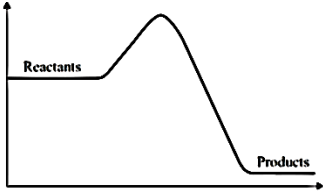
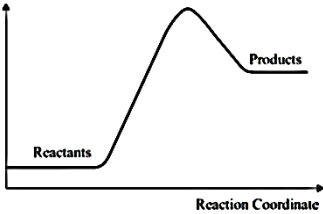
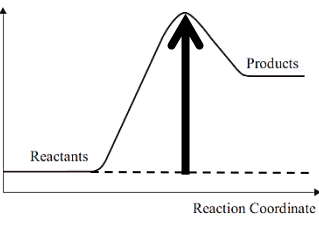
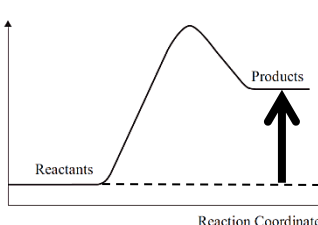
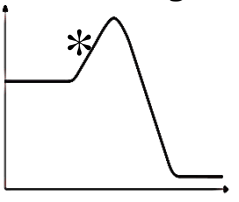
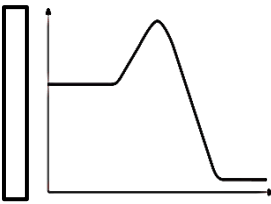
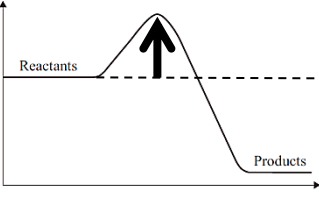
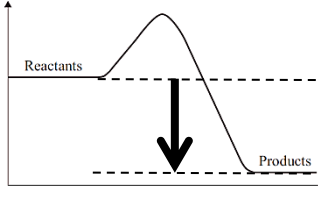
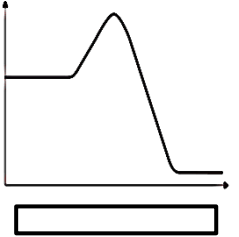
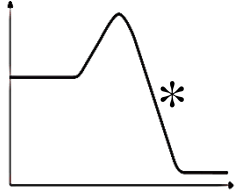
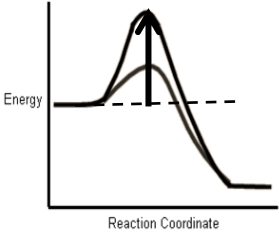
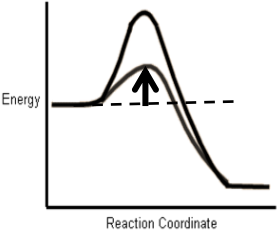


- ΔH means the reaction is	energy is released to the surroundings	surroundings warm up; reaction "feels hot" as temperature of reaction mixture increases	
exothermic	exothermic	exothermic	exothermic
Mg & HCl respiration & combustion are all ...	dissolving NH_4Cl & photosynthesis are both....	change of state $S \rightarrow L$ & $L \rightarrow G$ are both...	change of state $G \rightarrow L$ & $L \rightarrow S$ are both...
exothermic reactions	endothermic reactions	endothermic	exothermic
$+\Delta H$ means the reaction is	energy is absorbed from the surroundings	surroundings cool down; reaction "feels cold" as temperature of reaction mixture decreases	
endothermic	endothermic	endothermic	endothermic
reactants have more energy than the products	reactants have less energy than the products	bond making is always ...	bond breaking is always...
exothermic	endothermic	exothermic	endothermic

units for enthalpy changes			bond _____ is occurring 
kJ or kJ mol⁻¹	Ea / activation energy	enthalpy change ΔH (+ΔH)	breaking
			
energy or enthalpy	Ea / activation energy	enthalpy change ΔH (-ΔH)	reaction progress / coordinate
bond _____ is occurring 			a catalyst lowers the activation energy, E_a , for a reaction by...
making	Ea uncatalysed	Ea catalysed	allowing it to occur by an alternative reaction pathway / mechanism
A catalyst does / does not alter ΔH for a reaction	A _____ increases reaction rate by providing an alternative pathway of lower activation energy so a greater proportion of collisions have the required activation energy and are successful	<u>Surface area</u> Greater surface area \Rightarrow greater rate because there is an increase in the _____ of particle collisions	<u>Concentration</u> Greater concentration \Rightarrow greater rate because there is an increase in the _____ of particle collisions
does not	catalyst	frequency	frequency

<u>Pressure (gases)</u> Greater pressure \Rightarrow greater rate because there is an increase in the _____ of particle collisions	<u>Temperature</u> Greater temp. Particles have more _____ energy and are moving _____	<u>Temperature</u> Greater temp. Collisions more likely to have sufficient energy to overcome the E_a barrier so more _____ collisions	<u>Temperature</u> Greater temp. Molecules collide more frequently AND with greater energy so reaction rate ____
frequency	kinetic faster	successful / effective	increases
the fraction of total collisions that actually result in the formation of the product	if the frequency of effective collisions increases, so does the _____	substance that increases the rate of a reaction but is not consumed in the reaction	for _____ reactions, both forward & reverse reaction rates are affected by the catalyst; E_a for both directions is decreased
effective collisions	reaction rate	catalyst	equilibrium / reversible
$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$ the reaction was...	$K_c = \frac{[\text{O}_2]^3}{[\text{O}_3]^2}$ the reaction was..	the K_c expression for the reaction $2\text{NH}_3 \rightleftharpoons \text{N}_2 + 3\text{H}_2$ is...	the K_c expression for the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ is...
$\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$	$2\text{O}_3 \rightleftharpoons 3\text{O}_2$	$K_c = \frac{[\text{N}_2][\text{H}_2]^3}{[\text{NH}_3]^2}$	$K_c = \frac{[\text{NH}_3]^2}{[\text{H}_2]^3[\text{N}_2]}$
<u>large K_c</u> the concentration of _____ is high the concentration of _____ is low (as product concentration on top of the ratio)	<u>small K_c</u> the concentration of _____ is high the concentration of _____ is low (as product concentration is on top of the ratio)	<u>Equilibria</u> increase in temperature favours the...	<u>Equilibria</u> decrease in temperature favours the...
products reactants	reactants product	endothermic reaction / reaction that absorbs heat energy	exothermic reaction / reaction that releases heat energy

HCO_3^- is called _____ as it can both donate and accept H^+	HCl is a _____ acid and completely dissociates in solution	CH_3COOH is a _____ acid and only partially dissociates in solution	$\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{A}^- + \text{H}_3\text{O}^+$
amphiprotic	strong	weak	weak acid
a _____ acid • fully ionises / dissociates in water • reacts completely with water	a _____ acid • partially ionises / dissociates in water • reacts incompletely with water	Brønsted-Lowry definition of an acid	$\text{HA} + \text{H}_2\text{O} \rightarrow \text{A}^- + \text{H}_3\text{O}^+$
strong	weak	proton donor	strong acid
another name for the H^+ ion	the electrical conductivity of HCl will be high, as there will be a large concentration of _____ & _____ ions in solution.	the electrical conductivity of CH_3COOH will be very low, as there will be a very low concentration of _____ & _____ ions in solution.	Brønsted-Lowry definition of a base
proton	H^+ (or H_3O^+) and Cl^-	H^+ (or H_3O^+) and CH_3COO^-	proton acceptor
the _____ of an acid is a measure of its ability to donate hydrogen ion / protons	the lower the pH, the _____ the $[\text{H}_3\text{O}^+]$	HCl & CH_3COOH of the <u>same conc.</u> & <u>volume</u> will react with the same amount of NaOH / Mg / Na_2CO_3 as	$\text{pH} = -\log [\text{H}^+]$
strength	higher	the total amount of H_3O^+ ions available in each is the same	to calculate pH from $[\text{H}^+]$

$[H^+] = \text{invlog}(-\text{pH})$	$\text{pH} + \text{pOH} =$	$K_w = 1 \times 10^{-14}$ is called	$[H^+][OH^-]$ or $[H_3O^+][OH^-]$ =
to calculate $[H^+]$ from pH	14	the ionic product for water	$K_w / 1 \times 10^{-14}$
$= \frac{1 \times 10^{-14}}{[OH^-]}$	$= \frac{1 \times 10^{-14}}{[H^+]}$	$\text{pOH} = -\log [OH^-]$	Concentration of $[H^+]$ in a strong acid eg HCl is equal...
$[H^+]$	$[OH^-]$	to calculate pOH from $[OH^-]$	to the concentration of the acid (in mol L ⁻¹)
<u>Equilibria</u> increase in [reactant] favours the...	<u>Equilibria</u> increase in [product] favours the...	rate of the forward reaction = rate of backward reaction: we call this ___ equilibrium	Concentration of $[OH^-]$ in a strong alkali/base eg NaOH is equal...
forward reaction / reaction that uses up the reactant, to minimise the change	back reaction / reaction that uses up the product, to minimise the change	dynamic	to the concentration of the alkali/base (in mol L ⁻¹)
increase in pressure causes equilibrium to shift to ___ the no. of gaseous particles, shifts eqm. to side with ___ number of moles of gas	decrease in temp. causes an equilibrium shift to favour reaction that ___ energy, ie shift in the ___ direction.	endothermic reactions will be favoured by ___ temperatures but the reaction rate is too ___	<u>endothermic reactions</u> producing a sufficiently high % product in a short time requires a ___
reduce least/smaller	releases exothermic	low slow	compromise temp. (less % product & fast reaction rate)

$\Delta_r H$	solution containing the NH_4^+ ion would be a weak _____ as NH_4^+ is a proton _____	solution containing the CH_3COO^- ion would be a weak _____ as CH_3COO^- is a proton _____	equation for HCO_3^- acting as a base is...
enthalpy change for the reaction	acid donor	base acceptor	$\text{HCO}_3^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 + \text{OH}^-$
conjugate acids and bases differ by a ...	the conjugate acid of NH_3 is	the conjugate acid of HCO_3^- is	the conjugate base of HCO_3^- is
proton / H^+	NH_4^+	H_2CO_3	CO_3^{2-}
the conjugate base of CH_3COOH is	the conjugate base of H_2O is	equation for CH_3COO^- acting as a base is...	2.86×10^{-13} is given to ____ s.f.
CH_3COO^-	OH^-	$\text{CH}_3\text{COO}^- + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COOH} + \text{OH}^-$	3
write pH 3.467 to 3 s.f.	write pH 3.5 to 3 s.f.	entering a number like 1.25×10^{-3} in calculator....	writing a number like 3.4562E-04 as seen in calculator to 3 sf
4.47	3.50	1 . 2 5 EXP (-) 3	3.46×10^{-4}