Poisons are classified by source into:

1-Natural **(from plants, animals, microbes like fungi/bacteria, e.g., Aconite, Botulinum toxin, Snake venom)**

2- Artificial/Synthetic **(man-made chemicals, e.g., Pesticides, Nerve gases, Dioxins, Cleaners like bleach/ammonia, Alcohol), with further splits into metallic vs. non-metallic, organic vs. inorganic, and by their action (Corrosive, Irritant, Neurotoxic, etc.).**

Natural poisons are biotoxins, while artificial ones are toxicants, though terms are often mixed.

اصطناعية/صناعية (مواد كيميائية من صنع الإنسان، مثل المبيدات الحشرية، وغازات الأعصاب، والديوكسينات، والمنظفات مثل المبيضات/الأمونيا، والكحول)، مع تقسيمات أخرى إلى معدنية وغير معدنية، وعضوية وغير عضوية، ومن حيث تأثيرها (مسببة للتآكل، ومهيجة، وسامة للأعصاب، إلخ). السموم الطبيعية هي سموم حيوية، بينما السموم الاصطناعية مواد سامة، مع أن المصطلحات غالبًا ما تكون مختلطة.

classification By Chemical Nature (Organic vs. Inorganic)

- **Inorganic Poisons:** Lack carbon; examples include metals (lead, mercury, arsenic), acids (hydrochloric, sulfuric), alkalies (sodium hydroxide), and gases (carbon monoxide).
- **Organic Poisons:** Contain carbon; examples include plant-derived (opium, strychnine, castor oil), animal-derived (venoms), and synthetic substances (alcohol, barbiturates, amphetamines).

2. classification By Type of Action (Systemic/Targeted)

- **Corrosives:** Acids (acetic, oxalic) and alkalies (sodium/potassium hydroxides) causing tissue destruction.
- **Irritants:** Cause inflammation; include metals (arsenic, copper) and non-metals (phosphorus, chlorine).
- **Neurotoxins:** Affect the nervous system.
  - **Cerebral:** Alcohol, opium (affecting brain).

- **Spinal:** Strychnine (affecting spinal cord).
- **Peripheral:** Curare (affecting peripheral nerves).

- **Cardiac Poisons:** Affect the heart, e.g., digitalis, aconite, tobacco.
- **Asphyxiants:** Cause oxygen deprivation, e.g., CO, H_2S, CO_2.

3. classification By Physical State

- **Gaseous:** Carbon monoxide, chlorine.
- **Liquid:** Alcohol, castor oil.
- **Solid:** Metals (lead, arsenic), seeds (opium poppy).

4. classification By Isolation Method (Forensic Toxicology)

- **Volatile:** Easily vaporized (e.g., alcohol).
- **Non-Volatile:** Soluble in water/acid/alkali (e.g., heavy metals, alkaloids).

Sample preparation , representative sampling techniques

Samples can be gas or liquid or solid or biological material. Means of analyzing them can vary from sample to another.

♣ Analysis can be done to reveal chemical or physical properties, or to study its structure or its surface properties, or to reveal the sequence of proteins in genetic samples.

يمكن إجراء التحليل للكشف عن الخصائص الكيميائية أو الفيزيائية، أو لدراسة بنيتها أو خصائص سطحها، أو للكشف عن تسلسل البروتينات في العينات الجينية.

♣ However, one may think if an X sample is submitted to an instrument, all required information would be obtained straightaway. NO, this is impossible.

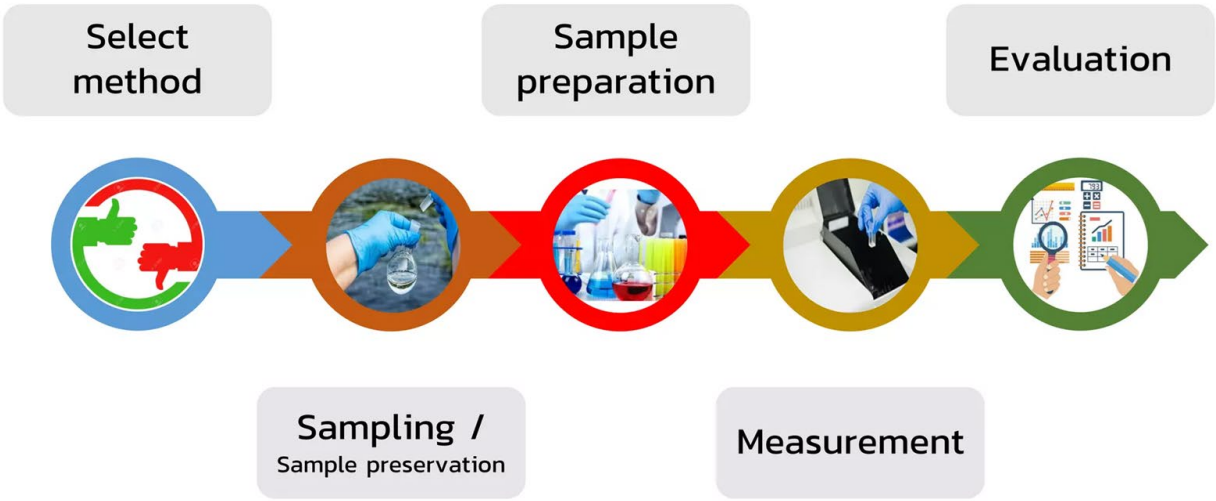
ومع ذلك، قد يظن المرء أنه إذا أُرسلت عينة X إلى جهاز، فسيتم الحصول على جميع المعلومات المطلوبة فورًا. ، ,وهذا مستحيل.

Each chemical instrument would do the analysis if samples are well prepared, if badly prepared then it may cause damage to the instrument or the obtained results would not be accurate for the original sample.

ϖ There are 4 general steps for any sample to be measured instrumentally;

(1)sampling, (2)sample preservation,

(3)sample preparation (4) doing the analysis.



Sampling. Collect a sample representing the actual sample from the site. For instance, if you want to determine the concentration of Zn 2+ in a lake (the site), then one sample from the lake would not represent the actual sample as the concentration of zinc varies between spots in the lake.

Sample preservation. In analysis routines, there is a delay between sampling and conducting the analysis. This require a sample to be kept in certain conditions that ensure the preservation of the chemical and physical properties of the sample. Otherwise, **if any changes occur in the sample during storage, the analysis result would not be applicable to the actual sample in the first instance.**

إذا حدثت أي تغييرات في العينة أثناء التخزين، فلن تكون نتيجة التحليل قابلة للتطبيق على العينة الفعلية في المقام الأول.

Sample preparation. Most samples need special treatment before the analysis. For example, if pesticides to be determined in fish liver, then pesticides need to be extracted into a solution which can be submitted safely to an instrument. (not doing the analysis directly on the liver).

The analytical technique determines the way by which a sample should be prepared. Gas chromatography can analyse the pesticides, only few microliters from the sample are needed to be injected in the GC.

So, sampling and sample preservation and sample preparation all aim at producing these few microliters which represents the actual sample.

لذا، فإن أخذ العينات وحفظ العينات وتحضيرها كلها تهدف إلى إنتاج هذه الميكرولترات القليلة التي تمثل العينة الفعلية.

There are many steps in the sample preparation, homogenization, size reduction, extraction, derivatization, concentration, speciation, etching, transfer to vapour phase, clean-up and analysis.

هناك العديد من الخطوات في تحضير العينة، التجانس، تقليل الحجم، الاستخلاص، الاشتقاق، التركيز، التحديد النوعي، النقش، النقل إلى مرحلة البخار، التنظيف والتحليل.

Analysis. Once the sample preparation is complete, the analysis can be conducted by an instrument.

Different instruments are available in the market to fit for different analysis purpose which depend on the required information to be obtained. AAS for metal analysis, capillary sequencing ….etc.

Reproducibility, replicates, duplicates

• **Reproducibility** and **repeatability** are ways to measure precision in any analytical analysis.

إن القدرة على التكرار والقدرة على الإنتاج هي طرق لقياس الدقة في أي تحليل تحليلي.

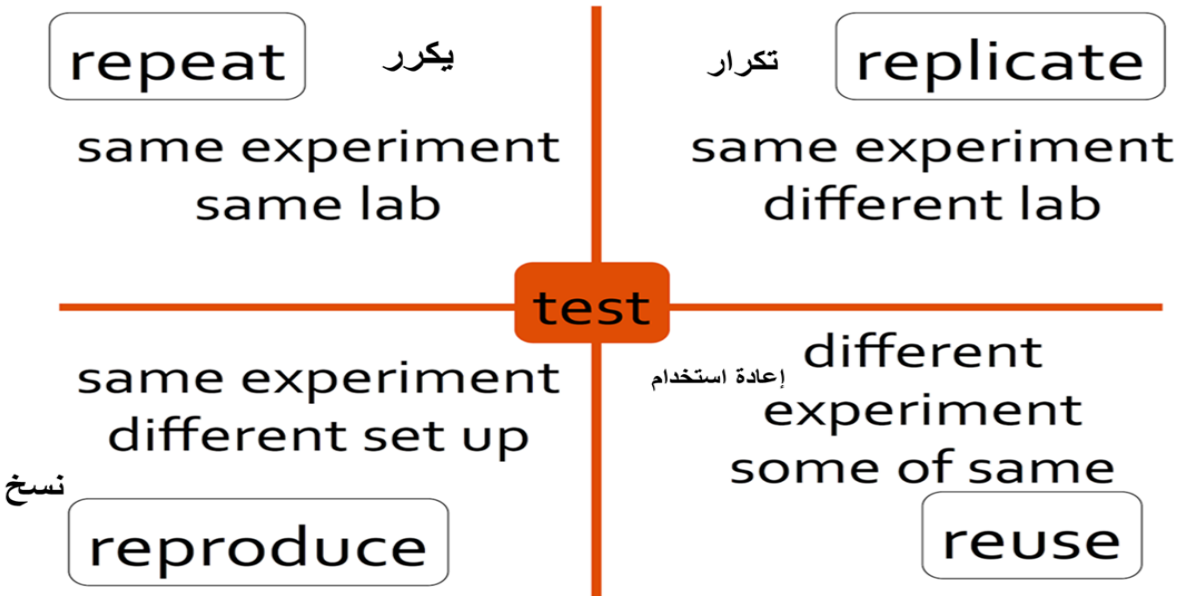
• **Reproducibility** is a type of precision which related to a situation in which environmental conditions and other factors will have changed and usually the results are obtained in different laboratories and at different times.

القدرة على إعادة الإنتاج هي نوع من الدقة يتعلق بموقف تتغير فيه الظروف البيئية والعوامل الأخرى وعادةً ما يتم الحصول على النتائج في مختبرات مختلفة وفي أوقات مختلفة.

As already mentioned, any measurement need to be done multiple times, not just once, to ensure that the results are valid and reliable.

Also, it is a way to detect the source of problems when the repeated measurements give different results on the same sample.

كما أنها طريقة للكشف عن مصدر المشاكل عندما تعطي القياسات المتكررة نتائج مختلفة على نفس العينة.



Calibration

If a group of student's attempt at measuring a line, already drawn on a paper, with their own rulers, they would not obtain similar measurement values, this is as rulers may be made from wood or plastic and they may be affected by ambient conditions.

However, if there was a standard ruler and all the students' rulers were calibrated against it, there would not a difference in reading the line length.

So, the term calibration was introduced to tackle the problem, and to improve the comparability of the measurements.

لذا، تم تقديم مصطلح المعايرة لمعالجة المشكلة، وتحسين إمكانية مقارنة القياسات.

In chemistry, calibration can be done by using either ways; pure chemical standards or a reference material.

Reference materials can be of two types: Areference material (RM). It is a material or a substance which has one or more properties that are sufficiently established to be effectively used for calibration.

يمكن أن تكون من نوعين: مادة مرجعية .(RM) وهي مادة أو مادة لها خاصية أو أكثر مثبتة بما يكفي لاستخدامها بفعالية في المعايرة.

Acertified reference material (CRM). It is a material or a substance which has one or more properties that are certified by a technically valid procedure issued by a certifying body.

هي مادة أو مكون له خاصية واحدة أو أكثر يتم التصديق عليها من خلال إجراء صالح من الناحية الفنية صادر عن هيئة التصديق.

Chemicals can be used as standards for the calibration process, and can be applied externally or internally with respect to the sample.

If they are added to a sample and measured with it, then it is called internal standard.

إذا تمت إضافتها إلى عينة وقياسها بها، فيسمى ذلك بالمعيار الداخلي.

If the standard is not added to the sample, but measured in isolation from the sample, then it is called external standard.

إذا لم تتم إضافة المعيار إلى العينة، بل تم قياسه بمعزل عن العينة، فإنه يسمى معيارًا خارجيًا.