Appello 17/07/2023

① 40 mL $Be(NO_3)_2$ $4.5 \cdot 10^{-4}$ M $[Be^{++}] = ?$

50 mL Na_2SO_4 $5 \cdot 10^{-5}$ M $[SO_4^{=}] = ?$

$$\frac{4.5 \cdot 10^{-4} \frac{mol}{L} \cdot 0.040\,L}{0.090\,L} = [Be^{++}] = 2 \cdot 10^{-4}\ M$$

$$\frac{5 \cdot 10^{-5} \frac{mol}{L} \cdot 0.050\,L}{0.090\,L} = [SO_4^{=}] = 2.78 \cdot 10^{-5}\ M$$

$[Be^{++}][SO_4^{=}] = Qps = 5.56 \cdot 10^{-9} > Kps$ precipita

$$BeSO_4 \longrightarrow Be^{++}_{(aq)} + SO_4^{=}_{(aq)}$$

i	0.3	
e	0.3 + s	s

$Kps = (0.3 + s)(s) = 1.2 \cdot 10^{-10}$

$s = \frac{1.2 \cdot 10^{-10}}{0.3} = 4 \cdot 10^{-10}$

$$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$$

	0.3		
	0.3 − x	x	x

$\frac{10^{-14}}{1.8 \cdot 10^{-5}} = \frac{x^2}{0.3 - x}$ $x = [OH^-] = \sqrt{\frac{Kw}{Ka} \cdot 0.3} =$

$[OH^-] = 1.29 \cdot 10^{-5}$ M $pOH = 4.89$ $\boxed{pH = 9.11}$

29 · 5 (1)

~~2~~/2

$$5\,Cu_2SO_4 + 2\,NMnO_4 + 8\,H_2SO_4 \rightarrow 10\,CuSO_4 + N_2SO_4 + 2\,MnSO_4 + 8\,H_2O$$

5	Cu^+	$\rightarrow Cu^{2+} + 1e^-$
2	$MnO_4^- + 5e^- + 8H^+$	$\rightarrow Mn^{2+} + 4H_2O$
	$5\,Cu^+ + MnO_4^- + 8H^+$	$\rightarrow 5\,Cu^{2+} + Mn^{2+} + 4H_2O$

3.80 g $NMnO_4$ 97%.

$$\frac{3.80\,g}{158.0\,g/mol} = 2.41\cdot10^{-2}\,mol \cdot 0.97 = 2.33\cdot10^{-2}\,mol$$

$$2 : 5 = 2{,}33\cdot10^{-2}\,mol : x\,mol\ Cu_2SO_4$$

$$mol\ Cu_2SO_4 = 5.83\cdot10^{-2}\,mol$$

$$m_{Cu_2SO_4} = 5.83\cdot10^{-2}\,mol \cdot 283.15\,g/mol = 13.01\,g$$

$$m_{Cu_2SO_4}\ 40\% = \frac{13.01\,g}{0.40} = \boxed{32.54\,g}$$

$$V = \frac{32.54\,g}{1.38\,g/mL} \rightarrow 23.58\,mL$$

Ex3

$$NO + O_3 \rightleftharpoons NO_2 + O_2 \qquad Wc = 69.3$$

	NO	O_3	NO_2	O_2
i	0.1	0.1		
e	$0.1-x$	$0.1-x$	x ✓	x ✓

$$Wc = \sqrt{69.3} = \frac{x^2}{(0.1-x)^2} = 8.32$$

$$\frac{x}{0.1-x} = 8.32 \qquad x = 8.32(0.1-x)$$

$$x = -8.32x + 0.832$$

$$9.32x = 0.832$$

$$\boxed{x = 0.089}$$

$$[NO] = [O_3] = (0.1 - 0.089)\,M = 0.0107\,M$$

$$[NO_2] = [O_2] = 0.089\,M$$

$$NO + O_3 \rightleftharpoons NO_2 + O_2$$

	NO	O_3	NO_2	O_2
i	0.0107	0.0107	0,089 +0.02	0.089
e	$0.0107+x$	$0.0107+x$	$0.109-x$	$0.089-x$

$$69.3 = \frac{(0.109-x)(0.089-x)}{(0.0107+x)^2}$$

$[NO] = [O_3] = 0{,}0107 + 0{,}011 = \underline{0.0217\ M}$

$[NO_2] = 0.109 - 0.011 = \underline{0.098\ M}$

$[O_2] = 0.089 - 0.011 = \underline{0.078\ M}$

EX4

$\frac{13.20\ g\ CO_2}{44\ g/mol} = \underline{0.3\ mol\ C} \cdot 12 = 3.6\ g\ C$

$\frac{1.80\ g}{18\ g/mol} = 0.1\ mol \cdot 2 = \underline{0.2\ mol\ H}$

$0.2\ mol \cdot 1.01\ g/mol = 0.0404\ g$

$(5.40 - 3.6 - 0.0404)\ g = 1.76\ g\ O$

$\frac{1.76\ g}{16.0\ g/mol} = \underline{0.11\ mol\ O}$

C_3H_2O

5

$$HA + NaOH \rightarrow NaA + H_2O$$

42 mL NaOH 0.10M | $0.042\,L \cdot 0.1\,\frac{mol}{L} = 0.0042\,mol$

$$A^- + H_2O \rightarrow HA + OH^-$$

$$[OH^-] = \sqrt{\frac{Kw}{Ka} \cdot Cs} = \sqrt{\frac{10^{-14}}{1.6\cdot10^{-5}} \cdot \frac{0.0042}{0.042}}$$

$[OH^-] = 7.45 \cdot 10^{-6}\,M \Rightarrow$ pOH = 5.13

pH = 8.87

a)

	HA	+ NaOH	→ NaA	+ H_2O
i	0.0042	0.001		
f	0.0032	–	0.001	

b)

	HA	+ NaOH	→ NaA	+ H_2O	
i	0.0042	0.002	–	–	
f	0.0022	–	0.002	–	

a) $[H^+] = 1.6\cdot10^{-5} \cdot \frac{0.0032}{0.001} = 5.12\cdot10^{-5}\,M \Rightarrow$ pH = 4.29

b) $[H^+] = 1.6\cdot10^{-5} \cdot \frac{0.0042}{0.002} = 1.76\cdot10^{-5}\,M \Rightarrow$ pH = 4.75

(5)