

# OCR (B) Chemistry A-level

## Storyline 8: Oceans

### Definitions and Concepts

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## Definitions and Concepts for OCR (B) Chemistry A-level Oceans

### Energetics

**Aqueous solution:** The solution formed when a species is dissolved in water.

**Born-Haber cycle:** Calculates the lattice enthalpy by applying Hess's law and comparing the standard enthalpy change of formation of the ionic compound to values such as ionisation energy and electron affinity.

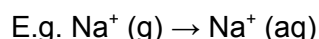
**Charge density:** The ratio of the charge of an ion compared to its volume, for example, a 3+ ion will have a higher charge density than a 1+ ion of similar size.

**Energy profile:** A graph used to show the relative energy levels of reaction species (including reactants and products) as a reaction proceeds. Also shows the activation energy of a reaction.

**Enthalpy (H):** A value that represents the heat content of a system.

**Enthalpy change ( $\Delta H$ ):** The change in the heat content of a system during a reaction. This can be determined from experimental results using  $q = mc\Delta T$  (where  $q$  is the heat change of the surroundings,  $m$  is the mass of the surroundings,  $c$  is the specific heat capacity and  $\Delta T$  is the change in temperature).

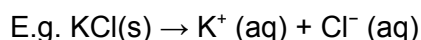
**Enthalpy of hydration:** The enthalpy change when one mole of a gaseous ion is completely dissolved in water under standard conditions.



**Enthalpy of lattice dissociation:** The enthalpy change when one mole of a solid ionic compound is converted into its gaseous ions.

**Enthalpy of lattice formation:** The enthalpy change when one mole of a solid ionic compound is formed from its gaseous ions.

**Enthalpy of solution:** The enthalpy change when one mole of ionic solid completely dissolves in water under standard conditions to form an infinitely dilute solution.



**Entropy:** A measure of the disorder of a system. The units of entropy are  $\text{JK}^{-1}\text{mol}^{-1}$ . On a molecular level, gases are more disordered than liquids, which are more disordered than solids. A reaction that produces a greater number of molecules than the number of reactants molecules will have a positive entropy change, as there will exist more random arrangements of these molecules, i.e. the system will become more disordered.

**Entropy change:** This can be calculated by finding the difference between the standard entropies of the products and the reactants:

$$\Delta S_{\text{total}} = \sum \Delta S_{\text{products}} - \sum \Delta S_{\text{reactants}}$$

If the entropy change for a reaction is positive, the products are more disordered than the reactants. If the entropy change for a reaction is negative, the products are less disordered than the reactants.

**Feasible reaction:** For a reaction to be feasible at a given temperature it must occur spontaneously. This means no extra energy is required for the reaction to occur.

**Hydrated ions:** Ions that have dissolved in water to form a solution and are therefore surrounded by water molecules. These water molecules are often organised into a shell around the ion.

**Nonaqueous solution:** A solution in which the solvent is any liquid except for water.

**Solubility:** The ability of a given substance to dissolve in a solvent.

**Solubility product ( $K_{\text{sp}}$ ):** The product of dissolved ion concentrations raised to the power of their stoichiometric coefficients. A high value for  $K_{\text{sp}}$  indicates a high solubility.

**Standard conditions:** Solutions of  $1.0 \text{ mol dm}^{-3}$  concentration, a temperature of  $298\text{K}$  and  $100 \text{ kPa}$  pressure.

**Standard state:** The physical state (solid, liquid, gas, aqueous) of a substance under standard conditions.

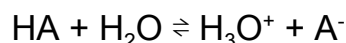


## Equilibria (Acid-Base)

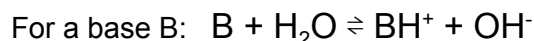
**Acidic buffer:** A buffer containing a weak acid and its conjugate base, e.g. a solution of acetic acid and sodium acetate.

**Basic buffer:** A buffer containing a weak base and its conjugate acid, e.g. a solution of ammonia and ammonium chloride.

**Brønsted-Lowry acid:** Proton donors. They release hydrogen ions when mixed with water. The hydrogen ions react with water molecules to form hydronium ions:



**Brønsted-Lowry base:** Proton acceptors. In solution, they bond to hydrogen ions from water molecules to release  $\text{OH}^-$  ions.



**Buffer:** A solution that resists changes in pH when small volumes of acid or base are added.

**Conjugate acid-base pair:** A pair of compounds that transform into each other by the transfer of a proton. Conjugate acid-base pairs are important in the formation of buffers to control pH.

**Diprotic acid:** An acid that can release two  $\text{H}^+$  ions upon dissociation, e.g.  $\text{H}_2\text{SO}_4$ .

**$K_a$ :** Acid dissociation constant, a quantitative measure of the strength of an acid in solution. The larger the  $K_a$  value the stronger the acid, since it means the acid is largely dissociated into its ions.

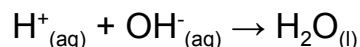
$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$

**$K_w$ :** Ionic product of water. At 298K,  $K_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ .

$$K_w = [\text{H}^+][\text{OH}^-]$$

**Monoprotic acid:** An acid that can release only one  $\text{H}^+$  upon dissociation, e.g.  $\text{HCl}$ .

**Neutralisation:** A reaction between an acid and a base to form water and a salt. The ionic equation for neutralisation is:





**pH:** A value expressing the acidity or alkalinity of a solution. A value of 0-6 indicates an acidic solution, 7 indicates a neutral solution, and 8-14 implies an alkaline solution.

$$\text{pH} = -\log[\text{H}^+]$$

$$[\text{H}^+] = 10^{-\text{pH}}$$

**Strong acid:** An acid that dissociates almost completely in water. This means nearly all the  $\text{H}^+$  ions will be released. E.g.  $\text{HCl}$ .

**Strong base:** A base which ionises almost completely in water. E.g.  $\text{NaOH}$ .

**Weak acid:** Acids that only dissociate very slightly in water so that only a small number of  $\text{H}^+$  ions are released. E.g. Ethanoic acid.

**Weak base:** A base that only slightly ionises in water. E.g.  $\text{NH}_3$ .

## Energy and Matter

**Greenhouse effect:** The warming of the globe due to the trapping of heat in the Earth's atmosphere, due to an increase in greenhouse gasses being released.

**Greenhouse gases:** Cause the greenhouse effect. Examples include: carbon dioxide, water vapour and nitrous oxide.

**Troposphere:** The lowest part of the atmosphere, closest to the earth.

