Molarity

M1V1 = M2V2

M = moles of solute

 liters of solution

1. Calculate the mass of solute needed to prepare each of the following solutions:

a) ?? g of 0.400 M ethyl alcohol solution (C2H5OH)

b) 0.40 liters of 0.20 M Sodium Iodide Solution

c) 750. ml of 0.300 M Aluminum Chloride Solution

2. Calculate the molarity of solution that contains

a) 98.0 g of Sulfuric Acid in 250. ml of solution

b) 398.4 g of NaI in 2.00 liters of solution

3. Calculate the mass of solute in the following solutions

a) 3.00 liters of 0.0200 M solution of Ammonium Sulfide

b) 250. ml of a 0.250 M solution of Potassium Sulfate

4. Calculate the number of moles of solute in each solution

a) 3.00 liters of 4.00 M Hydrochloric Acid

b) 100. ml of 0.500 M Hydrochloric Acid

5. A certain reaction requires 24.0 g of H2SO4. How many milliliters of a 3.0 M solution would be used?

6. A mass of 98.0 g of Sulfuric Acid is dissolved in H2O to prepare a 0.50 M solution. What is the volume of this solution?

7. A solution of Hydrochloric Acid is 0.300 M. What mass of acid is dissolved in 150. ml of solution?

8. What is the molarity of a solution of Magnesium Hydroxide that contains 20.0 g of solute in 325 ml of solution?

9. Calculate how much of the original solution you would need to prepare dilute solutions of:

a) 40.0 ml of a 6.0 M HCl solution from 12.0 M HCl

b) 12.0 ml of 0.50 M H2SO4 from 4.0 M H2SO4

10. How many milliliters of a solution of 4.00 M KI are needed to prepare 250.0 mL of 0.760 M KI?

ANSWER KEY

1. Calculate the mass of solute needed to prepare each of the following solutions:

a) ?? g of 0.400 M ethyl alcohol solution (C2H5OH)

0.400 M = 0.400 moles / 1.00 L

C 2 x 12.0 = 24.0

H 6 x 1.00 = 6 GMM = 46.0 g/mole

O 1 x 16.0 = 16

0.400 moles x 46.0 g/mole = **18.4 g**

b) 0.40 liters of 0.20 M Sodium Iodide (NaI) Solution

0.20 M 🡪 0.20 moles / 1 L

0.20 moles / 1 L = X moles / 0.40 L = 0.080 moles

Na 1 x 23.0 = 23.0

I 1 x 127 = 127 GFM = 150. g/mole

0.080 moles x 150. g/mole = **12 g**

c) 750. ml of 0.300 M Aluminum Chloride (AlCl3) Solution

0.300 M 🡪 0.300 moles / 1 L

0.300 moles / 1 L = X moles / 0.750 L = 0.225 moles

Al 1 x 27.0 = 27.0

Cl 3 x 35.5 = 106.5 GFM = 133.5 g/mole

0.225 moles x 133.5 g/mole = **30.0 g**

2. Calculate the molarity of solution that contains

a) 98.0 g of Sulfuric Acid [H2SO4] in 250. ml of solution

H 2 x 1.00 = 2.00

S 1 x 32.0 = 32.0 GMM = 98.0 g/mole

O 4 x 16.0 = 64.0

98.0 g x 1 mole/98.0 g = 1.00 mole

M = X moles / 1.00 L = 1 mole / 0.250 L

4.00 moles/L = **4.00 M**

b) 398.4 g of NaI in 2.00 liters of solution

Na 1 x 23.0 = 23.0

I 1 x 127 = 127 GFM = 150. g/mole

398.4 g x 1mole/150. g = 2.66 moles

M = X moles / 1.00 L = 2.66 moles / 2.00 L

1.33 moles/L = **1.33 M**

3. Calculate the mass of solute in the following solutions

a) 3.00 liters of 0.0200 M solution of Ammonium Sulfide [(NH4)2S]

0.0200 M = 0.0200 moles / 1.00 L = X moles / 3.00 L

0.0600 moles/L = 0.0600 M

N 2 x 14.0 = 28.0

H 8 x 1.00 = 8.00 GMM = 68.0 g/mole

S 1 x 32.0 = 32.0

0.0600 moles x 68.0 g/mole = **4.08 g**

b) 250. ml of a 0.250 M solution of Potassium Sulfate [K2SO4]

0.250 M = 0.250 moles / 1.00 L = X moles / 0.250 L

0.0625 moles/L = 0.0625 M

K 2 x 39.0 = 78.0

S 1 x 32.0 = 32.0 GMM = 174 g/mole

O 4 x 16.0 = 64.0

0.0625 moles x 174 g/mole = **10.9 g**

4. Calculate the number of moles of solute in each solution

a) 3.00 liters of 4.00 M Hydrochloric Acid

4.00 M 🡪 4.00 moles / 1 L

4.00 moles / 1.00 L = X moles / 3.00 L = 12.0 moles

b) 100. ml of 0.500 M Hydrochloric Acid

0.500 M 🡪 0.500 moles / 1.00 L

0.500 moles / 1.00 L = X moles / 0.100 L = 0.0500 moles

5. A certain reaction requires 24.0 g of H2SO4. How many milliliters of a 3.0 M solution would be used?

H 2 x 1.00 = 2.00

S 1 x 32.0 = 32.0 GMM = 98.0 g/mole

O 4 x 16.0 = 64.0

24.0 g x 1mole/98.0 g = 0.240 moles

3.0 moles/1000 ml = 0.24 moles / X ml

X = 80. ml = 0.080 L

6. A mass of 98.0 g of Sulfuric Acid [H2SO4 (aq)] is dissolved in H2O to prepare a 0.50 M solution. What is the volume of this solution in liters?

H 2 x 1.00 = 2.00

S 1 x 32.0 = 32.0 GMM = 98.0 g/mole

O 4 x 16.0 = 64.0

98.0 g x 98.0 g/mole = 1.00 mole

0.50 moles/1.00 L = 1.00 mole / X L

X = 2.0 L

7. A solution of Hydrochloric Acid (HCl(aq)) is 0.300 M. What mass of acid is dissolved in 150. ml of solution?

0.300 M = 0.300 moles / 1.00 L = X moles / 0.150 L

0.0450 moles/L = 0.0450 M

H 1 x 1.00 = 1.00

Cl 1 x 35.5 = 35.5 GMM = 36.5 g/mole

0.0450 moles x 36.5 g/mole = **1.64 g**

8. What is the molarity of a solution of Magnesium Hydroxide [Mg(OH)2 (aq)] that contains 20.0 grams of solute in 325 ml of solution?

Mg 1 x 24.0 = 24.0

H 2 x 1.00 = 2.00 GMM = 58.0 g/mole

O 2 x 16.0 = 32.0

20.0 g x 1 mole /58.0 g = 0.345 moles

X moles / 1.0 L = 0.345 moles / 0.325 L

1.06 moles = **1.06 M**

9. Calculate how much of the original solution you would need to prepare dilute solutions of:

a) 40.0 ml of a 6.0 M HCl solution from 12.0 M HCl

M1V1 = M2V2

M1V1 = M2V2

V1 = M2V2 / M1

V1 = 6.0 M x 40.0 ml / 12.0 M

V = 20. ml

Add 20.0 ml of 12 M HCl to 20.0 ml of water to get a 40.0 ml solution of 6.0 M HCl

b) 12.0 ml of 0.50 M H2SO4 (aq) from 4.0 M H2SO4 (aq)

M1V1 = M2V2

V1 = M2V2 / M1

V1 = 0.50 M x 12.0 ml / 4.0 M

V = 1.5 ml

Add 1.5 ml of 4 M H2SO4 (aq) to 10.5 ml of water to get a 12.0 ml solution of 0.50 M H2SO4 (aq)

10. How many milliliters of a solution of 4.00 M KI are needed to prepare 250.0 mL of 0.760 M KI?

M1V1 = M2V2

250.0 mL x 1 L/1000 mL = 0.250 ml

M1V1 = M2V2

V1 = M2V2 / M1

V = 0.760 M x 0.250 L / 4.00 M

V = 0.0475 L = 47.5 ml

Add 47.5 ml of 4.00 M KI to 202.5 ml of water to get 250. mL of a 0.760 M of KI