CONCENTRATION / pH / Indicators

Name: SOLUTIONS

(REVIEW)

Answer all questions completely. Write all needed formulas.

1) What amount of salt would be needed to prepare a 450mL salt water solution with a concentration of 6g/L ?

$C = \frac{m}{V}$ $\quad 6 = \frac{m}{0.45}$ $\quad m = 2.7g$

2) The maximum concentration of lead (Pb) which is considered safe in drinking water is 0.012ppm. You study 200L of tap water which contains 0.002g of lead. Is this sample safe to drink ?

$\frac{2mg}{200L} = 0.01ppm$ ← safe.

3) How much water is there present in a 240g 35% mass solution?

$\%\,m/m = \frac{\text{mass solute}}{\text{mass solution (solute + solvent)}} \times 100 \rightarrow 35 = \frac{\text{mass solute}}{240} \times 100$

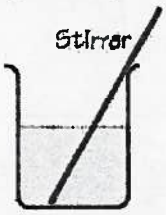
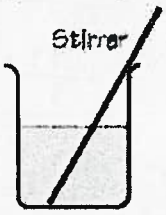
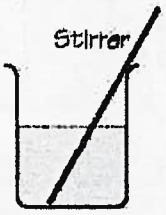
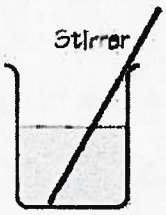
mass solute = 84g

solution = solute + solvent

240 = 84 + solvent

solvent (water) = 156g

4) In the laboratory. Wendy prepared four solutions that were different in concentration and in volume. The following is the diagram from Wendy's procedure.

SOLUTION I	SOLUTION II	SOLUTION III	SOLUTION IV
			
50 g of HCl dissolved in 2 L of water	25 g of NaOH dissolved in 4 L of water	5.0 g of NaCl dissolved in 250 mL of water	2.5 g of $CaCl_2$ dissolved in 500 mL of water

In her report, Wendy listed the solutions in ***increasing*** order of concentration (g/L). In which order were the solutions listed?

a) I, III, II, IV
b) II, I, IV, III
c) IV, II, III, I
d) IV, III, II, I

5) What is the molar concentration of a solution that contains 5 moles dissolved in 3000ml of water?

$C = \frac{n}{V}$ $\quad C = \frac{5}{3}$ $\quad C = 1.67\,mol/L$

6) How many moles are contained in a 7L solution of concentration 0.5mol/L.

$C = \frac{n}{V}$ $0.5 = \frac{n}{7}$ $n = 3.5$ moles

7) What is the volume of solution whose concentration is 0.2 mol/L if it contains 92g of NO_2 ?

$V = ???L$
$C = 0.2 mol/L$
$m = 92g$
NO_2

① $M_{NO_2} = 46 g/mole$

② $n = \frac{m}{M}$ $n = \frac{92}{46}$ $n = 2$ moles

③ $C = \frac{n}{V}$ $0.2 = \frac{2}{V}$ $V = \frac{2}{0.2}$ $V = 10L$

8) What mass of $NaNO_3$ must be used in order to make a 10L solution of 0.2mol/L ?

$C = 0.2 mol/L$
$V = 10L$
$m = ???g$
$NaNO_3$

① $M_{NaNO_3} = 85 g/mole$

② $C = \frac{n}{V}$ $0.2 = \frac{n}{10}$ $n = 2$ moles

③ $n = \frac{m}{M}$ $2 = \frac{m}{95}$ $m = 170g$

9) What volume of solution must be used to prepare a 3mol/L solution, if 200g Li_2SO_3 are used?

$V = ???L$
$C = 3 mol/L$
$m = 200g$
Li_2SO_3

① $M_{Li_2SO_3} = 94 g/mole$

② $n = \frac{m}{M}$ $n = \frac{200}{94}$ $n = 2.13$ moles

③ $C = \frac{n}{V}$ $3 = \frac{2.13}{V}$ $V = \frac{2.13}{3} = 0.71L$

10) Why is universal indicator more useful than litmus paper: _____

Not only tells if we have an acid or base, but also strength of the Acid or Base

11) Bases will typically have pH's that range from 7 to 4.

12) How many times more powerful is an acid of pH 1 than an acid of pH 4? 1000

13) Define Turning Point: pH range at which an indicator changes colour

14) In the table below, which indicator has a turning point completely within the basic range of the pH scale?

PH Scale	1 3 5 7 9 11		
Indicator 1	Yellow	Green	Blue
Indicator 2	Colourless	Pink	Fuchsia
Indicator 3	Red	Orange	Yellow
Indicator 4	Red	Orange	Yellow

#2

15) In the laboratory, you are given tow acid-base indicators and a colourless solution with an unknown pH. The following table gives the colours of the two indicators at different pH values.

pH	1	2	3	4	5	6	7	8	9	10	11	12	13
Indicator 1	Yellow				Green			Blue					
Indicator 2	Violet			Yellow			Red						

When you add a drop of each indicator to the colourless solution, it turns yellow.
What is the pH range of this solution? 3-4

16) Complete the following table.

Solution	pH	$[H^+]_{aq}$(mol/L)	$[OH^-]_{aq}$(mol/L)	Type of solution
A	8	10^{-8}	10^{-6}	B
B	3	10^{-3}	10^{-11}	A
C	7	10^{-7}	10^{-7}	Neutral

17) Analysis of a hair shampoo reveals that it has a pH of 8. $[H^+] = 10^{-8}$
What is the molar concentration of $OH^-_{(aq)}$ ions in the shampoo? 10^{-6} mol/L = $[OH^-]$
What is the nature of this shampoo? BASE

*18) If 10.0 ml of 0.001 mol/l $HNO_{3(aq)}$ (ACID), is added to a beaker containing 90.0 ml of distilled water, what will be the pH of the new solution? (show work)

A) 1
B) 9
C) 4
D) 3

① $C_1 = 0.001$ mol/L $C_1V_1 = C_2V_2$
$V_1 = 10$mL $\frac{(0.001)(10)}{100} = C_2$
$C_2 = ???$
$V_2 = 100$mL $0.0001 = C_2$ mol/L

$[H^+] = 0.0001$ mol/L
10^{-4} mol/L
pH = 4

19) Fill in spaces provided:

$[H^+]$	=	0.01 mol/L	=	1×10^{-2} mol/L	=	pH 2
$[OH^-]$	=	0.00001 mol/L	=	10^{-5}	=	9
$[H^+]$	=	0.000001	=	1×10^{-6} mol/L	=	6
$[OH^-]$	=	0.001	=	1×10^{-3} mol/L	=	11

20) What is the molar concentration of an 1800 mL solution containing 132.3 g of potassium dichromate, $K_2Cr_2O_7$?

C = ??? mol/L
V = 1.8L
m = 132.3g

① $M_{K_2Cr_2O_7} \approx 294$ g/mole

② $n = \frac{m}{M}$
$n = \frac{132.3}{294}$
$n = 0.45$ moles

③ $C = \frac{n}{V}$
$C = \frac{0.45}{1.8} = 0.25$ mol/L