YEAR 12 CHEMISTRY - EQUILIBRIUM WORKSHEET 1

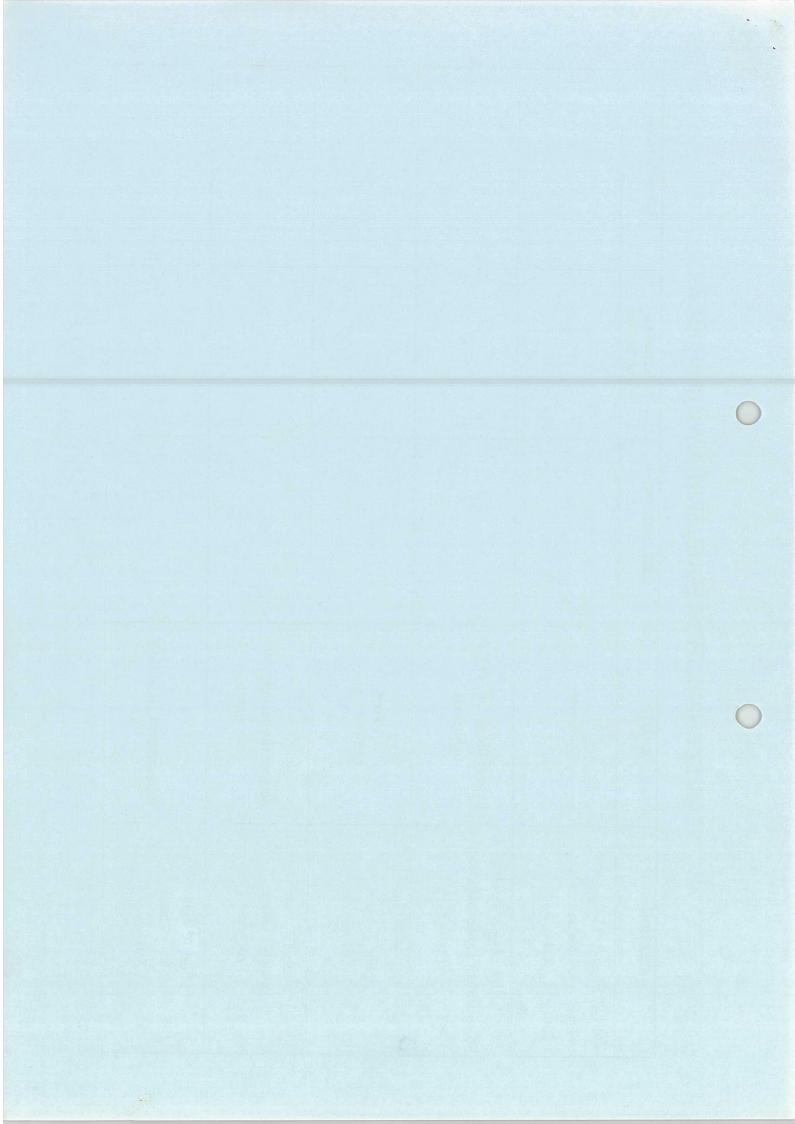
EXPLANATION					
POSITION OF EQUILIBRIUM					
OBSERVATIONS					
CHANGE	Remove some HI at constant volume	Sone Remove Cl ⁻ (aq)	Decrease the temperature	Raise the temperature	Add OH ^{- (aq)}
REACTION	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2 HI_{(g)}$ colourless violet colourless (ρ_{curv})	Cu(H ₂ O) ₄ ²⁺ (aq) + 4 C ℓ ⁻ (aq) \Longrightarrow blue colourless CuC ℓ ₄ ²⁻ (aq) + 4 H ₂ O (ℓ) yellow	$N_{2(g)} + 3 H_{2(g)} \rightleftharpoons 2 NH_{3(g)}$ all colourless $\Delta H - ve$	$2 \text{ NO}_{2(g)} \rightleftharpoons \text{N}_2\text{O}_{4(g)} \Delta \text{H}$ -ve brown colourless	2 $CrO_4^{2^-}(aq) + 2 H^+(aq) \rightleftharpoons$ yellow $Cr_2O_7^{2^-}(aq) + H_2O_{(\ell)}$ Orange

YEAR 12 CHEMISTRY - EQUILIBRIUM WORKSHEET 2

EXPLANATION					
POSITION OF EQUILIBRIUM					
OBSERVATIONS					
CHANGE	Reduce the volume of the container	Increase the volume of the container	Reduce the temperature	Increase the concentration of CrO ₄ ²⁻ (aq)	Add more H ₂ at constant volume
REACTION	$2 \text{ NO}_{2(g)} \rightleftharpoons \text{N}_2\text{O}_{4(g)} \Delta \text{H-ve}$ brown colourless	$N_{2(g)} + 3 H_{2(g)} \rightleftharpoons 2 NH_{3(g)}$ all colourless $\Delta H - ve$	CaCO _{3(s)} \rightleftharpoons CaO _(s) + CO _{2(g)} white white colourless $\triangle H$ +ve	2 $CrO_4^{2^-}(aq_1) + 2 H^+(aq_1) \rightleftharpoons$ yellow $Cr_2O_7^{2^-}(aq_1) + H_2O_{(\ell)}$ Orange	$H_{2(g)} + I_{2(g)} \stackrel{\longleftarrow}{\longleftarrow} 2 HI_{(g)}$ colourless violet colourless

YEAR 12 CHEMISTRY - EQUILIBRIUM WORKSHEET 3

EXPLANATION					
POSITION OF EQUILIBRIUM					
OBSERVATIONS					
CHANGE	Add water	Reduce the volume of the container	\$مسو Remove ا _{2(s)}	Increase the volume of the container	Increase the temperature
REACTION	Cu(H ₂ O) ₄ ²⁺ (aq) + 4 C ℓ ⁻ (aq) \rightleftharpoons blue colourless CuC ℓ ₄ ²⁻ (aq) + 4 H ₂ O(ℓ) vellow	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2 HI_{(g)}$ colourless violet colourless	$1_{2(g)} {\longleftarrow} 1_{2(s)}$ violet black ΔH -ve	$I_{2(g)} {\longleftarrow} I_{2(s)}$ violet black ΔH -ve	$1_{2(g)} \overset{\bullet}{\frown} 1_{2(s)}$ violet black $\Delta H - ve$



YEAR 12 CHEMISTRY - EQUILIBRIUM WORKSHEET 1

EXPLANATION	System trying to increase the HI concentration	Trying to increase the chloride ion concentration	Trying to increase the temperature so it would favour the exothermic reaction	Trying to decrease the temperature to it will favour the endothermic reaction	H ⁺ ion concentration will decrease due to reaction with OH, so system will be trying to increase the H ⁺ ions
POSITION OF EQUILIBRIUM	†		1	1	
OBSERVATIONS POSITI	Solution would become lighter	Solution would become bluer	No visual observations	Go Darker Brown	Become yellower
CHANGE	Remove some HI at constant volume	Remove Cl ^e (aq)	Decrease the temperature	Raise the temperature	Add OH [*] (aq)
REACTION	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2 HI_{(g)}$ colourless violet colourless	$Cu(H2O)42+(aq) + 4 Cl-(aq) \rightleftharpoons$ blue colourless $CuCl42-(aq) + 4 H2O(\ell)$ yellow	$N_{2(g)} + 3 H_{2(g)} \rightleftharpoons 2 NH_{3(g)}$ all colourless $\Delta H - ve$	$2 \text{ NO}_{2(g)} \rightleftharpoons \text{N}_2\text{O}_{4(g)} \Delta \text{H -ve}$ brown colourless	$2 \text{ CrO}_4^{2^-}(aq) + 2 \text{ H}^+(aq) \rightleftharpoons$ yellow $\text{Cr}_2 \text{O}_7^{2^-}(aq) + \text{H}_2 \text{O}_{(\ell)}$ Orange

YEAR 12 CHEMISTRY - FOUILIBRIUM WORKSHEET 2

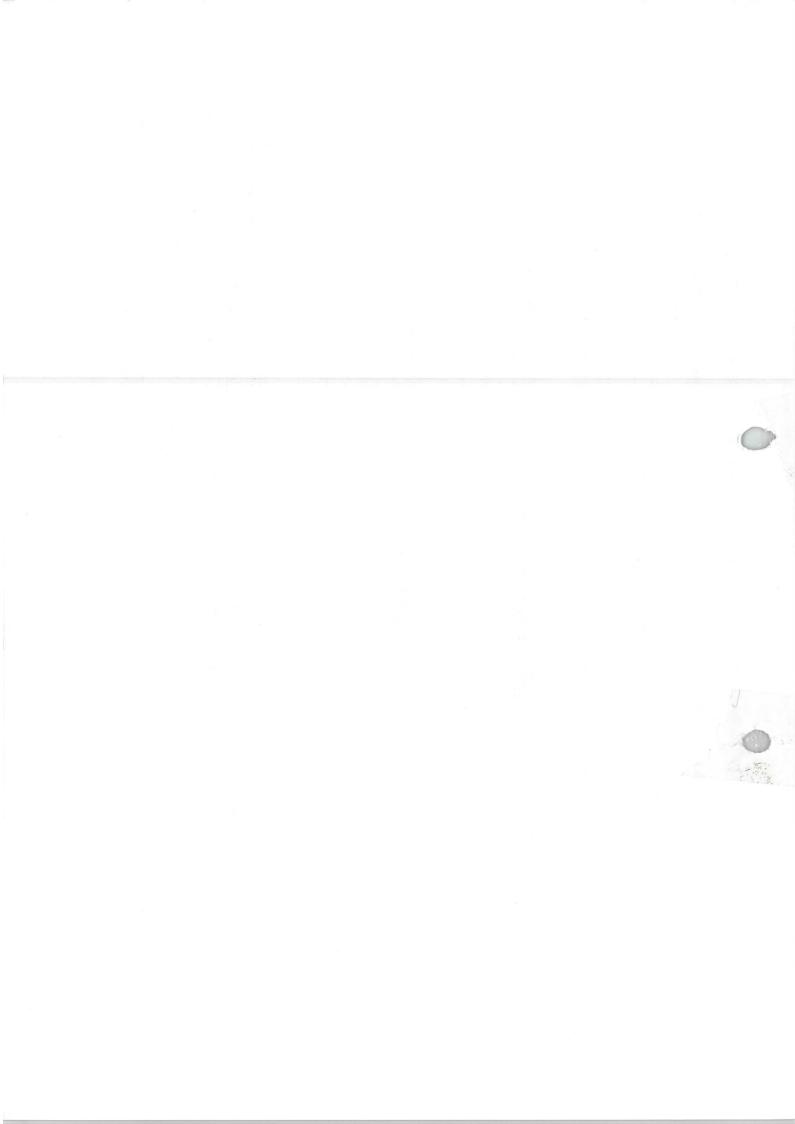
EXPLANATION	Trying to decrease the pressure so it will favour the side with less molecules	Trying to increase the pressure so favour the side with more molecules	Trying to increase the temperature so it will favour the exothermic reaction	Trying to decrease the chromate ion concentration so it will favout the forward reaction	Trying to decrease the hydrogen gas concentration so favour the forward reaction.
POSITION OF EQUILIBRIUM					
OBSERVATIONS	Colour will fade	No visual observations	No visual observations	From yellow to orange	Colour will fade
CHANGE	Reduce the volume of the container	Increase the volume of the container	Reduce the temperature	Increase the concentration of ${\rm CrO_4^{2^-}}_{(aq)}$	Add more H ₂ at constant volume
REACTION	$2 \text{ NO}_{2(g)} \rightleftharpoons \text{N}_2\text{O}_{4(g)} \Delta \text{Hve}$ brown colourless	$N_{2(g)} + 3 H_{2(g)} \rightleftharpoons 2 NH_{3(g)}$ all colourless $\Delta H - ve$	$CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$ white white colourless $\Delta H + ve$	$2 \text{ CrO}_4^{2^-}(\text{aq}) + 2 \text{ H}^+(\text{aq}) \rightleftharpoons$ yellow $\text{Cr}_2\text{O}_7^{2^-}(\text{aq}) + \text{H}_2\text{O}_{(\ell)}$ Orange	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2 HI_{(g)}$ colourless violet colourless.

YEAR 12 CHEMISTRY - EQUILIBRIUM VORKSHEET 5

EXPLANATION		No change	No Change	Trying to increase pressure so favour reverse reaction	Trying to decrease temperature to favour the endothermic reaction.
POSITION OF EQUILIBRIUM	\	No change	No change	 	
OBSERVATIONS	Become blue	No change- depending on the volume decrease it may look a little darker	No change	Become a little lighter, more purple	More violet
CHANGE	Add water	Reduce the volume of the container	Remove I _{2(s)}	Increase the volume of the container	Increase the temperature
REACTION	$Cu(H_2O)_4^{2^+}(aq) + 4 C\ell^-(aq) \rightleftharpoons$ blue colourless $CuC\ell_4^{2^-}(aq) + 4 H_2O(\ell)$ vellow	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2 H_{(g)}$ colourless violet colourless	$I_{2(g)} {\rightleftharpoons} I_{2(s)}$ violet black ΔH -ve	$I_{2(g)} {\rightleftharpoons} I_{2(s)}$ violet black ΔH -ve	$I_{2(g)} \stackrel{\Gamma}{\rightleftharpoons} I_{2(s)}$ violet black ΔH -ve

Comparing Factors affecting Rate and Position of Equilibrium

		Reacti	Reaction Rate	Position of equilibrium
	Forward rate	Reverse rate	Explanation	Explanation
			Temperature (mean $E_K = \frac{1}{2} \text{m} \text{v}^2$)	$i_{\rm K} = 1/2{\rm m}{\rm v}^2$
Increasing the temperature				
Decreasing the temperature				
		Company of the company	Concentration (number of particles/moles)	particles/moles)
Increasing the concentration	45.2			
Decreasing the concentration				
			Gas Pressure (P	=u)
Increasing the pressure or (decreasing the volume)				
Decreasing the pressure or (increasing the volume)				
Note: if the n	numbers of mo equil	oles on both sic	des of a gaseous equilibrium systemethe concentrations of all species a	Note: if the numbers of moles on both sides of a gaseous equilibrium system are equal, altering the pressure has no effect on the position of equilibrium because the concentrations of all species are altered (changed) by an equal amount.
			Degree of subdivision (surface area)	surface area)
Increasing the surface area			-	
Decreasing the surface area				
			Catalyst	
Addition of a catalyst				



Comparing Factors affecting Rate and Poston of Equilibrium

Temperature (mean E _r the mean E _r (1/2 mv²) of es, hence more and more particles with stee the hence less and less particles with hence more collisions. Cas Pressure (Particles are collisions) Catalyst Temperature (mean E _r (1/2 mv²) of es, hence less particles with hence less particles with hence more collisions. Cas Pressure (Particles are collisions) Cas Pressure (Particles are collisions) Seous equilibrium system entrations of all species are collisions. In number of particles on ence less collisions. An number of particles on ence less can collide. An number of particles on ence less can collide. Catalyst Catalyst An hence more particles			Reac	Reaction Rate	Position of equilibrium
Increased Inc		L			
Temperature (mean E _K (½ mv²) of the particles, hence more collisions and more particles with E≥E _A . Decreased Decreased Decreases the mean E _K (½ mv²) of the particles, hence more collisions and less particles with E≥E _A . Concentration (number of particles, hence less collisions. Concentration (number of particles, hence more collisions. Decreased Decreases the number of particles, hence more collisions. Increased Decreases the number of particles, hence less collisions. Decreased Decreases the number of particles, hence less collisions. Decreased Decreases the number of particles, hence less collisions. Decreased Decreases the number of particles on particles, hence less collisions. Decreased Decreased number of particles on surface, hence more particles on surface, hence more particles on surface, hence less can collide. Decreased Decreased number of particles on surface, hence more particles on surface, hence more particles on with E≥E _A , hence more particles		rorward	Reverse	Explanation	Explanation
Increased Increased Increases the mean E _K (½ mv²) of the particles, hence more collisions and more particles with E≥E _A . Decreased Decreases the mean E _K (½ mv²) of the particles the hence less collisions and less particles with E≥E _A . Concentration (number of particles, hence more collisions. Decreased Increased Increases the number of particles, hence less collisions. Decreased Decreases the number of particles, hence less collisions. Decreased Decreases the number of particles, hence less collisions. Decreased Increased Decreases the number of particles, hence more collisions. Decreased Decreased Decreases the number of particles and surface, hence less collisions. Decreased Decreased Decreases the number of all species and surface, hence more can collide. Decreased Decreased Decreased Increased number of particles on surface, hence more can collide. Decreased Decreased Decreased number of particles on surface, hence more can collide. Catalyst Increased Increased Lowers E _A , hence more particles and with E≥E _A				Temperature (mean E	$i_K = \frac{1}{2}mv^2$
Decreased Decreased Decreases the mean E _K (½ mv²) of the particles the, hence less collisions and less particles with E≥E _A . Concentration (number of particles, hence more collisions. Decreased Increased Decreases the number of particles, hence less collisions. Decreased Decreased Decreases the number of particles, hence less collisions. Decreased Increased Decreases the number of particles, hence more collisions. Decreased Decreased Decreases the number of particles and particles, hence more collisions. Decreased Decreased Decreased the concentrations of all species at the number of particles on surface, hence more can collide. Decreased Decreased Increased Increased number of particles on surface, hence more can collide. Decreased Decreased Decreased number of particles on surface, hence less can collide. Catalyst Increased Increased Lowers E _A , hence more particles with E≥E _A	Increasing the temperature	Increased	Increased	Increases the mean E_K (½ mv²) of the particles, hence more collisions and more particles with $E \ge E_{\mathbb{A}}$.	Pushes the position of equilibrium towards the endothermic process i.e. the absorption of heat. Both reaction rates are higher when equilibrium is restored. Since K _{eq} is temperature dependent, K _{eq} has a different value when equilibrium is re-established.
Concentration (number of particles, hence more collisions.	Decreasing the temperature	Decreased	Decreased	Decreases the mean E_K (½ mv²) of the particles the, hence less collisions and less particles with $E \ge E_A$.	Pushes the position of equilibrium towards the exothermic process i.e. production of heat. Both reaction rates are lower when equilibrium is restored. Since Keq is temperature dependent, Keq has a different value when equilibrium is re-established.
Increased Increased Increases the number of particles, hence more collisions. Decreased Decreased Decreases the number of particles, hence less collisions. Increased Increased Increased Particles, hence more collisions. Decreased Decreased Decreases the number of particles, hence less collisions. Degree of subdivision (s) Increased Increased Increased number of particles on surface, hence more can collide. Decreased Decreased Increased number of particles on surface, hence more can collide. Decreased Decreased Lowers E₄, hence more particles with E≥ E₄ Increased Increased Lowers E₄, hence more particles with E≥ E₄				oncentration (number of	particles/moles)
Decreased Decreases the number of particles, hence less collisions. Cas Pressure (Particles, hence less collisions.	Increasing the concentration	Increased	Increased	Increases the number of particles, hence more collisions.	Pushes the position of equilibrium towards the process which decreases the concentration. Both reaction rates are higher when equilibrium is restored. K_{eq} = constant value.
Increased Increased Increases the number of particles, hence more collisions. Decreased Decreased Decreases the number of particles, hence less collisions. Decreased Decreased Decreased the concentrations of all species at the concentration of	Decreasing the concentration	Decreased	Decreased	Decreases the number of particles, hence less collisions.	Pushes the position of equilibrium towards the process which increases the concentration. Both reaction rates are lower when equilibrium is restored. $K_{eq} = \text{constant value}$.
Increased Increased Increases the number of particles, hence more collisions. Decreased Decreased Decreases the number of particles, hence less collisions. Degree of subdivision (s) Increased Increased Increased number of particles on surface, hence more can collide. Decreased Decreased Decreased number of particles on surface, hence less can collide. Catalyst Increased Increased Lowers EA, hence more particles with E ≥ EA				Gas Pressure (F	
Decreased Decreases the number of particles, hence less collisions. numbers of moles on both sides of a gaseous equilibrium system equilibrium because the concentrations of all species a Decreased Increased Increased Increased Increased Decreased Decreased Decreased Decreased Decreased Decreased Decreased Decreased Decreased Surface, hence more can collide. Catalyst Catalyst Increased Increased Lowers EA, hence more particles with E ≥ EA	Increasing the pressure or (decreasing the volume)	Increased	Increased	Increases the number of particles, hence more collisions.	Pushes the position of equilibrium towards the process which decreases the pressure i.e. in the direction with less moles. Both reaction rates are higher when equilibrium is restored. Keq = constant value.
equilibrium because the concentrations of all species at the concentrations of an increased and the concentrations of the concentrations of a surface, hence less can collide. Catalyst Increased Increased Lowers E _A , hence more particles with E ≥ E _A	Decreasing the pressure or (increasing the volume)	Decreased	Decreased	Decreases the number of particles, hence less collisions.	Pushes the position of equilibrium towards the process which increases the concentration i.e. in the direction with more moles. Both reaction rates are lower when equilibrium is restored. $K_{eq} = constant value$.
Increased Increased Increased number of particles on surface, hence more can collide. Decreased Decreased number of particles on surface, hence less can collide. Catalyst Increased Increased Lowers E_A , hence more particles with $E \ge E_A$	Note: if the n	numbers of mo	oles on both s librium becau	ides of a gaseous equilibrium systen se the concentrations of all species a	n are equal, altering the pressure has no effect on the position of ire altered (changed) by an equal amount.
Increased Increased Increased number of particles on surface, hence more can collide. Decreased Decreased number of particles on surface, hence less can collide. Catalyst Increased Increased Lowers E _A , hence more particles with E≥ E _A				Degree of subdivision (s	surface area)
Decreased Decreased number of particles on surface, hence less can collide. Catalyst	Increasing the surface area	Increased	Increased	Increased number of particles on surface, hence more can collide.	Not applicable to equilibrium systems as solids have a constant concentration.
	Decreasing the surface area	Decreased	Decreased	Decreased number of particles on surface, hence less can collide.	Not applicable to equilibrium systems as solids have a constant concentration.
Increased Lowers $E_{A_{\nu}}$ hence more particles with $E \ge E_{A}$				Catalyst	
	Addition of a catalyst	Increased	Increased	Lowers E_A , hence more particles with $E \ge E_A$	No effect on the position of equilibrium, however both forward and reverse rates are increased when equilibrium is established.

