CONCENTRATION UNITS

WORKSHEET 1

QUESTION 1
A bottle of orange juice contains $80\,mg$ of vitamin C $(M = 176 g/mol)$ in every $200\,ml$ of orange juice.

The concentration of vitamin C, in mol/L, in the orange juice is:

A 0.090
B 0.0023
C 0.000090
D 0.0000023

Solution

QUESTION 2
Calculate the concentration of ions that would be present in a $0.125M$ solution of $Fe(NO_3)_3$.

Solution

QUESTION 3
What mass of solute is needed to prepare $400\,ml$ of $0.850M$ $CuSO_4$ from $CuSO_4.5H_2O$?

Solution

$M(CuSO_4) = 160\ gmol^{-1}$
$M(CuSO_4.5H_2O) = 250\ gmol^{-1}$

QUESTION 4 – TRICKY!
What is the mass percent of solute when 4.12 g is dissolved in 100.0 g of water?

Solution

QUESTION 5
25 g of fertiliser is dissolved in 75 g of water. What is the concentration of this solution in:

(a) g / L
(b) $\%(w / w)$

Solution

QUESTION 6
What mass of water would be needed to prepare 250 g of a 20% (w/w) solution of NaOH?

Solution

QUESTION 7
Calculate the concentration of NaOH, in grams per litre of solution, if 10 g of NaOH is dissolved in enough water to make 2 L of solution.

Solution

QUESTION 8
Determine the volume percent of toluene in a solution made by mixing 40.0 mL toluene with 75.0 mL of benzene.

Solution

QUESTION 9
What is the volume percent of 10.00 g of acetone (d = 0.789 g/mL) in 1.55 L of an acetone-water solution?

Solution

QUESTION 10
Find the % concentration of a solution in which 6.8 g of NaCl has been dissolved making a solution with a volume of 85 mL.

Solution

QUESTION 11
An NaCl solution has a concentration of 5.6%. What mass of NaCl is present in 25 mL of this solution?

Solution

QUESTION 12
An NaCl solution has a concentration of 5.6%. What volume of solution will provide a mass of 0.75 g of NaCl?

Solution

QUESTION 13

A glucose $(C_6H_{12}O_6)$ solution is prepared by adding 5.00 grams of glucose to enough water to make 200.0 ml of solution.

(a) What is the $\%(w/v)$ of the solution?
(b) What volume (mL) of this solution would contain 0.0735 grams of glucose?
(c) How many grams of glucose would be present in 185 mL of this solution?

Solution

QUESTION 14
What amount, in mole, of sodium sulfate (Na_2SO_4) is present in a 250 mL solution with a concentration of 15% (w/v)?

Solution

QUESTION 15 – TRICKY!
What is the mass percent sucrose in a solution obtained by mixing 225 g of an aqueous solution that is 6.25% sucrose by mass with 135 g of an aqueous solution that is 8.20% sucrose by mass?

Solution

QUESTION 16
An NaCl solution has a concentration of 132 ppm. What mass of NaCl is present in 250 mL of this solution?

Solution

QUESTION 17
An NaCl solution has a concentration of 132 ppm. What volume of solution will provide a mass of 0.024 g of NaCl?

Solution

QUESTION 18
Find the concentration in ppm of a solution in which 0.0059 g of NaCl has been dissolved in water to make a solution with a volume of 750 mL.

Solution

QUESTION 19
Find the concentration in ppb of a solution in which 9.6 x 10^{-6} g of NaCl has been dissolved in water to make a solution with a volume of 2.0 L.

Solution

QUESTION 20
The water supply of many cities is fluoridated giving 1.00 ppm of F^-. One city's water supply was analysed and the results indicated that there were 0.04 g F^- in a 500 mL sample. Did this city's water have the correct level of fluoridation?

Solution

ANSWERS

QUESTION 1 Answer is B

As $c = \frac{n}{V}$

$$= \frac{4.545\times10^{-4}}{200\times10^{-3}}$$

$$= 2.27\times10^{-3}$$

$$= B$$

QUESTION 2

$$[Ions] = 4\times[Fe(NO_3)_3] = 4\times0.125 = 0.500\ M$$

QUESTION 3

$$n = cV = 0.85\times0.4 = 0.340\ mol$$
$$m = n\times M = 0.340\times250 = 85.0\ g$$

QUESTION 4 – TRICKY!

$$\%(m/m) = \frac{\text{mass solute}}{\text{mass solution}} \times 100\%$$

$$= \frac{4.12}{100.0+4.12} \times 100\%$$

$$= \frac{4.12}{104.12} \times 100\%$$

$$= 0.818\%$$

QUESTION 5

(a)

25g fertiliser / 75g water

= 25g / 75mL water

= 25g / 0.075 L

= 3.3×10^{2} g/L

(b)

25g fertiliser / 75 g water

mass of solution = 25+75

= 100g

conc = 25g / 100g

= 25 %(w/w)

QUESTION 6

Let mass NaOH = x

x g NaOH | 250g solution = 20 % (w/w)

$$\frac{x}{250} = \frac{20}{100}$$

$$x = 50\ g$$

$\therefore$ m water required = 250 − 50 = 100g

QUESTION 7 $\frac{10\ g}{2\ L} = 5\ g/L$

QUESTION 8

$$\%\ (v/v) = \frac{\text{volume toluene}}{\text{volume toluene-benzene}} \times 100\ \%$$

$$= \frac{40.0}{40.0+75.0} \times 100\ \%$$

$$= \frac{40.0}{115.0} \times 100\ \% = 34.8\ \%$$

QUESTION 9

$$\%\ (v/v) = \frac{\text{volume solute}}{\text{volume solution}} \times 100\ \%$$

$$= \frac{\text{Volume acetone}}{\text{volume acetone} - H_2O \text{ solution}} \times 100\ \%$$

$$= \frac{12.6743}{155.0} \times 100\ \%$$

$$= 0.817716\ \%$$

$$= 0.818\ \%$$

$$d = \frac{m}{V}$$

$\therefore V_{acetone} = \frac{m}{d}$

$$= \frac{10.00}{0.789}$$

$$= 12.6743\ mL$$

d acetone/H_2O soln = 1 g/mL

QUESTION 10

$$\% = \frac{\text{amount of solute}}{\text{amount of solution}} \times 100$$

$$= \frac{6.8\ g\ NaCl}{85\ mL\ solution} \times 100$$

$$= 8.0\%\ NaCl$$

QUESTION 11

$$\% = \frac{\text{amount of solute}}{\text{amount of solution}} \times 100$$

$$\Rightarrow \frac{x}{25} = \frac{5.6}{100}$$

$$\therefore x = 1.4g$$

QUESTION 12

$$5.6\% = 5.6\ g / 100\ mL$$

$$0.75\ g / x$$

$$\therefore 5.6x = 0.75 \times 100$$

$$x = 13.4\ mL$$

QUESTION 13

(a)

$$\%(w/v) = \frac{\text{mass solute}}{\text{volume solution}} \times 100\%$$

$$= \frac{5.00}{200.0} \times 100\%$$

$$= 2.50\%\ (w/v)$$

(b)

$$2.50\%\ (w/v) = 2.50\ g \text{ in } 100\ mL$$

$$0.0735\ g \text{ in } x\ mL$$

$$2.50x = 7.35$$

$$\therefore x = 2.94\ mL\ solution$$

(c)

$$2.50\ g \text{ in } 100\ mL$$

$$x\ g \text{ in } 185\ mL$$

$$100x = 2.50 \times 185$$

$$\therefore x = 4.63\ g\ glucose$$

QUESTION 14

$M(Na_2SO_4) = 142.04\ g/mol$

$$\frac{x}{250} = \frac{15}{100}$$

$$100x = 250 \times 15$$

$$x = 37.5\ g$$

$$n = \frac{m}{M_r} = \frac{37.5}{142.04} = 0.264\ mol\ Na_2SO_4$$

QUESTION 15 – TRICKY!

$$\%\ (m/m) = \frac{mass(sucrose)}{mass(solution)} \times 100\%$$

$$= \frac{mass(sucrose)_1^*}{mass(Total\ soln)} + \frac{mass(sucrose)_2}{mass(Total\ soln)} \times 100\%$$

$$= \frac{(6.25\% \times 225)^* + (8.20\% \times 135)}{225 + 135} \times 100\%$$

$$= 6.98\%\ (m/m)$$

$mass(sucrose)_1^* = 6.25\%\ (m/m)$ sucrose solution

$= 6.25\ g$ sucrose in $100\ g$ solution

$x\ g$ sucrose in $225\ g$

$\therefore 100x = 6.25 \times 225$

$\therefore x = \frac{6.25 \times 225}{100} = 6.25\% \times 225$

QUESTION 16

$132\ ppm = 132\ g\ /\ 1 \times 10^6\ g$

If $d = 1\ g/mL \Rightarrow 132\ g\ |\ 1 \times 10^6\ mL$

$x\ /\ 250\ mL$

$x \times 1 \times 10^6 = 132 \times 250$

$x = 0.033\ g$

QUESTION 17

$$132\ ppm = \frac{132\ g / 1\times10^{6}\ g}{0.024\ g / x}$$

$$132x = 0.024 \times 1\times10^{6}$$

$$x = 181.8$$

$$= 1.8\times10^{2}\ mL$$

QUESTION 18

$$\times 1,333\tfrac{1}{3}\left(\frac{0.0059\ g\ NaCl / 750\ mL}{7.867\ g / 1\times10^{6}}\right) \times 1,333\tfrac{1}{3}$$

$$= 7.9\ ppm\ NaCl$$

QUESTION 19

$$9.6\times10^{-6}\ g\ NaCl / 2000\ mL \quad \times 500,000$$

$$9.6\times10^{-6}\times 500,000 / 1\times10^{9}\ mL$$

$$4.8\ g / 1\times10^{9}\ mL$$

$$= 4.8\ ppb$$

QUESTION 20

$$0.04\ g\ F^{-} / 500\ mL \quad \times 2000$$

$$0.04\times2000\ g / 1\times10^{6}\ mL$$

$$80\ g\ F^{-} / 1\times10^{6}\ mL$$

$$\Rightarrow 80\ ppm$$

No, it did not have the correct level