Equilibrium Short Answer Review

(1)

	$2NO$	$+ Cl_2$	$\rightleftharpoons 2NOCl$
I	0.40	0.40	∅
C	−0.12	−0.060	+0.12
E	0.28	0.34	0.12

$$K_{eq} = \frac{[0.12]^2}{[0.28]^2[0.34]} = \boxed{0.54}$$

(2.)

(a)

	X	$+ 2Y \leftrightarrow$	$2Z$
I	0.20	0.50	∅
C	−0.06	−0.12	+0.12
E	0.14	0.38	0.12

$$K_{eq} = \frac{[0.12]^2}{[0.14][0.38]^2} = \boxed{0.71}$$

(B)

	X	$+ 2Y \rightleftharpoons$	$2Z$
I	0.20	0.50	∅
C	−0.18	−0.36	+0.36
E	0.02	0.14	0.36

$$K_{eq} = \frac{[0.36]^2}{[0.02][0.14]^2} = \boxed{300}$$

(C) Because with increased **Temperature** the value of K_{eq} **increased**, the heat term must be on the reactant side ∴ **endothermic**

(3)

	H_2	+	I_2	⇌	$2HI$
I	5.0×10^{-2}		5.0×10^{-2}		$\emptyset$
C	$-x$		$-x$		$+2x$
E	$5.0\times10^{-2}-x$		$5.0\times10^{-2}-x$		$2x$

$$\sqrt{49.0} = \sqrt{\frac{(2x)^2}{(5.0\times10^{-2}-x)^2}}$$

$$7 = \frac{2x}{5.0\times10^{-2}-x}$$

$$7(5.0\times10^{-2}-x) = 2x$$

$$0.35 - 7x = 2x$$

$$0.35 = 2x + 7x$$

$$\frac{0.35}{9} = \frac{9x}{9}$$

$$\therefore x = 0.039$$

$$\therefore 2x = 0.078\ M$$

$$\boxed{[HI]_E = 0.078\ M}$$

(4.)

(a)

	$A(g)$	+	$B(g)$	⇌	$2C(g)$
I	4.0		4.0		$\emptyset$
C	$-x$		$-x$		$+2x$
E	$4.0-x$		$4.0-x$		$2x$

$$\sqrt{72.0} = \frac{(2x)^2}{(4.0-x)^2}$$

$$\cong 8.49 = \frac{2x}{4.0-x}$$

$$8.49(4.0-x) = 2x$$

$$33.9 - 8.49x \cong 2x$$

$$33.9 = 2x + 8.49x$$

$$\frac{33.9}{10.485} = \frac{10.485x}{10.485}$$

$$\therefore x = 3.236$$

$$[A] = 4.0 - 3.236$$

$$[A] \cong 0.76\ M \rightsquigarrow \boxed{[A]_E = 0.8\ M}$$

(b) $2x = C \rightarrow 2(3.236\ \frac{mol}{L}) \Rightarrow 6.47\ mol \times 0.50L$

(actual) $\Rightarrow \boxed{3.2\ mol\ C}$

(c) $A(g) + B(g) \rightleftharpoons 2C(g)$

2.0 mol 2.0 mol 4.0 mol

$$2.0\ mol\ A \times \frac{2\ mol\ C}{1\ mol\ A} = 4.0\ mol\ C \Rightarrow \boxed{4.0\ mol\ C}$$

(expected)

(d) $P.Y = \frac{\text{Actual}}{\text{Expected}} \times 100\% \rightarrow \frac{3.2\ \text{mol C}}{4.0\ \text{mol C}} \times 100\% = \boxed{8.0 \times 10^{1}\ \%}$

(5.)

	$A_2(g)$	+ $B_2(g)$	$\rightleftharpoons$ $2AB(g)$
I	0.200	0.200	0.400 + 0.100
C	+x	+x	−2x
E	0.200 + x	0.200 + x	0.500 − 2x

$K_{eq} = \frac{(0.400)^2}{(0.2)(0.2)} = \frac{0.16}{0.04} = \boxed{4.00}$

$\therefore 0.500 - 2(0.0250)$

$\boxed{[AB] = 0.450\,M}$

$\sqrt{4} = \sqrt{\frac{(0.500-2x)^2}{(0.200+x)^2}}$

$2 = \frac{0.500 - 2x}{0.200 + x}$

$2(0.200 + x) = 0.500 - 2x$

$0.400 + 2x = 0.500 - 2x$

$\frac{4x}{4} = \frac{0.100}{4} \rightarrow \boxed{x = 0.025}$

(6.) (a) $X_2(g) + Y_2(g) \rightleftharpoons 2XY(g)$

$K_{eq} = \frac{(0.8)^2}{(0.6)(1.6)} = \boxed{0.7}$

(b)

$K_{eq} = \frac{(1)^2}{(0.5)(1.5)} \simeq \boxed{1.33}$

The reaction is **endothermic** because the Products are favoured with an increase in temperature.

(7.) $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$ $K_{eq} = 4.2 \times 10^{-4}$

$$\text{Trial } K_{eq} = \frac{[0.200]^2[0.015]}{[0.050]^2} = \boxed{0.24}$$

B/c Trial K_{eq} > K_{eq} the reaction is NOT @ equilibrium and it must shift to the <u>REACTANTS</u> to reach equilibrium.