Chemguide – answers

K_P

1. a) The total number of moles is 95 + 55 + 5 = 155.

The mole fraction of ethene is 95/155 = 0.613
The mole fraction of steam is 55/155 = 0.355
The mole fraction of ethanol is 5/155 = 0.032
(All of these are quoted to 3 significant figures.)

b) Partial pressure = mole fraction x total pressure

The partial pressure of ethene is 0.613 x 60 = 36.78 atm
The partial pressure of steam is 0.355 x 60 = 21.3 atm
The partial pressure of ethanol is 0.0.032 x 60 = 1.92 atm
(To avoid further rounding errors, I haven't rounded off the ethene value any more.)

c) $$K_P = \frac{P_{CH_3CH_2OH}}{P_{CH_2=CH_2} \times P_{H_2O}}$$

Brackets are ***not*** needed in this expression. If you have used square brackets (implying concentrations in mol dm^{-3}), your answer is wrong.

d) $$K_P = \frac{1.92}{36.78 \times 21.3}$$

$$= 2.45 \times 10^{-3}\ atm^{-1}$$

In the K_P expression, you have the units atm at the top and atm x atm at the bottom. Overall, the units are 1/atm or atm^{-1}.

This calculation is at the very easy end of K_P calculations. You will need to look in detail at more complicated examples from another source.

2. a) $$K_p = \frac{P_{NH_3}^{\ 2}}{P_{N_2} \times P_{H_2}^{\ 3}}$$

b) $$K_p = P_{CO_2}$$

c) $$K_p = \frac{P_{SO_3}^{\ 2}}{P_{SO_2}^{\ 2} \times P_{O_2}}$$

d) $$K_p = \frac{P_{H_2} \times P_{CO}}{P_{H_2O}}$$