**Quiz 1**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Consider the following system at equilibrium:

A (aq) + B (aq) $⇌$ 2 C (aq)

Classify each of the following actions by whether it causes a leftward shift, a rightward shift, or no shift in the direction of the net reaction (5 points).

* 1. Increase [C] \_\_\_\_\_leftward shift\_\_\_\_\_\_
	2. Double [A] and halve [B] \_\_\_\_\_no shift\_\_\_\_\_\_\_\_
	3. Decrease [C] \_\_\_\_\_rightward shift\_\_\_\_\_
	4. Double both [B] and [C] \_\_\_\_\_leftward shift\_\_\_\_\_\_
	5. Decrease [B] \_\_\_\_leftward shift\_\_\_\_\_\_
1. The value of the equilibrium constant of a reaction decreases with increasing temperature. Is this reaction endothermic or exothermic (2 points)?

Exothermic

1. Consider the following reaction (8 points):

SO2Cl2 (g) $⇌$ SO2 (g) + Cl2 (g) Kc = 2.99 x 10-7 M at 227 °C.

* 1. If a reaction mixture initially contains 0.195 M SO2Cl2, what is the equilibrium concentration of Cl2 at 227 °C?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SO2Cl2 (g) | $$⇌$$ | SO2 (g) | + | Cl2 (g) |
| I | 0.195 M |  | 0 M |  | 0 M |
| C | -x |  | +x |  | +x |
| E | 0.195 M – x = 0.195 M – 0.000242 M = 0.194758 M ≈ 0.195 M |  | x = 0.000242 M |  | x = 0.000242 M |

$$K\_{c}=\frac{\left[SO\_{2}\right]\left[Cl\_{2}\right]}{[SO\_{2}Cl\_{2}]}=2.99×10^{-7}M=\frac{x^{2}}{(0.195 M-x)}$$

$$x^{2}+2.99×10^{-7}M x-5.83×10^{-8}M^{2}=0$$

$x\_{+}=\frac{2.99×10^{-7}M +\sqrt{(2.99×10^{-7} M)^{2}-4(1)(-5.83×10^{-8} M^{2})}}{2(1)}=2.42×10^{-4} M$

$x\_{+}=\frac{2.99×10^{-7}M-\sqrt{(2.99×10^{-7} M)^{2}-4(1)(-5.83×10^{-8} M^{2})}}{2(1)}=-2.41×10^{-4} M$

* 1. What is the value of Kp at 227 °C?

$$K\_{p}=K\_{c}(RT)^{∆n}=(2.99×10^{-7}\frac{mol}{L} )\left[0.08206 \frac{L atm}{mol K}×\left(227 °C+273\right)K\right]^{\left(1+1-1\right)}$$

$$K\_{p}=1.23×10^{-5} atm$$

1. Dilute exactly 5 mL of 6 M acetic acid to 25 mL. What is the new concentration of the acetic acid (5 points)?

$$M\_{1}V\_{1}=M\_{2}V\_{2}⇒M\_{2}=\frac{M\_{1}V\_{1}}{V\_{2}}=\frac{(6 M)(5 mL)}{(25 mL)}=1.2 M ≈1 M$$