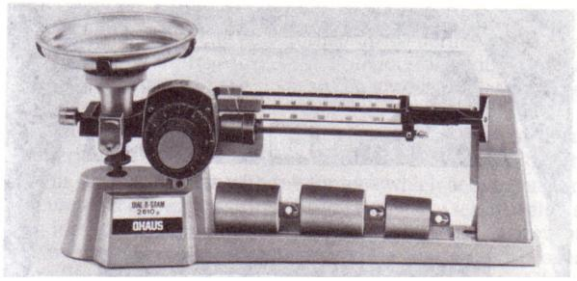
I. Weights and Measures:

a. Weighing System:
   i. Imperial System:
      1. Avoirdupois System
      2. Apothecaries System
   ii. Metric System
   iii. Arabic System

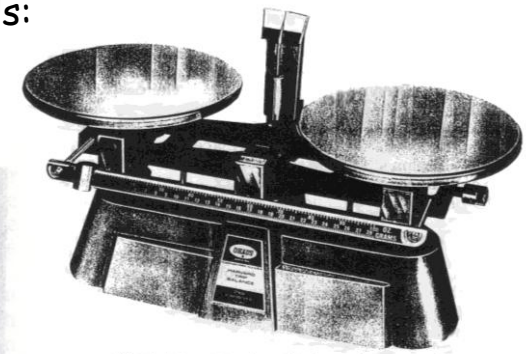
b. Measuring System:
   i. Imperial System:
      1. Avoirdupois System
      2. Apothecaries System
   ii. Metric System
   iii. Housing System

1 Lab. Tools:

- Weighing tools: (Balance)
- Measuring tools:

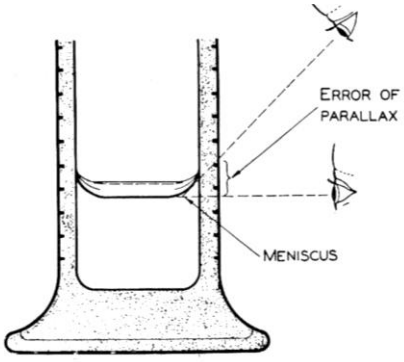


Manufacturing laboratory scale and weights

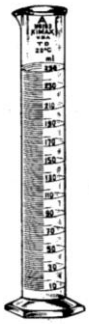


Single-beam equal-arm balance (courtesy, Ohaus).

Metric and apothecary weight set (courtesy, Troem

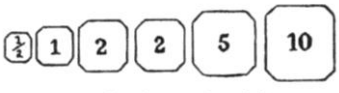


Error of measurement due to parallax.

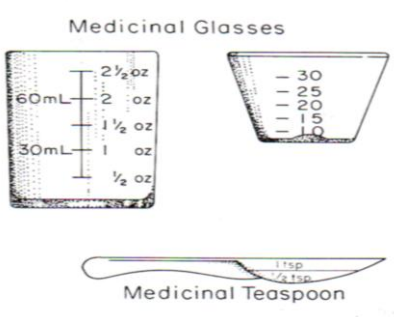


Glass cylindrical graduate (courtesy, Kimble Glas

Fig 6. Aluminum wire weights.



Aluminum grain weights.



(a) Imperial System

Imperial system is divided into two systems :

(i) Avoirdupois system
(ii) Apothecaries system.

Avoirdupois system

According to this system the standard unit for weighing is pound and all other measures of mass are derived from pound. It is represented by lb.

1 lb	= 16 oz (Avoir)	
1 lb	= 7000 grains	
1 oz	= 7000/16	= 437.5 grains

Apothecaries system

It is known as troy system. The standard weight in this system is grain.

20 grain	= 1 scruple	
60 grain	= 1 drachm	
480 grain	= 1 ounce (Apothe)	
8 drachm	= 1 ounce (Apothe)	
12 ounces (Apothe)	= 1 pound (Apothe)	
5760 grain	= 1 pound (Apothe)	

Abbreviations commonly used in weighing

Latin name	*Symbol*	*English name*	*Equal to*
Granum	gr	grain	1 grain
Scrupulus	℈	scruple	20 grains
Drachma	ʒ	drachm	60 grains
Uncia	oz	ounce (Avoir)	437.5 grains
Uncia	℥	ounce (Apothe)	480 grains
Libra	lb	pound (Avoir)	7000 grains
Libra	lb	pound (Apothe)	5760 grains

Measures of Capacity

Standard units for capacity are same in avoirdupois as well as apothecaries system. The standard unit is gallon and all other measures of capacity are derived from gallon.

1 gallon	= 160 fluid ounces	
1/4th of a gallon	= 1 quart	= 40 fl. ounce
1/8th of gallon	= 1 pint	= 20 fl. ounce
1/160th of a gallon	= 1 fl. ounce	
1/8th of one fl. ounce	= 1 fl. drachm	
1/60th of one fl. drachm	= 1 minim	
1 fluid ounce	= 480 minim	
1 fluid drachm	= 480/8	= 60 minim

Abbreviations commonly used in measures of capacity

Latin name	*Symbol*	*English name*	*Equal to*
Minimum	m	minim	1 minim
Fluidrachma	ʒ	fl. drachm	60 minim
Fluidunicia	℥	fl. ounce	480 minim
Octarius	O	pint	20 fl. ounces
Congius	C	gallon	160 fl. ounces

Metric System

Standard unit of measures of mass (weight) is kilogram and all other measures of mass are derived from kilogram.

1 Kilogram (kg)	= 1000 gm	
1 Hectogram (hg)	= 100 gm	
1 Decagram (dag)	= 10 gm	
1 Gram (gm)	= 1 gm	
1 Decigram (dg)	= 0.1 gm	= 100 mg
1 Centigram (cg)	= 0.01 gm	= 10 mg
1 Milligram (mg)	= 0.001 gm	= 1 mg
1 Microgram (µg, mcg)	= 1/1000 mg	

Measures of Capacity

Standard unit for measures of capacity (volume) is litre and all other measures of capacity are derived from litre.

1 litre (lt) = 1000 millilitre (ml)

Domestic Measures

1 drop	= 1 minim	= 0.06 ml
1 tea spoonful	= 1 fl. drachm	= 4 ml
1 desert spoonful	= 2 fl. drachm	= 8 ml
1 table spoonful	= 4 fl. drachm	= 15 ml
2 table spoonful	= 1 fl. ounce	= 30 ml
1 wine glassful	= 2 fl. ounce	= 60 ml
1 tea cupful	= 4 fl. ounce	= 120 ml
1 tumblerful	= 8 fl. ounce	= 240 ml

Conversion Factors

1 grain	= 64.8 mg	= 65 mg	(for all practical purposes)
1 drop	= 1 minim	= 0.06 ml	(for all practical purposes)
1 fl. ounce	= 29.57 ml	= 30 ml	(for all practical purposes)
1 gram	= 15.43 gr	= 15 gr	(for all practical purposes)
1 milligram	= 1/65 gr	= 1/65 gr	(for all practical purposes)
1 millilitre	= 16.23 minim	= 15 m	(for all practical purposes)
1 litre	= 33.8 fl. ounce		
1 kilogram	= 2.2 pound		

– الأوزان العربية :

الدرهم	=	١٦	قيراط	=	٣,١	غم
المثقال	=	٢٤	قيراط	=	٤,٩	غم
الأوقية	=	٦٦٢/٣	درهم	=	٢١٢,٦٧	غم
الأقة	=	٤٠٠	درهم	=	١٢٨٢	غم
الرطل	=	٢	أقة	=	٢٥٦٤	غم
٣٩ رطل	=	٧٨	أقة	=	١٠٠	كغم
القنطار	=	١٠٠	رطل	=	٢٥٦,٤	كغم

- المكاييل المنزلية:

يشيع استعمال هذه المكاييل في تناول الأدوية، وحجمها على وجه التقريب هو:

ملعقة صغيرة (شاي)	Teaspoonful	=	٥	مل
ملعقة متوسطة (حلو)	Dessertspoonful	=	٨	مل
ملعقة كبيرة (طعام)	Tablespoonful	=	١٥	مل
فنجان شاي	Teacupful	=	١٢٠	مل
كأس ماء	Tumblerful	=	٢٤٠	مل

ولما كانت هذه القياسات تقريبية، ونسبة الخطأ فيها عالية، بالنظر لاختلاف حجم الأداه من صانع لآخر، فان من المفضل ان يستعمل الصيدلي ادوات خاصة لهذه الغاية، الا انه يلاحظ ان مصانع الأدوية اصبحت اخيرا تزود ادويتها السائلة بالأداه اللازمة لقياس الجرعة.

Practical Part

- Weight:
  2.25 gm of NaCl, ZnO and $NaHCO_3$
- Measuring:
  5 ml, 20.5 ml and 50 ml of H_2O (water)
  - Tray on other solution (e.g. alcohol and paraffin)

II. Calculations:

- If 1 tab. of *Aspirin®* contain 300 mg
  How many **gm** should be contained 30 tablets?

- **Percentage (%)**
  - Percentage concentration:
    1. weight -in- volume (w/v) ⇨ no. gm in 100 ml
    2. volume -in- volume (v/v) ⇨ no. ml in 100 ml
    3. weight -in- weight (w/w) ⇨ no. gm in 100 gm

  - How many gram of dextrose are required to prepare 4L of 5% solution?

℞

Gentian Violet Solution 25%
H_2O to 240 ml

- **Ratio**

  e.g. 1:1000

  For solids in liquids = 1 g of solute or constituent in 1000 ml of solution or liquid preparation.
  For liquids in liquids = 1 ml of constituent in 1000 ml of solution or liquid preparation.
  For solids in solids = 1 g of constituent in 1000 g of mixture.

℞

Potassium permanganate *1:8000*
H_2O to *100ml*

Practical Part

- Prepare 15 ml of *Potassium permanganate* 1.25%
- Prepare 15 ml of *Potassium permanganate* *1:80*