AL-Mustaqbal university college
Pharmacy department

Principles of pharmacy practice

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Fundamentals of pharmaceutical calculations
Lec.1

Objectives

Upon successful completion of this chapter, the student will be able to:

- Convert common fractions, decimal fractions, and percentages to their corresponding equivalent expressions and apply each in calculations.
- Utilize exponential notations in calculations.
- Apply the method of ratio and proportion in problem-solving.
- Apply the method of dimensional analysis in problem-solving.
- Demonstrate an understanding of significant figures

Numbers &Numerals:

A number is a total quantity ,or amount, of units.

A numeral is a word or sign ,or a group of words or signs, ,expressing a number e.g 3,6,48 are Arabic numerals i:e 3times ,6times ,&48times the unit1.

Kinds of numbers

In arithmetic, the science of calculating with positive (real number) a number is usually

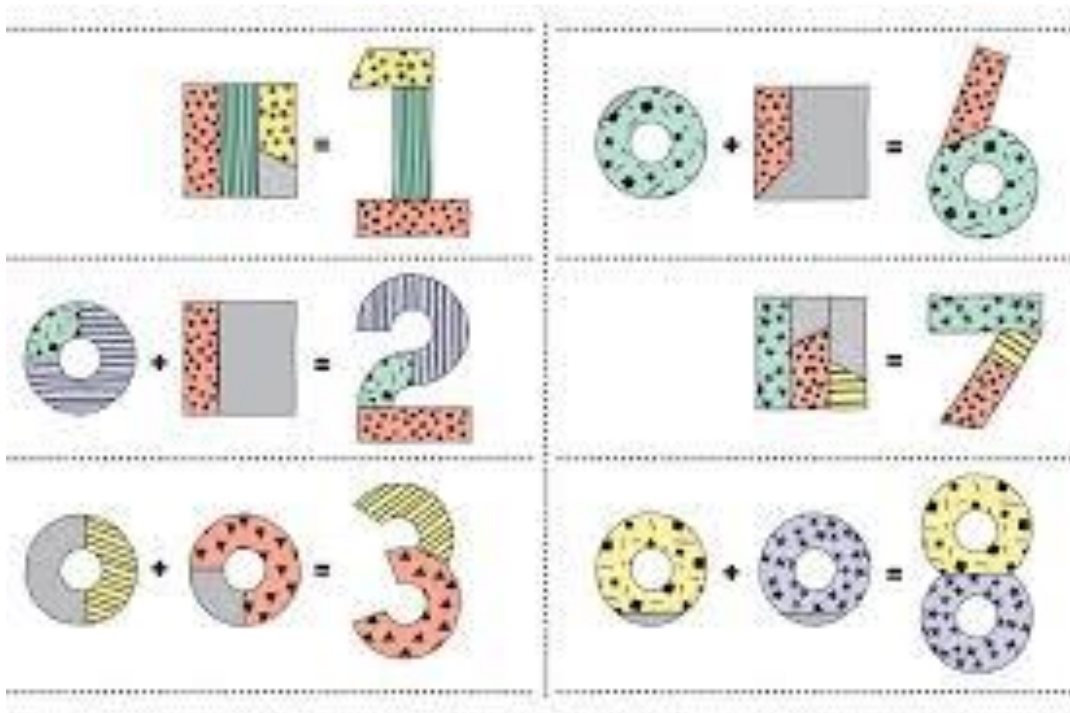
A natural or whole number such as 564.

A fraction or subdivision of a whole number such as 4/7 .

A mixed number, consisting of a whole number plus a fraction, such as 37/8 ,12ounces÷3=4ounces

A number such as 3,6,7,called an abstract or pure number ,if a number that designates a quantity of objects or units of measure ,such as 4gm ,8ml ,12ounces is called a concrete or denominate number, example

10gm +5gm =15gm
10ml --5ml = 5ml
300mg x2=600mg
12ounces÷3=4ounces



Arabic numerals

Arabic system of notation is properly called a decimal system .with only 10 figures a zero &nine digits (1,2,3,4,5,6,7,8,9) example

5,083.623

5,000.000 or 5thousands

+000.000plus 0hundreds

+080.000 plus 8tens

+003.000plus 3onesns

+ooo.600plus 6 tenths

+000.020plus 2hundredths

+000.003 plus 3 thousandths

Roman numerals

The roman system of notation expresses a fairly large range of numbers by the use of a few letters of the alphabet in a simple "positional" notation indicating adding to or subtracting from a subtracting from a succession of bases extending from 1 through 5,10,50,100 &500 to 1000.Roman numerals merely record quantities ;they are of no use in computation.

To express quantities in the roman system ,eight letters of fixed values are used (there is no letter for the value zero);

ss	= 1/2
1 or I	=1
V or v	=5
X or x	=10
L or l	=50

C or c	=100
D or d	= 500
M or m	= 1000

Other quantities are expressed by combining these letters .There are four general rules for reading roman numerals.

1-A letter repeated once or more repeats its value (e.g.,XX =20; XXX = 30) .

2-One or more letters placed after a letter of greater value increases the value of the greater letter (e.g., VI =6 ;XII =12 ;LX =60)

3- A letter placed before a letter of greater value decreases the value of the greater letter(e.g. IV =4 ; XL =40 ; CM =900).

4- A bar placed above a letter or letters increases the value by 1000times (e.g. XV =15 , but $\overline{\text{XV}}$ =15,000)

Examples:

ii = 2	xxx = 30	cxi = 111	lxxxviii = 88
iii = 3	xiii = 13	dl = 550	xciv = 94
iv = 4	xiv =14	mv =1005	cdxliv =444
vii =7	xviii =18	cd = 400	cdxc =490
ix = 9	ci =101	cm =900	mcdxcii = 1492

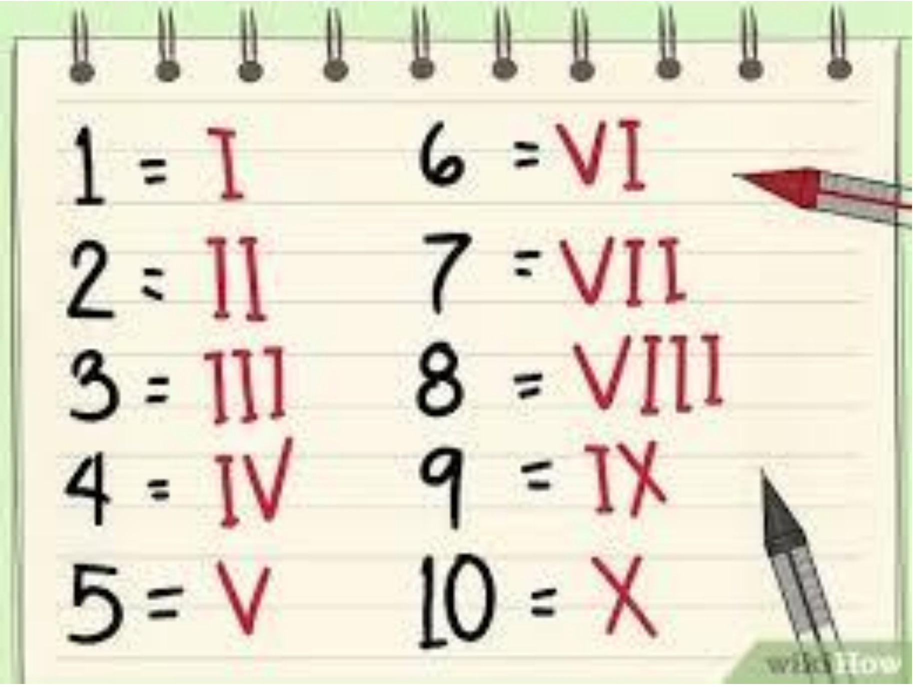
Greek numerals

α	β	γ	δ	ϵ
`\alpha`	`\beta`	`\gamma`	`\delta`	`\epsilon`

κ	σ
`\kappa`	`\sigma`

Roman numerals are used in pharmacy only occasionally on prescriptions :

1. To designate the number of dosage units prescribed (e.g. capsules no. C).
2. To indicate the quantity of medication to be administered (e.g. teaspoonfuls ii), and
3. in rare instances in which the common or apothecaries system of measurement are used (e.g. grains iv).



Common and decimal fractions:

Common fractions are portions of a whole, expressed at 1/3, 7/8, and so forth. They are used only rarely in pharmacy calculations nowadays. It is recalled, that when adding or subtracting fractions, the use of a common denominator is required. The process of multiplying and dividing with fractions is recalled by the following **example1**

If the adult dose of a medication is 2 teaspoonful (tsp.), calculate the dose for a child if it is 1/4 of the adult dose.

$$\frac{1}{4} \text{x} \frac{2tsp}{1} = \frac{2}{4} = \frac{1}{2} \textbf{ tsp.}$$

answer

example2

If a child's dose of a cough syrup is 3⁄4 teaspoonful and represents 1⁄4 of the adult dose, calculate the corresponding adult dose.

$\frac{3}{4}$tsp. $\div \frac{1}{4}$ **=** $\frac{3}{4}$tsp.$\times \frac{4}{1}$ **=** $\frac{3\times4}{4\times1}$ tsp.=$\frac{12}{4}$tsp=3tsp. answer

Note :When common fractions appear in a calculations problem, it is often best to Convert them to decimal fractions before solving.

Decimal fraction is a fraction with a denominator of 10 or any power of 10 and is expressed decimally rather than as a common fraction. Thus,$\frac{1}{10}$ is expressed as 0.1 and $\frac{45}{100}$ as 0.45

It is important to include the zero before the decimal point. This draws attention to the decimal point and helps eliminate potential errors. Decimal fractions often are used in pharmaceutical calculations.

To convert a common fraction to a decimal fraction, divide the denominator into the numerator.

Thus, $\frac{1}{8} = 1 \div 8 = 0.125$

To convert a decimal fraction to a common fraction, express the decimal fraction as a ratio and reduce.

Thus, $0.25 = \frac{25}{100} = \frac{1}{4}$

Percent:

The term **percent** and its corresponding sign, %, mean ‘‘in a hundred.’’ So, 50 percent (50%) means 50 parts in each one hundred of the same item. Common fractions may be converted to percent by dividing the numerator by the denominator and multiplying by 100.

Example1:

Convert $\frac{3}{8}$ to percent.

$\frac{3}{8}$ x 100 = 37.5%, answer.

Decimal fractions may be converted to percent by multiplying by 100.

Example2:

Convert 0.125 to percent.

0.125 x 100 = 12.5%, answ

Exponential notation

Many physical and chemical measurements deal with either very large or very small numbers. Because it often is difficult to handle numbers of such magnitude in performing even the simplest arithmetic operations, it is best to use exponential notation or powers of 10 to express them. Thus, we may express 121 as 1.21×10^2, 1210 as 1.21×10^3, and 1,210,000 as 1.21×10^6. Likewise, we may express 0.0121 as $1.21 \times 10^{---2}$, 0.00121 as $1.21 \times 10^{--3}$, and 0.00000121 as $1.21 \times 10^{--6}$

When numbers are written in this manner, the first part is called the **coefficient**, customarily written with one figure to the left of the decimal point. The second part is the **exponential factor** or power of 10

- **The exponent** represents the number of places that the decimal point has been moved—positive to the left and negative to the right—to form the exponential. Thus, when we convert19,000 to 1.9 $x10^4$, we move the decimal point 4 places to the left; hence the exponent 4. And when we convert 0.0000019 to 1.9 $x10^{-6}$, we move the decimal point 6 places to the right; hence the negative exponent $^{-6}$.
- In the multiplication of exponentials, the exponents are added. **For example**, $10^2 \times 10^4 = 10^6$. In the multiplication of numbers that are expressed in exponential form, the coefficients are multiplied in the usual manner, and then this product is multiplied by the power of 10 found by algebraically adding the exponents

Examples:

$(2.5 \times 10^{2}) \times (2.5 \times 10^{4}) = 6.25 \times 10^{6}$, or 6.3×10^{6}

$(2.5 \times 10^{2}) \times (2.5 \times 10^{-4}) = 6.25 \times 10^{-2}$, or 6.3×10^{-2}

$(5.4 \times 10^{2}) \times (4.5 \times 10^{3}) = 24.3 \times 10^{5} = 2.4 \times 10^{6}$

- In the division of exponentials, the exponents are subtracted. for example, $10^{2} \div 10^{5} = 10^{-3}$. In the division of numbers that are expressed in exponential form, the coefficients are divided in the usual way, and the result is multiplied by the power of 10 found by algebraically subtracting the exponents

  $(7.5 \times 10^{5}) \div (2.5 \times 10^{3}) = 3.0 \times 10^{2}$

  $(7.5 \times 10^{-4}) \div (2.5 \times 10^{-6}) = 3.0 \times 10^{-10}$

  $(2.8 \times 10^{-2}) \div (8.0 \times 10^{-6}) = 0.35 \times 10^{4} = 3.5 \times 10^{3}$.

Thank You!