# Answer on Question #56493 – Chemistry - General Chemistry

**Question:**

a) a student tested a solution with a pH meter and recorded the pH to be 7.43. calculate the $[H_3O^+]$ and $[OH^-]$ for this solution.

b) a 2.291 g sample containing sulfate ions was treated with barium to precipitate barium sulfate ($BaSO_4$; MW=233.4 g/mol). If the collected precipitate weighed 3.0687 g. Was the unknown sample sodium sulfate (Na_2SO_4; MW=142.0 g/mol) or potassium sulfate (K_2SO_4; MW=174.2 g/mol). Support your answer with calculations

c) consider the balanced reaction between Cu and nitric acid shown below. If 1.55 g of $Cu(NO_3)_2$ (mw=187.6 g/mol) was obtained from the reaction of 0.95 g of Cu(mw=63.55 g/mol) excess HNO_3 what is the % yield of the reaction?

$Cu_{(s)} + 4HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O_{(l)}$
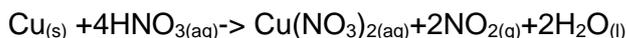
Answer:

a) $pH = -lg[H_3O^+]$
$pOH = -lg[OH^-]$
$K_w = [H_3O^+][OH^-] = 10^{-14}$
$[H_3O^+] + [OH^-] = 14$
$pOH = 14 - 7.43 = 6.57$
$[H_3O^+] = 10^{-pH}$
$[H_3O^+] = 10^{-7.43} = 3.71 \cdot 10^{-8}$ M
$[OH^-] = 10^{-6.57} = 2.69 \cdot 10^{-7}$ M

b) $Ba^{++} + K_2SO_4 = BaSO_4 + 2K^+$

$Ba^{++} + Na_2SO_4 = BaSO_4 + 2Na^+$
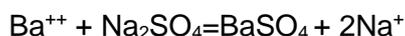
According to the reaction, $v(BaSO_4) = v(K_2SO_4)$

$v(BaSO_4) = v(Na_2SO_4)$

$v(BaSO_4) = \dfrac{3.0687}{233.4} = 0.013 \; mol$

$v(K_2SO_4) = \dfrac{2.291}{174.2} = 0.013 \; mol$

$v(Na_2SO_4) = \dfrac{2.291}{142.0} = 0.016 \; mol$

So that the unknown sample is Potassium Sulphate.

c) $v = \dfrac{m}{M}$

$v(Cu) = \dfrac{0.95}{63.55} = 0.02 \; mol$

According to the reaction, $v(Cu) = v(Cu(NO_3)_2)$
$m(Cu(NO_3)_2) = 0.02 \cdot 187.6 = 3.75 \; g$

$$\%(Cu(NO_3)_2) = \frac{1.55}{3.75} \cdot 100 = 41.33\%$$