm{SO_2}) = 0.75 \times 400 =$ 300 kPa

3.5

- $K_p = \dfrac{p(\mathrm{NO_2})^2}{p(\mathrm{N_2O_4})} = \dfrac{60^2}{40}$
- $K_p =$ **90** kPa

3.6

(a)

- 0.75 mol of each reacted, so $\mathrm{H_2} = \mathrm{I_2} =$ **0.25** mol

(b)

- $K_c = \dfrac{[\mathrm{HI}]^2}{[\mathrm{H_2}][\mathrm{I_2}]} = \dfrac{1.5^2}{0.25 \times 0.25} =$ **36**
- there are equal moles of gas on each side, so the volumes cancel and K_c has no units