## CH1012 Tutorial 1 Answers

1. What is the alkaline earth metal in the 4<sup>th</sup> period and how many protons and electrons does it have? Write down the atomic symbol for this element and include the atomic number.

calcium. Ca<sub>20</sub> this element has 20 protons, 20 electrons

2. Write down the **full electronic configuration** and the **valence electronic configuration** for each of the following: F,  $K^+$ 

Full el	lectronic configuration	Valence electronic configuration
F	$1s^22s^22p^5$	$2s^22p^5$
$\mathbf{K}^+$	$1s^22s^22p^63s^23p^6$	$3s^23p^6$

3. The oxidation of carbon (graphite) to carbon monoxide occurs spontaneously at 375K. After reaction of the above system in a closed reaction vessel the equilibrium partial pressure of oxygen is 0.021 atm and that of carbon monoxide is 0.50 atm. Write down the expression for K<sub>p</sub> and determine the value of K<sub>p</sub> in the above system.

Balanced equation:	$2C(s) + O_2(g) \rightarrow$	2CO(g)
$Kp = p(CO)^2 / p(O_2)$	$= (0.50)^2 / 0.021 = 1$	1.91 = 12

[or Balanced equation:	$C(s) + \frac{1}{2}O_2(g)$	$\rightarrow$	CO(g)
$Kp = p(CO) / p(O_2)^{1/2}$	$= 0.50 / \sqrt{0.021}$	= 3.45	= 3.5 ]

4.

 $3O_2(g) = 2O_3(g) \qquad \Delta H^0 = 286 \text{ kJ mol}^{-1}$ 

In an equilibrium reaction mixture of the above reaction how would  $p(O_2)$  and  $K_p$  change if the temperature of the reaction vessel were raised? Explain your answer.

 $p(O_2)$  would decrease.  $K_p$  would increase.

Le Chatalier's principle states that for an endothermic reaction external heating will result in an increase in the forward (endothermic) reaction to reduce the effect of the change. This will result in an increase in  $p(O_3)$  and a decrease in  $p(O_2)$  hence  $K_p$  will increase  $[Kp = p(O_3)^2 / p(O_2)^3]$ .

5. What do you understand by the following?

(a) Colloid

A <u>colloid</u> is a disperse system in which the particles have approximate diameters in the range 1-1000 nm. (As a consequence, the particles are not retained by conventional filters and are only visible in the electron microscope.). A colloidal particle will display Brownian motion in solution.

(b) Electrical Double Layer

<u>Electrical Double Layer</u>. The distribution of ions which occurs in a medium in the proximity of a charged surface (e.g. lyophobic colloid particles, electrode surface.)

		Medium			
	_	+	+	+	_
	_	+	+	_	+
negatively	_	+	_	+	_
charged	_	-	+	+	+
surface	_	+	+	+	_
	_	+	+	_	+
	_	+	_	+	_
	_	+	+	+	+

Electrical Double Layer – may be <u>several</u> ions thick, i.e. > 3 as shown

(c) The Tyndall effect

When viewed from the *side* a beam of light is *broad* and *visible* when passed through a colloidal dispersion.

Whereas through a normal solution it is nearly invisible from the side. This enables a colloid to be distinguished from a solution.