***Question 1.1***

What is the molarity when 0.75 mol $CaSO_4$ (calcium sulphate) is dissolved in 2.50 L of solution?

molarity = moles of solute / volume of solution

molarity = $[CaSO_4]$ = c = n/V = 0.75 mol / 2.50 L = 0.30 mol/L = 0.30 M

***Question 1.2***

Sea water contains roughly 28.0 g of NaCl per liter. What is the molarity of sodium chloride in sea water?

molarity = moles of solute / volume of solution  molar mass of NaCl = 23.0 + 35.5 = 58.5 g/mol

moles of NaCl = mass/molar mass = 28.0 / 58.5 = 0.479 mol

molarity = [NaCl] = c = n/V = 0.479 mol / 1 L = 0.479 mol/L = 0.479 M

***Question 1.3***

5.95g of potassium bromide (KBr) was dissolved in water, and make a 400 mL solution.

(a) Calculate its molarity. (b) What is the concentration in grams per L?

(a) moles = mass / molar mass, (KBr = 39.1 + 79.9 = 119 g/mol)

mol KBr = 5.95/119 = 0.0500 mol

400 mL = 400/1000 = 0.400 L

molarity = moles of solute / volume of solution

molarity of KBr solution = 0.0500/0.400 = 0.125 mol/L

(b) concentration = mass / volume, volume = 400 / 1000 = 0.400 L

concentration = 5.95 / 0.400 = 14.9 g/L

***Question 1.4***

(a) How many moles of $H_2SO_4$ are there in 250 mL of a 0.800 mol/L sulfuric acid solution?

(b) What mass of acid is in this solution?

(a) molarity = moles of solute / volume of solution, rearranging equation for the sulfuric acid

mol $H_2SO_4$ = molarity $H_2SO_4$ x volume of $H_2SO_4$ in L

mol $H_2SO_4$ = 0.800 x 250/1000 = 0.200 mol

(b) mass = moles x molar mass

molar mass of $H_2SO_4$ = 1.0×2 + 32 + (4x16) = 98

0.200 mol $H_2SO_4$ x 98 = 20 g of $H_2SO_4$

***Question 1.5***

What mass of sodium hydroxide (NaOH) is needed to make up 500 mL of a 0.500 mol/L solution?

1 mole of NaOH = 23.0 + 16.0 + 1.0 = 40 g

c = n /V n = c x V

500 mL = 500/1000 = 0.500 L

mol NaOH needed = n = 0.500 x 0.500 = 0.250 mol

mass = mol x molar mass = 0.250 x 40 = 10 g NaOH required

***Question 1.6***

*What is the concentration of sodium chloride (NaCl) in g/L and g/mL in a 1.50 M solution?*

molar mass NaCl = 23.0 + 35.5 = 58.5 g/mol

mass = mol x molar mass, for 1 L solution, n = c × V = 1.50 × 1 = 1.50 mol

mass = 1.50 mol x 58.5 g/mol = 87.8 g,

concentration = 87.8 g / 1L = 87.8 g/L

concentration = 87.8 g / 1000 mL = 0.0878 g/mL

***Question 1.7***

A solution of calcium sulphate ($CaSO_4$) contained 0.500 g dissolved in 2.00 L of water.

Calculate the concentration in (a) g/L, (b) g/mL and (c) mol/L.

(a) concentration = 0.500/2.00 = 0.250 g/L, then since 1L = 1000 mL

(b) concentration = 0.250/1000 = 0.00025 g/mL (or from 0.500/2000 = 0.00025)

(c) molar mass of $CaSO_4$ = 40.1 + 32.1 + (16.0 x 4) = 136

n = mass/molar mass = 0.500 / 136 = 0.00368 mol

[$CaSO_4$] = 0.00368 / 2 = 0.00184 mol/L = 0.00184