

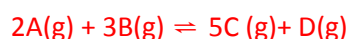
Friday Worksheet

Name:

Chemical equilibrium worksheet 4

- 1) Consider the equilibrium expression on the right. All species are in the gaseous state.

- a) Write the chemical equation for the reverse reaction.

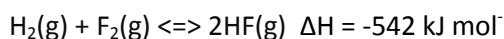


$$K = \frac{[A]^2[B]^3}{[C]^5[D]}$$

- b) Write the chemical equation whose equilibrium expression is given on the right

$2A(g) + 3B(g) \rightleftharpoons 5C(g) + D(g)$	$\frac{1}{K}$
$5/2 C(g) + 1/2 D(g) \rightleftharpoons A(g) + 3/2 B(g)$	$K^{1/2}$
$10C(g) + 2D(g) \rightleftharpoons 4A(g) + 6B(g)$	K^2

- 2) Hydrogen and fluorine react according to the equation below.



In an experiment 0.300 mol of hydrogen and 0.440 mol of fluorine were placed in a reaction vessel of volume V litres. Once equilibrium was established there was 0.320 mol of HF present in the reaction vessel. Calculate the K_e for this reaction.

Since the number of mol of particles on both sides of the equation are the same volume is not a factor in determining the K_e .

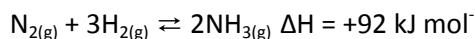
Step 1 Find the mol of each reactant and product at equilibrium.

$$n_{\text{hydrogen}} = 0.140, n_{\text{fluorine}} = 0.280, n_{\text{HF}} = 0.320$$

Step 2 calculate K_e

$$K_e = (0.320)^2 / (0.140 \times 0.280) = 2.61$$

- 3) Nitrogen and hydrogen react to produce ammonia according to the equation below.



An amount of 2.00 mol of ammonia was placed in a sealed vessel at a constant temperature and allowed to reach equilibrium.

- a) Explain why the rate of the reaction $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightarrow 2\text{NH}_{3(g)}$ will never be greater than the rate of the reaction $2\text{NH}_{3(g)} \rightarrow \text{N}_{2(g)} + 3\text{H}_{2(g)}$
- as the system approaches equilibrium.

Because the rate of the reverse reaction $2\text{NH}_{3(g)} \rightarrow \text{N}_{2(g)} + 3\text{H}_{2(g)}$ is favoured as the system moves towards equilibrium. In order to reach equilibrium the reverse reaction must be faster than the forward reaction $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightarrow 2\text{NH}_{3(g)}$

- once equilibrium is established.

Rates of reverse and forward reactions are equal at equilibrium.

- b) Sketch, on the axes provided below, a fully labelled energy profile diagram for the decomposition reaction of NH_3 . Indicate on the diagram the effect of using a catalyst in this reaction

