

## Answer on the question #64361, Chemistry / General Chemistry

### Question:

2. A bottle of sodium hydroxide is found in the lab with label reading 0.024mole/litre.
- What are the concentrations of all of the ions present in the solution?
  - What is the pH of the solution?

### Solution:

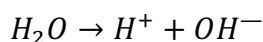
a) Sodium hydroxide, present in solution, dissociates into ions almost completely, as a strong electrolyte:



Then, we have concentrations of sodium  $Na^+$  ion and hydroxide anion, that are equal to the concentration of the sodium hydroxide:

$$c(Na^+) = c(OH^-) = c(NaOH) = 0.024 \text{ mol L}^{-1}$$

Also, we should consider the equilibrium of water autoionisation:



There, the constant of equilibrium is:

$$K_w = [H^+][OH^-] = 10^{-14}$$

Then, we can find the concentration of hydrogen ions:

$$c(H^+) = \frac{10^{-14}}{0.024} = 4.2 \cdot 10^{-13} \text{ mol L}^{-1}$$

b) The pH of solution is minus logarithm of the concentration of hydrogen ions:

$$pH = -\log(c(H^+)) = -\log(4.2 \cdot 10^{-13}) = 12.4$$

**Answer:** a) Ions present in solution are: sodium cation, hydroxide anion, hydrogen cation. The concentrations are:  $c(Na^+) = c(OH^-) = 0.024 \text{ mol L}^{-1}$ ,  $c(H^+) = 4.2 \cdot 10^{-13} \text{ mol L}^{-1}$ ; b)  $pH = 12.4$ .