Types of Balances and Scales, Common Terms, and Care

The history of balances and scales dates back to Ancient Egypt. A simplistic equal-arm balance on a fulcrum that compared two masses was the standard. Today, scales are much more complicated and have a multitude of uses. Applications range from laboratories weighing of chemicals to weighing of packages for shipping purposes.

To fully understand how types of balances and scales operate, there must be an understanding of the difference between mass and weight.

What Is Mass?

Mass is a constant unit of the amount of matter an object possesses. It stays the same no matter where the measurement is taken. The most common units for mass are the kilogram and gram.

What Is Weight?

Weight is the heaviness of an item. It is dependent on the gravity on the item multiplied by the mass, which is constant. The weight of an object on the top of a mountain will be less than the weight of the same object at the bottom due to gravity variations. A unit of measurement for weight is the newton. A newton takes into account the mass of an object and the relative gravity and gives the total force, which is weight.

Although mass and weight are two different entities, the process of determining both weight and mass is called weighing.

Balance and Scale Terms

Accuracy The ability of a scale to provide a result that is as close as possible to the actual value. The best modern balances have an accuracy of better than one part in 100 million when one-kilogram masses are compared.

Calibration The comparison between the output of a scale or balance against a standard value. Usually done with a standard known weight and adjusted so the instrument gives a reading in agreement.

Capacity The heaviest load that can be measured on the instrument.

Precision Amount of agreement between repeated measurements of the same quantity; also known as repeatability. Note: A scale can be extremely precise but not necessarily be accurate.

Readability This is the smallest division at which the scale or balance can be read. It can vary as much as 0.1g to 0.0000001g. Readability designates the number of places after the decimal point that the scale can be read.

Tare The act of removing a known weight of an object, usually the weighing container, to zero a scale. This means that the final reading will be of the material to be weighed and will not reflect the weight of the container. Most balances allow taring to 100% of capacity.

Types of Balances and Scales

Analytical Balance These are most often found in a laboratory or places where extreme sensitivity is needed for the weighing of items. Analytical balances measure mass. Chemical analysis is always based upon mass so the results are not based on gravity at a specific location, which would affect the weight. Generally capacity for an analytical balance ranges from 1 g to a few kilograms with precision and accuracy often exceeding one part in 106 at full capacity. There are several important parts to an analytical balance. A beam arrest is a mechanical device that prevents damage to the delicate internal devices when objects are being placed or removed from the pan. The pan is the area on a balance where an object is placed to be weighed. Leveling feet are adjustable legs that allow the balance to be brought to the reference position. The reference position is determined by the spirit level, leveling bubble, or plumb bob that is an integral part of the balance. Analytical balances are so sensitive that even air currents can affect the measurement. To protect against this they must be covered by a draft shield. This is a plastic or glass enclosure with doors that allows access to the pan.

Equal Arm Balance/Trip Balance This is the modern version of the ancient Egyptian scales. This type of laboratory scale incorporates two pans on opposite sides of a lever. It can be used in two different ways. The object to be weighed can be placed on one side and standard weights are added to the other pan until the pans are balanced. The sum of the standard weights equals the mass of the object. Another application for the scale is to place two items on each scale and adjust one side until both pans are leveled. This is convenient in applications such as balancing tubes or centrifugation where two objects must be the exact same weight.

Platform Scale This type of scale uses a system of multiplying levers. It allows a heavy object to be placed on a load bearing platform. The weight is then transmitted to a beam that can be balanced by moving a counterpoise, which is an element of the scale that counterbalances the weight on the platform. This form of scale is used for applications such as the weighing of drums or even the weighing of animals in a veterinary office.

Spring Balance This type of balance utilizes Hooke's Law which states that the stress in the spring is proportional to the strain. Spring balances consist of a highly elastic helical spring of hard steel suspended from a fixed point. The weighing pan is attached at the lowest point of the spring. An indicator shows the weight measurement and no manual adjustment of weights is necessary. An example of this type of balance would be the scale used in a grocery store to weigh produce.

Top-Loading Balance This is another balance used primarily in a laboratory setting. They usually can measure objects weighing around 150–5000 g. They offer less readability than an analytical balance, but allow measurements to be made quickly thus making it a more convenient choice when exact measurements are not needed. Top-loaders are also more economical than analytical balances. Modern top-loading balances are electric and give a digital readout in seconds.

Torsion Balance Measurements are based on the amount of twisting of a wire or fiber. Many microbalances and ultra-microbalances, that weigh fractional gram values, are torsion balances. A common fiber type is quartz crystal.

Triple-Beam Balance This type of laboratory balance is less sensitive than a top-loading balance. They are often used in a classroom situation because of ease of use, durability and cost. They are called triple-beam balances because they have three decades of weights that slide along individually calibrated scales. The three decades are usually in graduations of 100g, 10g and 1g. These scales offer much less readability but are adequate for many weighing applications.

Balance and Scale Care and Use

A balance has special use and care procedures just like other measuring equipment. Items to be measured should be at room temperature before weighing. A hot item will give a reading less than the actual weight due to convection currents that make the item more buoyant. And, if your balance is enclosed, warm air in the case weighs less than air of the same volume at room temperature.

Another important part of using a balance is cleaning. Laboratory scales are exposed to many chemicals that can react with the metal in the pan and corrode the surface. This will affect the accuracy of the scale.

Also, keep in mind that a potentially dangerous situation could occur if a dusting of chemicals is left on the lab balance pan. In many lab and classroom situations, more than one person uses a single scale for weighing. It would be impossible for each person to know what everyone else has been weighing. There is a chance that incompatible chemicals could be brought into contact if left standing or that someone could be exposed to a dangerous chemical that has not been cleaned from the balance. To avoid damaging the scale or putting others in danger, the balance should be kept extremely clean. A camel's hair brush can be used to remove any dust that can spill over during weighing.

Calibration is another care issue when it comes to scales. A scale cannot be accurate indefinitely; they must be rechecked for accuracy. There are weight sets available that allow users to calibrate the scale themselves or the scales can be calibrated by hiring a professional to calibrate them on site.

The correct weight set needs to be chosen when calibrating a scale. The classes of weight sets start from a Class One which provides the greatest precision, then to Class Two, Three, Four and F and finally go down to a Class M, which is for weights of average precision. Weight sets have class tolerance factors, and as a general rule, the tolerance factor should be greater than the readability of the scale.

WHAT ARE BALANCES?

A BALANCE is a measuring device/instrument used to measure the mass of an object.

A *Scale*, on the other hand, is device/instrument used to measure the weight of an object

PURPOSE OF THE MODULE

The purpose of this module is to review the proper technique on the use, handling and maintenance of the laboratory analytical and microbalance in a pharmaceutical setting.

WHY?

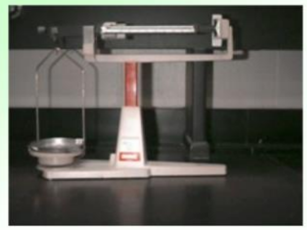
The use of the laboratory balance may determine the acceptability of a product or the outcome of the result.

Weighing is a common source of error that can be very difficult to detect in the final analyses of the results.

TYPES OF BALANCES

Beam Balance: This type of balance uses a comparison technique in the form of a beam from which a weighing pan and scale pan are suspended. The object to be weighed is placed on the measuring pan, and standard weights are added to the scale pan until the beam is in equilibrium.

***Example**: Four-beam and triple-beam balances*



TYPES OF BALANCES

Analytical Balance: This type of instrument is used to measure mass to a very high degree of precision. The weighing pan(s) of a high accuracy analytical balance are inside a see-through enclosure with doors so that dust does not collect and so any air currents in the room do not affect the delicate balance.

Types of Analytical Balance

- *Two-Pan Analytical Balance*: These balances consist of a symmetrical beam and three knife-edges. The two terminal knives support the pans and a central knife-edge acts as a pivot about which the beam swings.

Types of Analytical Balances

• *Single-Pan Mechanical Balance:* These generally consist of a beam with two knife-edges, one to support the weighing pan and the other acting as a pivot. A fixed counterweight balances the load on the pan. The displays on these balances tend to be of the optical variety and the user can usually adjust the sensitivity of the balance.

Types of Analytical Balances

• *Electronic Single-Pan Balance*: These are usually top loading balances with the applied load being measured by an electromagnetic force compensation unit or a strain gauged load cell. The mass of the load is proportional to the current needed to balance it. Single-pan electronic balances give a direct reading of the mass applied whereas the other two types of analytical balance rely on the comparison of two forces (an unknown weight with either an external or internal weight).

Types of Analytical Balances

Microbalance: This type of analytical balance is capable of measuring samples to at least 1 million parts of a gram Microbalances are used to accurately measure small amounts of a sample.

The more sensitive quartz crystal microbalance (QCM) measures mass by measuring the change in frequency of a piezoelectric quartz crystal when it is disturbed by the addition of a small mass such as a virus or any other tiny object intended to be measured

DEFINITION OF TERMS

MASS: the property of a physical object that quantifies the amount of matter and energy it is equivalent to.

WEIGHT: a term of measurement referring to either an object's mass or to the gravitational force acting on the object. In the physical sciences, it is often narrowly defined as referring only to the force due to gravity, while in everyday discourse, it is often used synonymously with mass.

TARE: the mass of an empty vessel

SENSITIVITY: refers to the smallest increment of mass that can be measured.

TOLERANCE: refers to allowable deviations for laboratory weights and balances.

INTERNAL CALIBRATION WEIGHTS : designed by manufacturers to enable the automatic loading and unloading of the weights. The manufacturers store the accurate mass of these weight(s) within the balance memory.

EXTERNAL CALIBRATION WEIGHTS : set of weights manufactured from austenitic (non-magnetic) stainless steel, with a hollow center into which small stainless steel ball bearings can be added or removed to set the tolerance.

DEFINITION OF TERMS

CHECK WEIGHTS: these are weights used to check the performance of balances but which would preclude the use of calibrated weight sets, e.g. the balance may be used for check weighing in a clean room of a sterile manufacturing facility.

NIST: National Institute of Standards and Technology. Founded in 1901, NIST is a non-regulatory federal agency within the U.S. Commerce Department's Technology Administration. NIST's mission is to develop and promote measurements, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life.

"AS FOUND" CALIBRATION DATA: Calibration measurements are taken with NIST traceable standards prior to any adjustments being made to a piece of equipment. This "as found" data indicates whether the equipment being calibrated was within tolerances during the time between calibrations.

"AS LEFT" CALIBRATION DATA: If the "as found" calibration data indicates that the equipment is out of tolerance, the equipment is adjusted to bring it within calibration tolerances. Calibration measurements are taken with NIST traceable standards after the adjustments to verify that the adjustments were effective and that the equipment is now within the calibration tolerances.

DEFINITION OF TERMS

NVLAP: National Voluntary Accreditation Program

NVLAP WEIGHT CALIBRATION CERTIFICATE: Procedures and processes used to generate this multi-page certificate, as well as its format and content, are prescribed by the NIST-administered National Voluntary Laboratory Accreditation Program (NVLAP). It meets all ISO, FDA, GMP, GLP, DOD, ANSI/NCSL Z540-1 and Nuclear requirements. The document contains: customer name, address, date of calibration, equipment and standards used in calibration, accuracy class, true mass value (mass in a vacuum), "as found" mass correction (for recalibration), "as left" mass corrections for each weight, uncertainty of measurement process for each weight, environmental conditions during test, construction and density of weights, calibration procedures used, statement of traceability to NIST and a helpful list of terms and definitions.

REPEATABILITY: This is a measure of the random variations in a balance reading. Statistical analysis of the repeatability of a measurement provides an assessment of the balance performance under normal weighing conditions.

ACCURACY: degree of measurement uncertainty as compared the true value.

EXTERNAL CALIBRATION WEIGHTS

CLASS DESIGNATIONS (as per USP)

- **Class 1.1 Weights:** for low capacity, high sensitivity balances (recommended for weighing quantities below 20mg using optical or electrical methods) – weight range: 1 to 500mg; tolerance: 5μg
- **Class 1 Weights:** for high precision standards - used for weighing quantities below 20mg.
- **Class 2 Weights:** used as working standards for calibration (usually built-in weights for analytical balances, or laboratory weights for routine analytical work)
- **Class 3 and Class 4:** used with moderate precision laboratory balances

EXTERNAL CALIBRATION WEIGHTS

GENERAL INSTRUCTIONS FOR CARE AND USE OF PRECISION ANALYTICAL WEIGHTS

- Never touch analytical weights with bare hands. Oils from the skin can affect the accuracy of the weight. Wear gloves and use the forceps provided when manipulating the weights. The forceps should have no sharp edge, and when possible, not have metal-to-metal contact with the weights.

Ungloved hand, potential heat transfer to weight and enclosure.

Users hand in balance enclosure affecting the thermal stability.

Gloved hand outside enclosure **Recommended practice.**

EXTERNAL CALIBRATION WEIGHTS

GENERAL INSTRUCTIONS FOR CARE AND USE OF PRECISION ANALYTICAL WEIGHTS

• Analytical weights must be stored in their original cases when not in use. Take care when handling cases, as very small weights can still rattle within the case. Rough handling of the case can create the potential for damage to the weights inside.

• Never store analytical weights next to sources of EMF radiation, such as computer monitors or magnets. The weights can become magnetized, which will affect their accuracy.

•Never place analytical weights on a rough or abrasive surface. The weights should only be placed on an impeccably clean balance pan, and then immediately back in their storage box.

EXTERNAL CALIBRATION WEIGHTS

GENERAL INSTRUCTIONS FOR CARE AND USE OF PRECISION ANALYTICAL WEIGHTS

•Never drop or bang analytical weights on to the balance pan. If this occurs, notify the manager immediately, as the weights will likely be damaged. The weight in question must be taken out of service and re-calibrated.

• Never clean analytical weights with any liquid, solvent or abrasive. The weights can be dusted with an impeccably clean soft brush or wiped gently with clean gloves. If weights are very dirty, notify the manager immediately. The weights can be sent for professional cleaning and re-calibration (if necessary).

•Never breath on or speak over the weights. Moisture may condense on the surface of the weights.

ELECTRONIC ANALYTICAL BALANCE

LOCATION OF THE BALANCE

- The balance should be sited in such a way that the transmission of vibration is minimized and sagging cannot occur when weighing.
- The bench should be made of non magnetic material and grounded to prevent the build-up of any electrostatic charge.
- Care should be taken to avoid external influences from the balance such as magnetic fields, and radio frequency interference.
- The room has to be temperature and humidity controlled (*a change of 1°C for a balance with a resolution of 0.1mg will result in a 0.1mg change in the reading of a 100g weight*)
- The balance has to be clear of any AC units and fans, including cooling fans from electrical equipment (e.g., computers)
- Make sure that balances are not in direct sunlight as this could generate localized temperature fluctuations in the weighing chamber.
- If the balance needs to be sited in a production environment, set balance filters to minimize draft or vibration effects.

ELECTRONIC ANALYTICAL BALANCE

THE WEIGHING PROCEDURE:

- *Planning*
- *Checking the Balance*
- *Weighing the Material*

ELECTRONIC ANALYTICAL BALANCE

THE WEIGHING PROCEDURE:

- ***Planning:***

- Assemble all proper equipment and necessary reagents, vessels, forceps, etc.

- Use containers that do not exceed the loading capacity of the balance.

- Make sure containers used as weighing vessels are clean and dry.

- Samples/materials must be brought back to the temperature of the balance (or ambient temperature) before the container is opened and they are weighed.

ELECTRONIC ANALYTICAL BALANCE

THE WEIGHING PROCEDURE:

- ***Checking the Balance***

- Check the *Balance Environment*, *Calibration*, and *Balance Uncertainties* (**Never assume that the balance has been left in proper operating conditions by the previous user.**)

Balance Environment

The surrounding work area has to be kept neat and tidy. It is a good idea to dust the balance pan with a camel's hair brush (or any equivalent) to remove any materials that may have been left by the previous user.

ELECTRONIC ANALYTICAL BALANCE

Calibration

Before weighing anything on the analytical balance, make sure that the pan is unloaded, clean and free of debris, and the display is zero.

Check that the balance does not wobble, and the leveling bubble is centered. If not, center it by turning the leveling screws on the feet of the balance.

Make sure that weekly and daily verifications have been performed before performing any weight determination.

If the balance power has gone off and then back on again, as in a power failure, certain types of balance will display a message indicating that the balance must be calibrated. If the message is cleared without performing verification, the balance will not give the accurate weight until it has been calibrated/verified.

ELECTRONIC ANALYTICAL BALANCE

Balance Uncertainties

There are always limitations in operator knowledge and performance of the instruments whenever the balance is used. A measurement is not complete without an estimate of the the doubt that surrounds it (the **uncertainty**) and the confidence we have in that estimate. The sources of uncertainties are dependent on the measurement process and equation used – as defined in the test methods and procedures, and by the laboratory environment.

ELECTRONIC ANALYTICAL BALANCE

Sources of Uncertainties

- Drift:
  - Gives an indication of the balance's stability and its sensitivity to changes in environmental conditions
  - Gives an indication of how long the balance should be left to give a stable reading (effectiveness of the damping)
  - One of the most common errors and one of the easiest to reduce or eliminate.
  - Can be present without the operators being aware of the problem.
  - Possible sources of drift in a balance:
    * an open balance door.
    * temperatures of the balance and the material to be weighed are not the same.
    * sample is losing or gaining weight (deliquescent & efflorescent samples)
    * balance has been recently moved but has not been allowed to equilibrate to its surroundings (or has not been recalibrated).
    * air currents are present in the laboratory
    * balance is not properly leveled
    * laboratory operations are causing vibrations
    * hysteresis of the mechanical parts occurs during weighing.

ELECTRONIC ANALYTICAL BALANCE

Sources of Uncertainties

- Mechanical Hysteresis

  - Caused by excessive stretching of the springs , and it is primarily due to overloading or accidental dropping of an object onto the pan.

  - Balance overhaul may be needed in the event of excessive stretching of the springs.

  - Checked by taking readings of increasing and decreasing load.

  - Drifts due to hysteresis can be eliminated by allowing the balance to stand without weighing long enough for it to recover.

ELECTRONIC ANALYTICAL BALANCE

THE WEIGHING PROCEDURE:

- ***Weighing the Material***

  - Do not allow the material to remain on the balance for an extended period of time (changes caused by interaction with atmospheric water or carbon dioxide may occur)

  - Load Limit: select the appropriate balance for the quantity and accuracy needed. Do not exceed the weight limit. (Electronic balances operate on a "load cell" principle that produces an electrical output proportional to the movement of the strain gauge and is linear over the range.)

  - Receivers: select the proper receiver for the material.

ELECTRONIC ANALYTICAL BALANCE

Receivers:

- Common receivers include weighing bottles, weighing funnels, weighing paper, flasks, depending on the quantity and material that needs to be weighed.
- Receiver should be clean and dry.
- Always wear gloves, use forceps or any other type of gripping device when handling receivers (**Oils from fingers can add weight, Heat transfer can also occur from the hand to the receiver**)
- When weighing powders, make sure to deionize the receiver and the spatula/spoonula
- Handle weighing paper with gloved hand and take extra care to avoid spills.

ELECTRONIC ANALYTICAL BALANCE

Weighing Methods (per current USP):

Method 1:

• Place the receiver on the balance (in the center of the pan)

•Press the tare key on the balance

•Add the material to the receiver and record the weight.

•Transfer the weighed material to the final flask or container

•Reweigh the original weighing receiver by placing it in the same position on the pan and record the weight. (Do not change the set tare of the balance between these two weighings.)

•Subtract the second weight from the initial weight. The difference represents the weight of the transferred material.

ELECTRONIC ANALYTICAL BALANCE

Weighing Methods (per current USP):

Method 2:

•Add the material to the receiver.

•Place the receiver with the material on the balance (in the center of the pan) and record the weight.

•Transfer the weighed material to the final flask or container.

•Reweigh the original weighing receiver by placing it in the same position on the pan and record the weight.

•Subtract the second weight from the initial weight. The difference represents the weight of the transferred material.

ELECTRONIC ANALYTICAL BALANCE

Weighing Methods (per current USP):

Method 3: Quantitative Transfer

•Place the receiver with the material on the balance (in the center of the pan) and record the weight.

•Press the tare key on the balance

•Add the material to the receiver and record the weight.

•Transfer the weighed material to the final flask or container quantitatively (e.g., by washing the receiver with a solvent and transferring the washings into the final flask or container)

ELECTRONIC ANALYTICAL BALANCE

WEIGHING SOLIDS:

• **Fine powders** tend to pick up static charge. This charge must be eliminated (by deionizing the receiver and spatula) before any suitable weighing can be made.

Static Charge depends upon the relative humidity of the laboratory (which depends on the atmospheric conditions). It can also be caused by the type of clothing worn by the analyst (this causes large errors in weighing when discharged).

• For **hygroscopic reagents** , weigh a capped bottle containing the dry reagent/sample. Quickly pour some of the sample from the weighing bottle into a receiver. Cap the weighing bottle and weigh it again. The difference is the mass of the reagent delivered to the receiveing vessel.

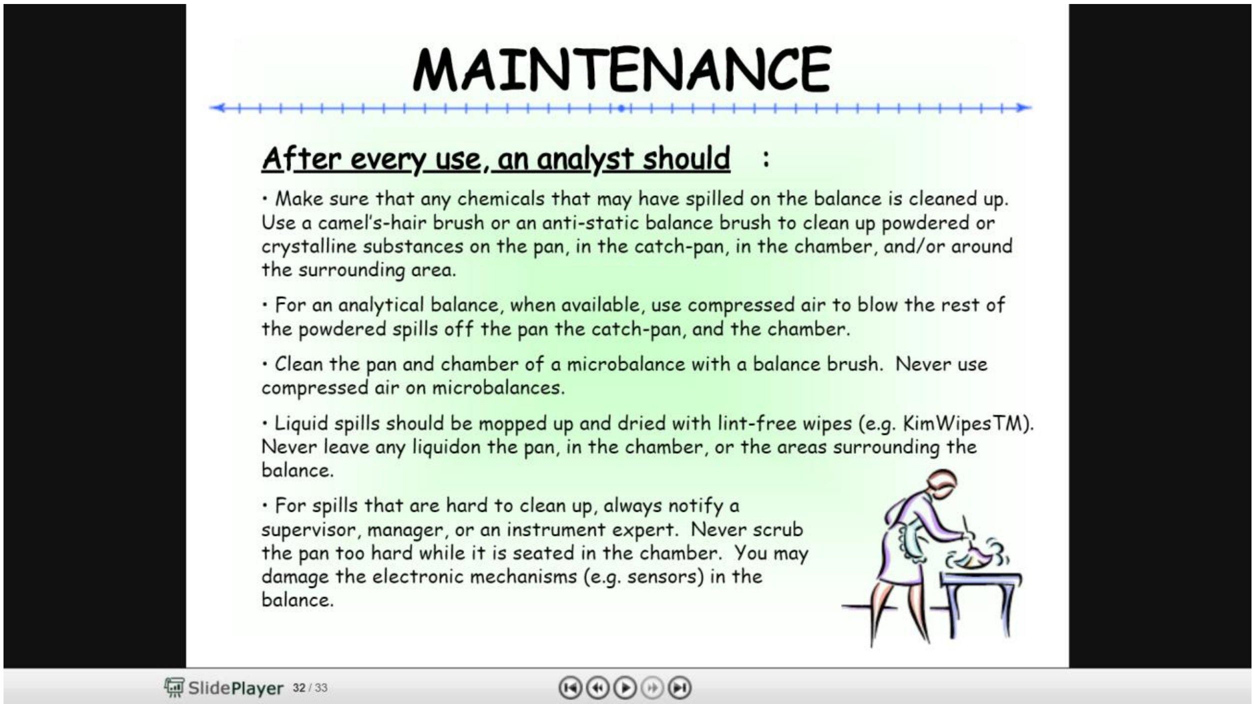
ELECTRONIC ANALYTICAL BALANCE

Cartridge Weighing Techniques with the ME5-F

1. Make sure you are wearing personal protective equipment when weighing. **Always wear gloves** .
2. When weighing cartridges, make sure that the inner draft ring is in the chamber. If not, install the inner draft ring. This ensures more precise weighing results.
3. Handle the receivers (cartridges or filter papers) with anti-static forceps.
4. Use the deionizer with cartridges. Tilt cartridge when passing through the deionizer.
5. Turn off deionizer when not in use.
6. Press *"Print"* after chamber is closed to allow the printer to print on stability.
7. When weighing filter paper, remove the inner draft ring and proceed with the weighing procedure

SAFETY

- Always be familiar with the precautions described in the MSDS of the material being weighed.
- Handle hazardous materials in an enclosure having appropriate air filtration.
- Use a mask that covers the nose and mouth to prevent any inhalation of finely divided particles or chemical dust.
- Use gloves to prevent any contact with the skin (Gloves also prevent heat transfer, and moisture/oils from being deposited into the receiver)



WEIGHING BALANCE

WEIGHING BALANCE

- A weighing scale is a device for measuring weight
- Balances measure the mass of an object and are used in science
- In many industrial and commercial applications, scales and balances to determine the weight and/or mass of things ranging from feathers to loaded tractor-trailers.

WEIGHING PRINCIPLE

- The basis of the rapid and exact working method of our Weigh Cells is the Principle of **Electro Magnetic Force Restoration (EMFR).**
- The basic principle is comparable to a simple beam balance. The **weight** is laid on one side of the beam (coil arm). The result is that the coil attached to the other side of the **beam tries to move** out of the magnetic field of the magnet.

WEIGHING PRINCIPLE

- A zero indicator (**photoelectric beam**) recognizes any minimal deviation, and immediately **so much current is sent through the coil** via an electrical regulator circuit that the balance beam hardly moves and **remains in its neutral position**.
- The deviation occurring is merely a matter of a **few nanometres.**

DIFFERENT TYPES OF BALANCES

- **Analytical balance**
- Micro balance
- Gold and carat balance
- Spring balance

Analytical balances

- Very accurate balances, called analytical balances, are used in scientific fields such as chemistry.
- An analytical balance is a class of balance designed to measure small mass in the sub-milligram range.

Analytical balances/lab balance

- Analytical balances are found throughout most laboratories.
- They are mostly used to weigh substances and **samples between 0.01 to 500 milligrams.**
- These units' measuring pans are usually encased in a **glass box** so **as to prevent any dust particles** settling in the pan.
- An analytical balance measures masses to within **0.0001 g.**
- Use these balances when you need **this high degree of precision.**

Mechanical analytical balance

Automated analytical balance

Micro balance

- Microbalances are generally designed to measure, weigh and provide data on the **tiniest of samples**.
- Most models can effectively provide data for samples weighing between **6 and 0.0001** milligrams.
- These types of balances are generally used to **weigh highly valuable substances in minute quantities.**
- These units typically come standard with **draft shields** so that dust and other foreign particles do not make their way into the dish and corrupt data and materials being worked on.

Gold and Carat balance

- Gold and carat balances, as the name implies, are designed to **weigh gold** as well as give carat values.
- These are more commonly found in jewellery design workshops and retail jeweller outlets, however, they are used in some laboratory exercises too.
- These units are not limited to weighing gold; they are also commonly used to measure and provide carat values for both **precious and semiprecious stones and metals.**

Spring Balance

- Spring balances or spring scales measure **weight (force) by balancing the force due to gravity** against the force on a spring,
- whereas a balance or **pair of scales** using a balance beam compares masses by **balancing the weight to the unknown mass of an object against the known weight mass** or masses.


Analytical Balance
fppt.com

Objective:

- define the meaning and how to use properly the analytical balance.

Analytical balance

- Analytical balances are instruments used for precise determining mass of matter.
- Analytical balances are designed for great precision in quantitative chemical analysis.
- They yield readability to four decimal places to the right of the decimal point (up to .0001 g).

- They are extremely sensitive and, since air currents can affect their measurement, must be covered by a draft shield. They are used for samples up to about 320 g.

- It requires mains electricity or battery supplied power.

These balances are used:

- To weigh small quantities usually in mili gram(mg) range. When great accuracy is required.

Example, 2.750mg, 0.330 mg, 5.860mg, etc Its sensitivity is 0.5 mg to 1 mg depending on the model.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How to Use the Analytical Balance

I. Preparing the balance for use

- Before weighing anything on the analytical balance you must make sure that it is leveled and zeroed.

- To check the leveling on the balance, look at the leveling bubble on the floor of the weighing chamber. If it is not centered, center it by turning the leveling screws on the bottom toward the back of the balance.

- Once the balance is leveled, close all the chamber doors and press the control bar on the front of the balance. After a few seconds, a row of zeros will appear. This indicates that the balance is zeroed and ready for use.

II. Weighing a liquid, powder, or granular substance

These substances must always be weighed using an appropriate weighing container.

1. Place the weighing container on the balance pan and close the doors.

2. Tare the container by briefly pressing the control bar. The readout will read zero with the container sitting on the pan. This allows the mass of your sample to be read directly.

3. Add the substance to be weighed. Be careful not to spill chemicals on the balance. If need be, you can remove the container from the weighing chamber while you add the sample provided that no one presses the control bar before you weigh your sample.

4. With the sample and its container sitting on the pan, close the chamber doors and read the display to find the mass of your sample

III. Weighing a solid object directly on the balance

If the object you need to weigh is a solid object, you can weigh it directly on the pan. Be sure the balance is zeroed. Open the chamber doors, carefully place the object on the balance pan, close the doors, and read the mass of your object.

IV. Cleaning up and shutting down the balance

When you are done with the balance, make sure you have properly cleaned up any chemicals that may have spilled on the balance. At the end of the day, the balance can be turned off by lifting up gently on the control bar.