16–18 years

Swimming pool chemistry

ROYAL SOCIETY OF CHEMISTRY

Education
Inspiring your teaching and learning

https://rsc.li/39eZpYL

You should be able to…

1. Describe how the water in swimming pools is disinfected.
2. Calculate the concentration of various ions present in the water.
3. Interpret data obtained from a mass spectrometer.
4. Determine the structure of organic molecules.

The problem

Swimming pools are a place to relax, get fit and have fun. Nobody wants to swim or play in a dirty pool that is crumbling and falling apart.

What is the role that chemistry plays in keeping a swimming pool well maintained, clean and safe for the general public to use?

Health and safety information

Chemical	Concentration	Hazard symbol
Chlorine gas		
Chlorine water		Low hazard
Concentrated sodium chlorate(I)	More than 0.7 mol dm^{-3}	
Moderately-dilute sodium chlorate(I)	Less than 0.7 mol dm^{-3} but more than 0.4 mol dm^{-3}	
Dilute sodium chlorate(I)	Less than 0.4 mol dm^{-3} but more than 0.15 mol dm^{-3}	
Very dilute sodium chlorate(I)	Less than 0.15 mol dm^{-3}	Low hazard

Information

Swimming pool maintenance

Discussion

The water quality in swimming pools is monitored on a daily basis. What is actually being monitored?

What parts of the pool need regular maintenance?

Calcium chloride is often added to the water to help prevent the grout dissolving, which also contains calcium sulfate.

Why do you think this works?

What processes could be involved?

Solubility product, K_{sp}

Solubility products are equilibrium constants.

You get an equilibrium set up when the rate at which some ions are breaking away from the solid is the same at which some are returning.

$$A_aB_b(s) \rightleftharpoons aA^+(aq) + bB^-(aq)$$

$$K_{sp} = [A^+]^a[B^-]^b$$

The position of the equilibrium lies far to the left.

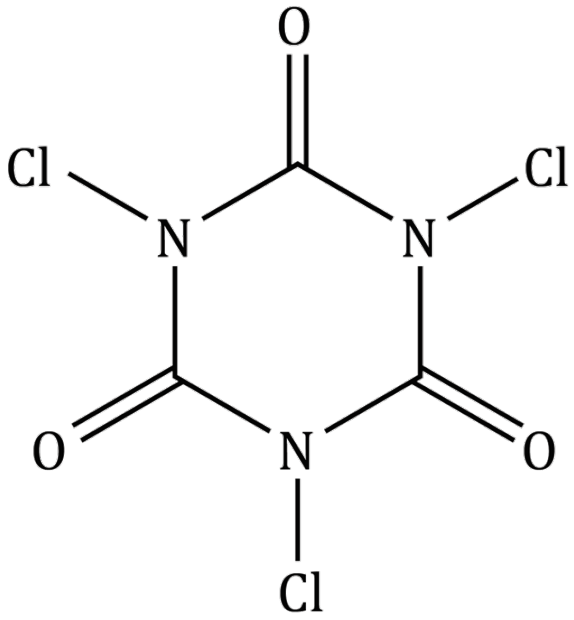
The concentration of the solid is left out of the expression. We can think of it as being a constant and therefore not relevant

The units of K_{sp} differ depending on the expression

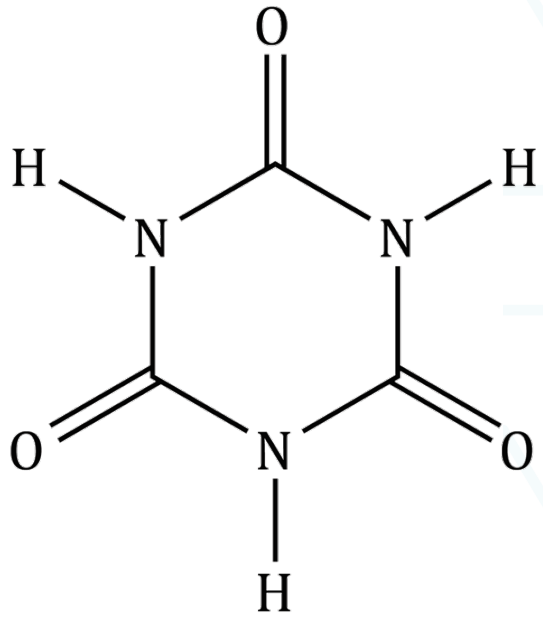
$$\text{Units} = \textbf{mol}^{(a+b)}\,\textbf{dm}^{-3(a+b)}$$

Organic compounds

(a)



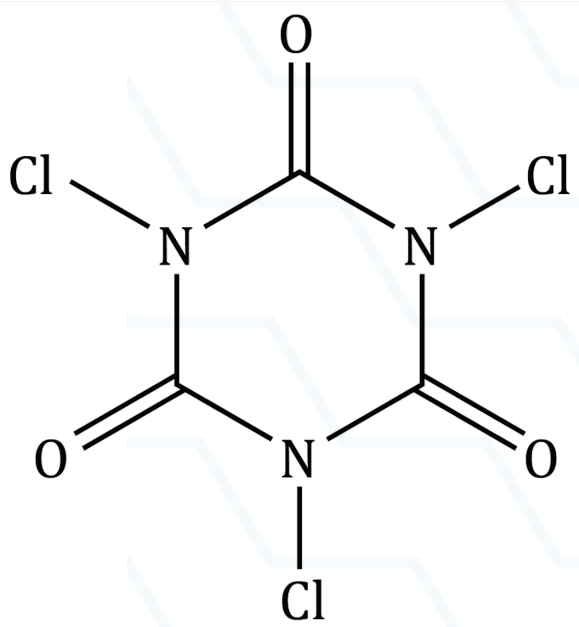
(b)



Trichloroisocyanuric acid (a)undergoes hydrolysis to form an equilibrium with $HOCl$ and isocyanuric acid (b).

Look at the structure of isocyanuric acid, do you think it will have a delocalised π system like benzene?

Predicting oxidation states



How do the electronegativities of the different elements compare?

What implications does this have on the nature of bonds present in the molecule?

How could the products of hydrolysis influence your answer?

Pauling electronegativity values for some elements

H 2.1						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0