Concentration expressions, dilution and mixing

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Q1

How many grams of NaCl and water are there in 80 g of 20% solution?

Q2

There are 12.04 ×10^{14} molecules of HCl in 100 µL of solution. The concentration of HCl is:

A. 2 µM

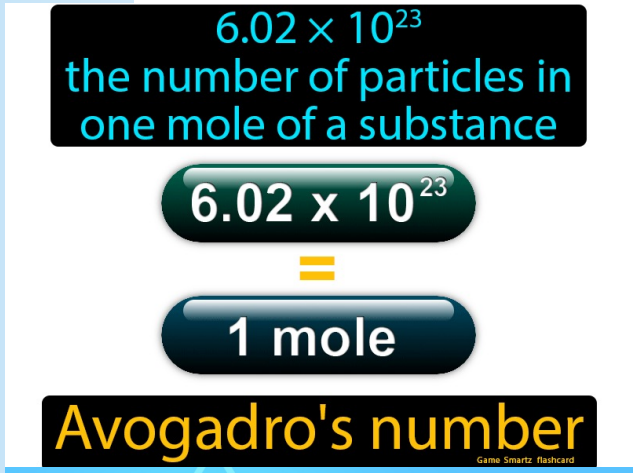
B. 20 µM

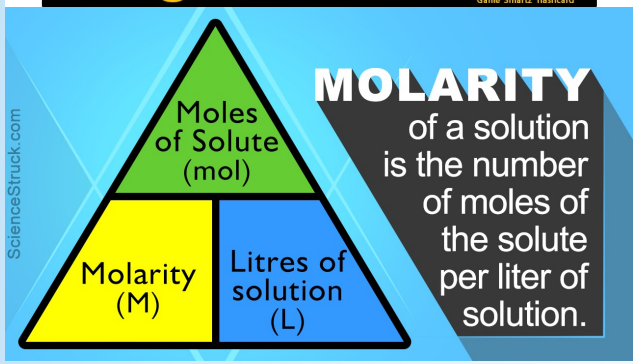
C. 2mM

D. 20 mM

E. 20 nM

Value	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f





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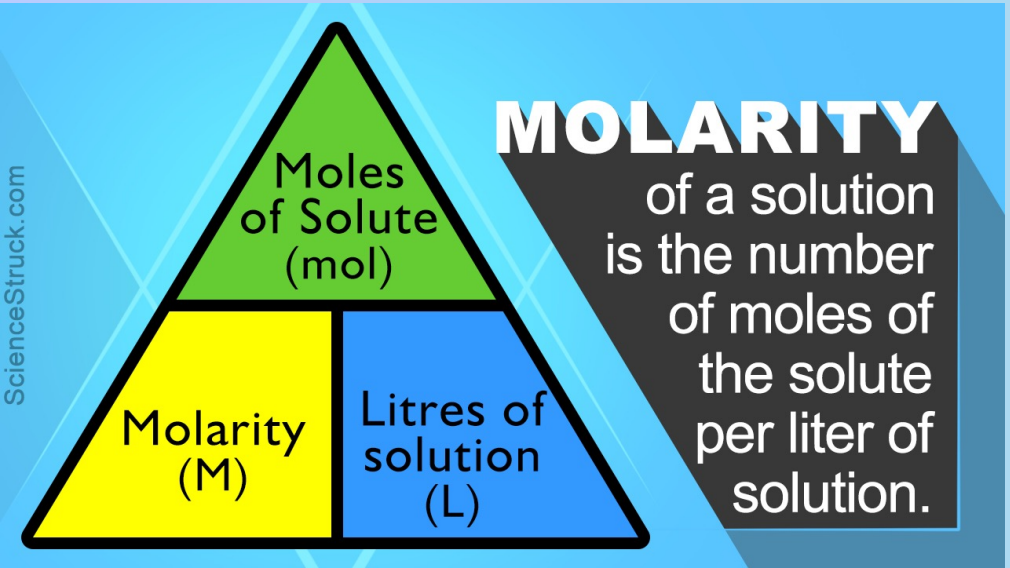
Q3

Calculate the molar concentration of acetic acid if 20mL of 0.05M NaOH was used for titration of 10 mL of acid sample.



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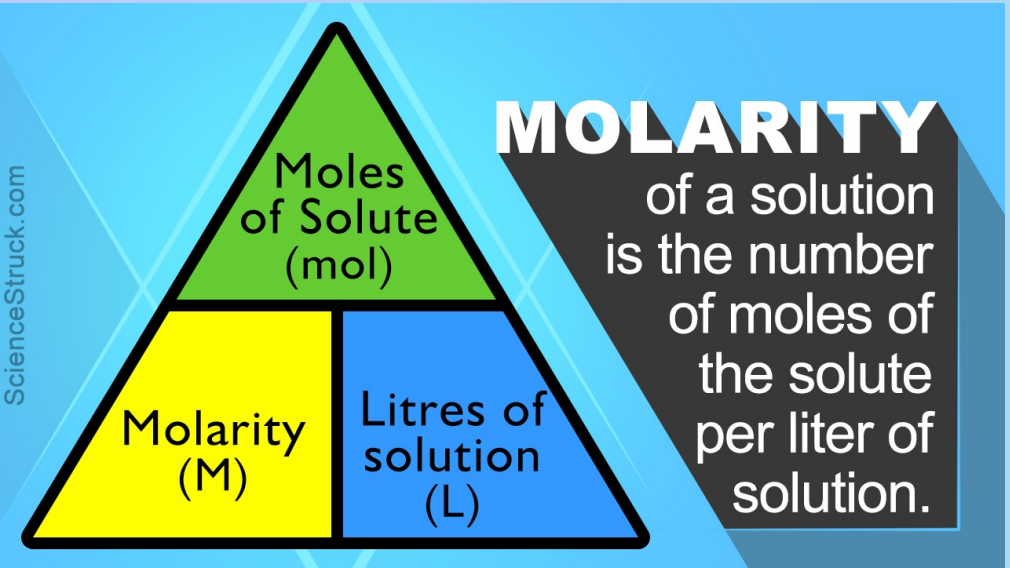
Q4

20 mL of 10^{-2} M NaOH was used for titration of 5 mL HCl sample.

What was the HCl concentration in the sample?



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Q5

How many mL of water should be added to 2 ml of 0.2 M solution to obtain 20 mM solution?

A. 1.8

B. 18

C. 20

D. 180

E. 200

The Dilution Equation

$$M_1V_1 = M_2V_2$$

M_1 = initial molarity ("stock solution")

V_1 = initial volume (Liters)

M_2 = final (desired) molarity

V_2 = final volume (Liters)

This equation is used when you have a "stock solution" of higher molarity than you need and you need to dilute it to a lower molarity by adding additional solvent.

Q6

How many grams of KCl should be dissolved in 50g of water to obtain 5% solution?

Q7

KCl solution contains 2 mg of this compound in 1ml of solution (d =1g/ml)

Calculate the % concentration.

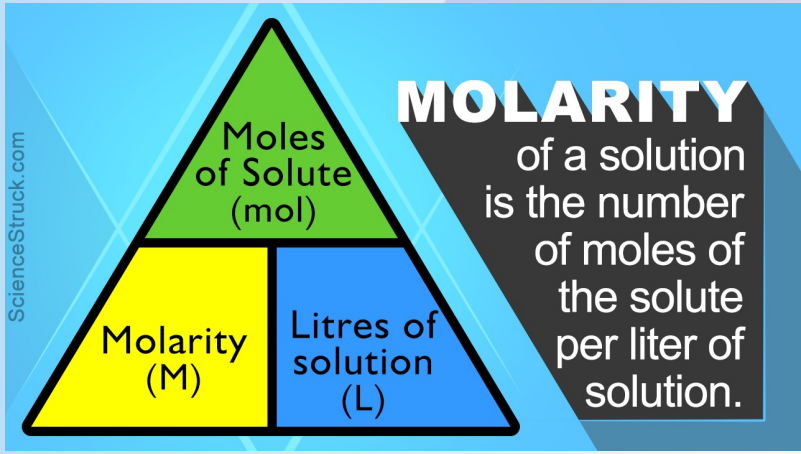
Q8

Water solution contains 40 mg of NaOH in 100 g of the solution.

(d=1g/mL)

Molar mass of NaOH is 40g/mol.

Molar and % concentrations are respectively:



A. 0.01M and 0.04%

B. 0.1M and 0.1%

C. 0.01M and 0.4%

D. 1mM and 0.04%

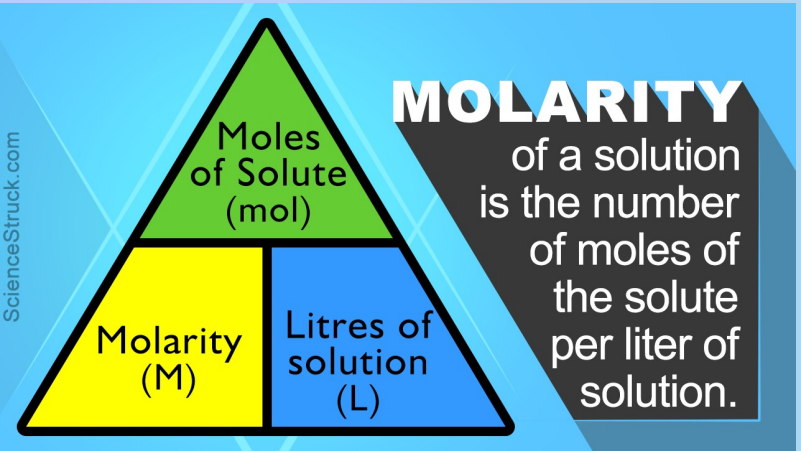
E. 0.1 M and 0.4%

Q9

Calculate molar (M), millimolar (mM) and micromolar (µM) concentration if HCl solution contains 3.65 mg in 1 mL.

M HCl = 36.5g/mol

Value	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f



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Q10

When 0.25 mole of an anesthetic is dissolved in 500mL of an injectable water the concentration of the final solution is:

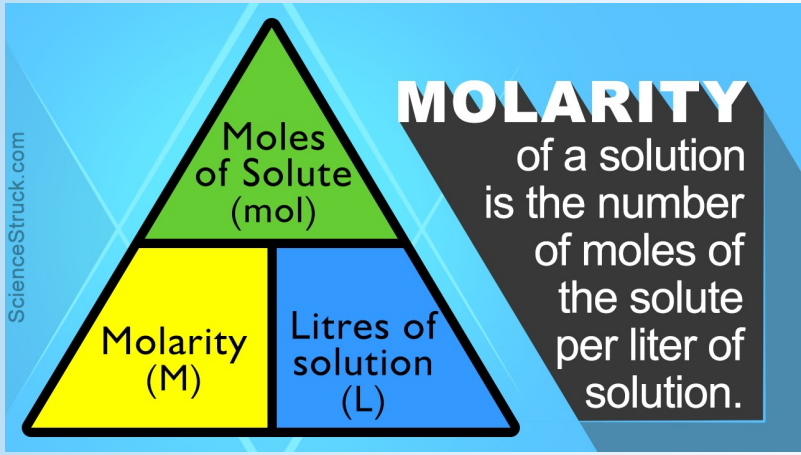
A. 0.5M

B. 0.25 M

C. 1M

D. 2M

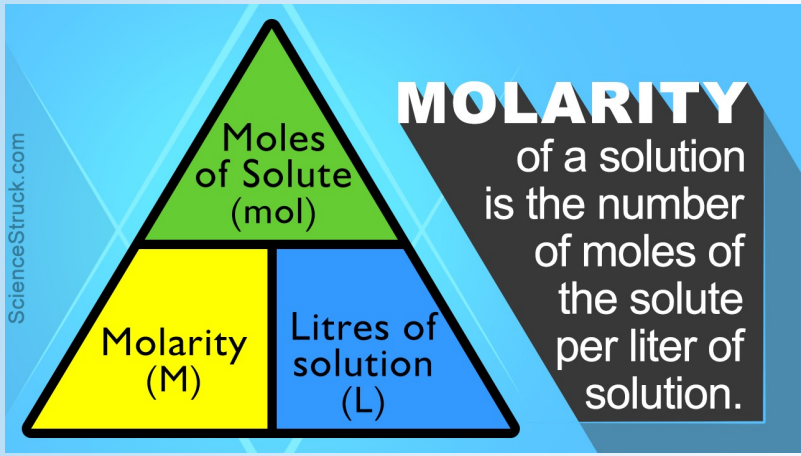
E. 4M



Q11

How many moles of NaCl is in 100 µL of 1 mM NaCl solution:
(1 L = 10^6 µL)

A. 1 mmol
B. 10^{-3} mol
C. 10^{-2} mmol
D. 10^{-7} mol
E. 10^{-3} mmol



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Q12

How many mL of water should be added to 20 mL of 0.2M solution to obtain 0.01M solution?

(d=1g/mL)

The Dilution Equation

$$M_1V_1 = M_2V_2$$

M_1 = initial molarity ("stock solution")

V_1 = initial volume (Liters)

M_2 = final (desired) molarity

V_2 = final volume (Liters)

This equation is used when you have a "stock solution" of higher molarity than you need and you need to dilute it to a lower molarity by adding additional solvent.

Q13

How many grams of 1% solution(A) and 0.1% solution (B) should be mixed to obtain 180 g of 0.5% solution (C)?

Q14

How many mL of 0.09M solution (A) and 0.01M solution (B) should be mixed to obtain 100 mL of 0.02M solution (C)?

Q15

Solution A was diluted 5 times with water.

Then 20μL of the resulting solution B was mixed with 0.48 mL of water (solution C)

and finally 200μL of solution C was introduced to the volumetric flask of the nominal volume 10 mL.

The flask was filled with water and the molarity of the solution in the flask was assayed 1μM.

Calculate the initial molarity of solution A.

Q16

100 mL of 2mM KOH solution was mixed with 400 ml of 1 mM HCl solution.

Calculate molar concentrations (M) of all compounds in the reaction mixture.

(d=1 g/mL)

Q17

In the iron (III) sulfate (VI) solution the concentration of sulfate anions is 3 mM. The salt concentration is:

A. 3 mM

B. 0.3 mM

C. 1 mM

D. 0.1 mM

E. 10 mM

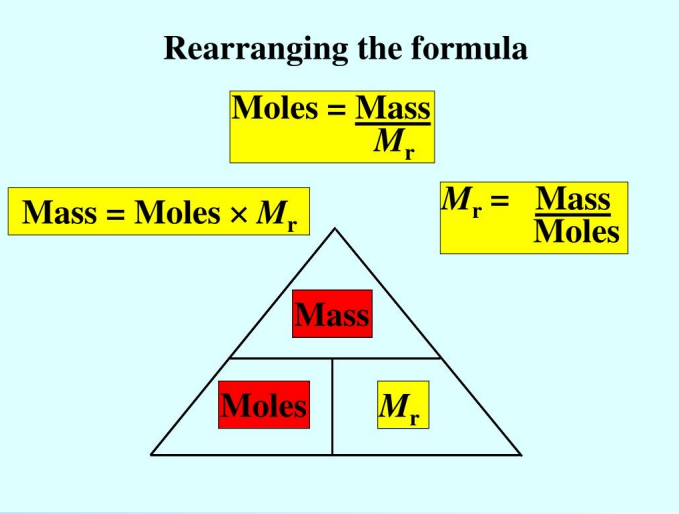
Q18

When hard water is heated, Ca^{2+} ions react with bicarbonate ions to form insoluble calcium carbonate $CaCO_3$.

The reaction allows to soften the water:
$Ca^{2+}(aq) + 2HCO_3^-(aq) \rightarrow CaCO_3(s) + H_2O(aq) + CO_2(g)$

What is the mass of $CaCO_3$ in the reaction if 2 moles of CO_2 are produced?
(*M* CaCO3 = 100g/mol)

A. 100g
B. 200g
C. 44.8g
D. 22.4g
E. 400g



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Q19

How many grams of CO_2 is produced in the reaction of decomposition of 50 g of $CaCO_3$?

$CaCO_3 \rightarrow CaO + CO_2$

M $CaCO_3$ = 100g/mol

M CO_2 = 44g/ mol

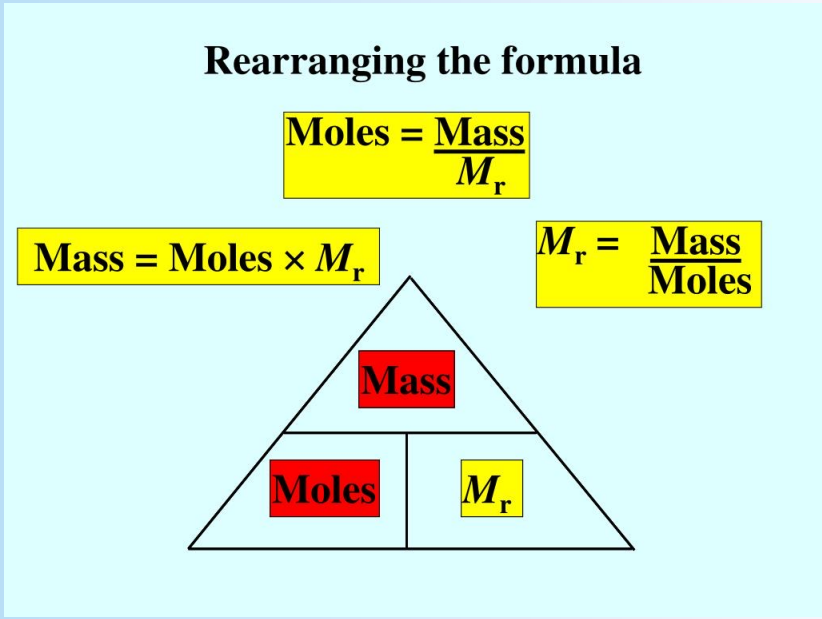
A. 44g

B. 88g

C. 22g

D. 11g

E. 100g



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Q20

The percentage concentration of any solution is commonly expressed as mass percent.

What is the H_2SO_4 % concentration if 2% of all molecules in the water solution are H_2SO_4?

(Atomic masses of H, S and O are 1.0, 32.0 and 16.0(g/mol) respectively)

A. 1.0

B. 1.1

C. 10.0

D. 11.1

E. 2.0