InkChemistry

QUESTION WORKBOOK

Kp: equilibria in the gas phase

Chemical equilibria · Unit C06

AQA 3.1.10 · OCR A 5.1.2

15 questions · 55 marks

NAVY SCREEN EDITION

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SECTION B · Standard, 3 to 5 marks

B1 KE-Q8

Calculate the degree of dissociation of PCl_5 at 500 K and a total pressure of 150 kPa, given that Kp for $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is 63.0 kPa at 500 K. [5]

B2 KE-Q7

Calculate Kp at 330 K for $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, given that N_2O_4 is 50.0% dissociated at 330 K and a total pressure of 100 kPa. [4]

B3 KE-Q11

Explain why a sealed tube containing an equilibrium mixture of N_2O_4 and NO_2 turns a deeper brown when it is warmed, and why adding a catalyst to the tube would change neither the colour nor Kp. The dissociation of N_2O_4 into NO_2 is endothermic. [4]

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B4 KE-Q17 Evaluate a student's claim that doubling the total pressure on $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ doubles Kp, because every partial pressure doubles. [4]

B5 KE-Q18 Calculate Kp at 298 K for $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$, in atm^2 and in kPa^2, given that solid ammonium hydrogensulfide placed in an evacuated flask at 298 K gives a total pressure of 0.660 atm at equilibrium. Take 1 atm as 101 kPa. [4]

B6 KE-Q19 Explain why the amount of carbon is not included when the mole fractions are calculated for the equilibrium $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$, and the effect of raising the total pressure at constant temperature on the proportion of carbon monoxide. [4]

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B7 KE-Q1 State what is meant by the mole fraction and by the partial pressure of a gas in a mixture, and state how the partial pressures of the gases in a mixture are related to the total pressure. [3]

B8 KE-Q3 Give the expression for Kp for $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, and give its units when the pressures are in kPa and when they are in Pa. [3]

B9 KE-Q9 Explain why increasing the total pressure on $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at constant temperature changes the position of equilibrium but not Kp. [3]

B10 KE-Q13 Outline the steps for calculating Kp from the initial amounts of reactants, one equilibrium amount and the total pressure. [3]

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B11 KE-Q14 Suggest an expression for Kp for $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, its units in kPa, and why the amount of calcium carbonate present does not affect the equilibrium pressure. [3]

B12 KE-Q15 Suggest why the total pressure need not be known to calculate Kp for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ from the equilibrium amounts, and why changing the total pressure does not move this equilibrium. [3]

B13 KE-Q16 Compare Kc and Kp for the same gas-phase equilibrium. [3]

B14 KE-Q23 Justify the statement that Kp for $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ has the unit kPa, when partial pressures are in kPa, but Kp for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ has no unit. [3]

SECTION C · Long, 6 marks or more

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C1
KE-Q22

Explain, by writing Kp for $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ in terms of mole fractions and the total pressure P, why raising the total pressure at constant temperature increases the proportion of ammonia at equilibrium, and why raising the temperature decreases it. $\Delta H = -92$ kJ mol^{-1}. [6]

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