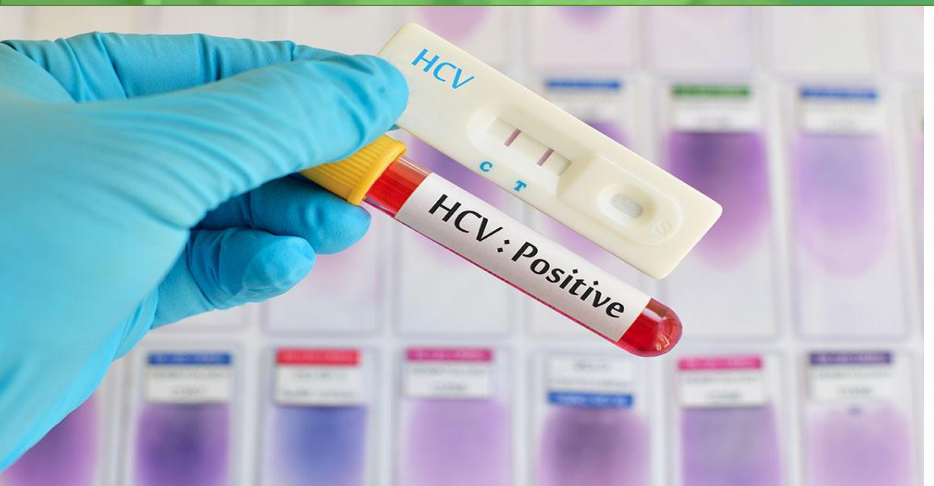
Medical Investigation



Dr : Amr Abd El Rahman

Medical Laboratory Specialst

THE BRITISH UNIVERSITY IN EGYPT

Ain Shams University Specialized Hospital

Master of Clinical Biochemistry

Medical Laboratory Departments Divided into :

1-Histopathology Laboratory.

2-Clinical Pathology Laboratory

- Histopathology Laboratory :

- Histology …. Study of biological tissue ..
- Histopathology …. Microscopic examination to diseased tissue ..
- Biopsy … Tissue Removed From the body (Living Tissue)

Clinical pathology Laboratory
Divided into Units :

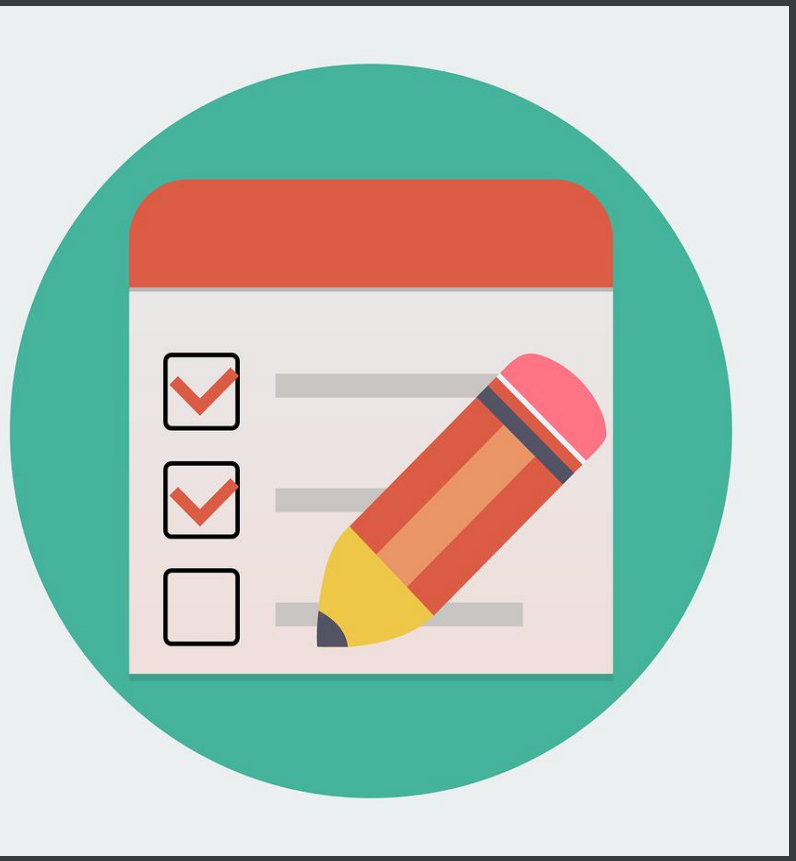
Chemistry
Microbiology
Hematology
Body Fluids
Immunology

Laboratory procedures :

1- Pre-analytical stage:

- Reading the request form.
- Recording the patient data and medical history.
- Preparation of the patient sample collection and transport of the specimen.

- **البانات الشخصية الواجب توافرها لمريض المعمل :**



الاسم ثلاثي : حتى لا يحدث خطأ أثناء أخذ العينات من حيث الأسماء.

العنـــوان : حتى يتثنى إدارة المعمل الاتصال بالمريض عند حدوث أى ظرف طارئ.

رقم التليفون : حتى يتثنى لطبيب المعمل الاتصال بالمريض للاستفسار عن نوع علاج أو زيادة جرعة خصوصاً في تحليل سيولة الدم.

الســـن: لكل سن نسب طبيعية في الدم.

الطبب المعالج : حتى يتثنى لطبيب المعمل الاتصال بالطبيب المعالج للاستفسار عن طبيعة تحليل أو نوع علاج أو تشخيص الحالة.

- **اهم الأسئلة لمريض المعمل :**

عدد ساعات الصيام : لأنه يوجد تحاليل تحتاج إلى صيام 12 ساعة مثل دهون الدم مثلاً و 8 ساعات مثل السكر.

هل يؤخذ علاج للسكر : إذا كان المريض يريد عمل اختبار سكر.

هل يؤخذ علاج لسيولة الدم : إذا كان المريض يريد عمل اختبار لسيولة الدم خاصة (PT , PTT , C.T , B.T)

هل يؤخذ علاج للغدة : إذا كان المريض يريد عمل اختبارات الغدة.

هل يؤخذ مضاد حيوى : إذا كان المريض يريد عمل مزرعة.

هل سبق نقل دم : وذلك لعلاقة الدم بنسبة الهيموجلوبين أو فيروسات الالتهاب الكبدى أو الإيدز ومتابعة نسبة الهيموجلوبين و G6PD .

أول يوم في أخر دورة : وهذا مهم في حالة اختبارات الهرمونات أو الحمل.

هل تم إجراء أشعة بالصبغة أو بالمواد المشعة : وذلك لأن الصبغة تؤثر علي تحاليل البول والكيمياء العادية أما المواد المشعة فتؤثر علي الهرمونات

2- Analytical stage:

- checks the test method, the reagents, standards, and control materials.
- checks the equipment and instruments used.
- perform the test and calculate the results.

3- Post-Analytical stage:

#Reporting the test result which must include

1. Test name and type of specimen analyzed
2. Test results clearly
3. The measurement unit and reference range
   (Review the range with the age and sex)
4. The comment if found

REPORT

Visit Number	Age	Gender	Referred By	Client ID
28720508320	21 Year	Female	Prof : -	3416

Test Name	Result	Unit	Reference Range
Inflammatory Markers			
C-Reactive Protein (Quantitative)	2.7	mg/L	0 - 5
Liver Function Tests			
SGPT (ALT)	33	U/L	7 - 40
SGOT (AST)	17	U/L	0 - 34
Iron Profile			
Ferritin	54	ng/mL	13 - 150
Serum LDH	155	U/L	0 - 248

Laboratory Safety Rules

Lab Safety Rules

Science labs offer great opportunities for learning, teaching, and research. They also pose hazards that require proper safety precautions.

Dress appropriately

Tie back long hair, and wear suitable gloves, goggles, and other protective equipment.

Proper supervision

Don't perform lab experiments without instructor supervision (unless given permission to do so).

Keep a clean workspace

Don't obstruct work areas, floors, or exits. Keep coats, bags, and other personal items stored in designated areas away from the lab. Don't block sink drains with debris.

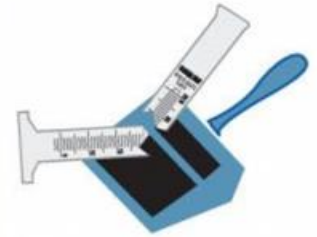
Know location of emergency numbers & safety equipment

Know the location of safety equipment and emergency phone numbers (such as poison control) so you can access them quickly if necessary.

ID hazards

Identify hazardous materials before beginning labs.

Stay safe when conducting your labs by following these guidelines.



Handle glassware carefully

Properly dispose of anything that breaks. Report cuts, spills, and broken glass to your instructor immediately.

No food

Don't eat or drink in the lab—and never taste chemicals.

Clean up

After completing the lab, carefully clean your workspace and the equipment, and wash your hands.

Sources: Carolina Biological Supply Company. "Lab Safety Dos and Don'ts for Students." http://www.carolina.com/teacher-resources/Interactive/lab-safety-instructions/tr11076.tr.

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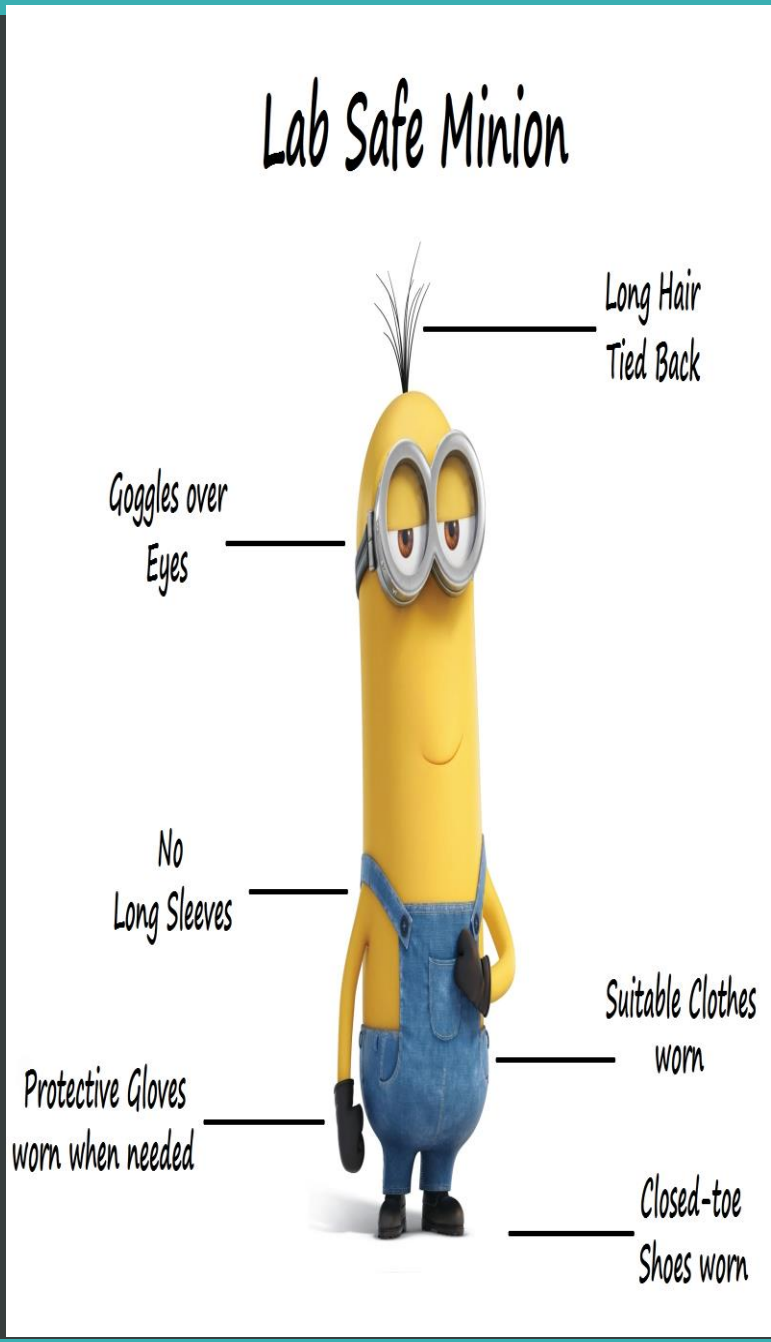
Rules related to Chemist:

- Treat all body fluids as a potentially infectious materials.
- A lab coat and gloves should be worn during laboratory work.
- Do not eat food, drink, or chew gum in the laboratory.
- Do not use laboratory glassware as containers for food or drinks.
- Work areas should be kept clean and tidy at all times.
- Do not place contaminated pipettes on the bench top.
- Keep hands away from face, eyes, mouth, and body while using chemicals or lab equipment.
- Wash your hands with soap and water after performing all experiments.
- Never use mouth suction for chemicals or body fluids Keep fingers, pencils, loops etc. out of your mouth.



Needle stick injuries

The 'first aid' instructions

1. Don't panic.

2. Make sure that injury does not happen again.

3. Clean the infected area.

4. Rinse with substantial amount of water and soap.

5. Don't squeeze wounded area (the practice to "milk out" more blood is controversial and not recommended).

6. If you have blood on eczema or on puncture wound, place a patch with alcohol (at least 70% alcohol) over it for two minutes.

Blood sampling

Anticoagulants

It is the substances that prevent coagulation of blood and it is used to prepare a plasma sample in laboratory

1- EDTA (Ethylene diamine tetra acetic acid)

2- Sodium citrate

3- Sodium Fluoride

4- Heparin

1- EDTA (Ethylene diamine tetra acetic acid)

- Found as disodium salt or dipotassium salt (K salt is more soluble so it is more preferable)

- Preparation

Dissolve 1gm of powder in 100 ml DW then use 50 µl for each 1ml blood

- Mechanism of action

It acts by binding calcium ion that is essential for blood clotting to form insoluble salt.

- Uses

Must be used in tests that need whole blood
CBC, ABO & Rh

- Excess EDTA will cause shrinkage of the blood cell

2- Sodium citrate

- Preparation

Dissolve 38 gm in 100 ml DW

- Mechanism of action

It converts ionized Ca into unionized soluble complex but not as strongly as EDTA

- Uses

ESR test
PT & PTT test

- It cause blood dilution when used as solution so it is not suitable for some tests as Hb

3- Sodium Fluoride

- Mechanism of action

Sodium Fluoride has a weak anticoagulant action through the formation of a weakly dissociated Ca complex

- Uses

It is used as a powder 5 mg/ml blood for glucose determination

- Advantage

- Sodium fluoride prevents glycolysis for 3 days by forming an ionic complex with Mg
- preventing the consumption of glucose by the RBC‘s if blood is left standing at room temperature.

- Disadvantage

- Very poisonous
- It is poorly soluble so blood must be mixed well

4- Heparin

- It is used in concentration of (0.1 ml /5ml blood)

- Advantages

- Some samples must be collected on heparin such as Blood gases
- Heparinized plasma is preferred for potassium measurements to avoid an elevation due to the release of potassium from platelets as the blood clots.

- Disadvantages

- More expensive
- Blood should be examined with in 8 h (because it prevent coagulation for only limited period)
- Can not be used for coagulation testing.
- It cause platelets aggregation so it is not recommended for CBC.

Stopper color	Additive	Uses
Red	None	Collecting serum sample
Purple	EDTA	Collecting plasma sample
Blue	Sodium citrate	PT & PTT tube
Black	Sodium citrate	ESR tube
Gray	Sodium fluoride	Blood sugar tube
Green	Lithium heparin	Collecting heparinated blood
Gold	None	Serum separator tube (SST) contains a gel at the bottom to separate blood from serum

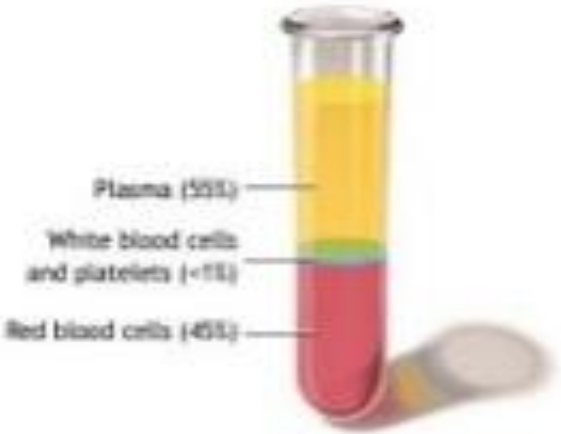
2. Plasma vs. serum

•**Plasma** is the liquid, cell-free part of blood, that has been **treated with anti-coagulants**.

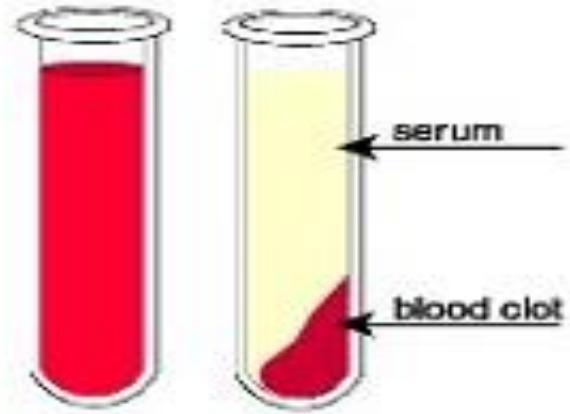
Serum is the liquid part of blood **AFTER coagulation**, therfore devoid of clotting factors as fibrinogen.

Anticoagulated

Clotted



•serum= plasma - fibrinogen



Venipuncture

1- Preparation for blood collection

- Verify the patient's condition. Fasting, dietary restrictions, timing of the test, and medical treatment (especially in blood glucose test and PT test).
- prepare equipment for blood sampling (Tourniquet, Alcohol, Cotton, Adhesive strip, Sterile Disposable syringes).
- Estimate the blood volume to take.
- Prepare the suitable tubes for each test.

3- Positioning the patient and choosing the vein

- The patient should sit Comfortable in a chair or sit up in bed.
- In order to avoid problems with hem concentration and hem dilution, the patient should be seated for 15 to 20 minutes before the blood is drawn.
- Patients should not stand or sit on high stools because of possibility of fainting.
- The patient arm extend from shoulder to wrist and arm should not bent at elbow.
- Avoid arm with burn area, hematoma , scaring , recently injected or withdrawn syringe and avoid edematous extremities (tissue fluid accumulation alters test results).

- The vein selected should be large, straight that does not roll, readily accessible, and sufficiently close to the surface to be seen and palpate

BLOOD SAMPLING VIDEO

https://www.youtube.com/watch?v=DzTmDlcE_3U

Vein Viewer

Vein Viewer is a direct projection vascular imaging device clinically proven to improve peripheral vascular access. Vein Viewer uses harmless near-infrared light to produce a digital image of a patient's veins and project it directly on the surface of the skin. Vein Viewer projects an image much like a picture on a movie screen, but Vein Viewer does this in real time making the patient’s skin the “screen”.

Venipuncture with syringe

1. Check the syringe
2. Use 70% alcohol as disinfectant the site in concentric circle and let it to dry for 30–60 sec to avoid hemolysis and burning sensation.
3. Palpate the vein by left hand. It should rebound
4. Fix the vein by drawing skin tight over the vein to prevent vein from moving
5. Enter by the needle at 45 degree angle (under the skin and then into the vein)
6. Remove the tourniquet once the needle has been inserted
7. Withdraw blood gradually by gently pulling upon the syringe plunger
8. Place a sterile cotton piece over the point where the needle entered the skin.
9. Remove the syringe quickly
10. Dispose of contaminated materials and needles in special disposal containers

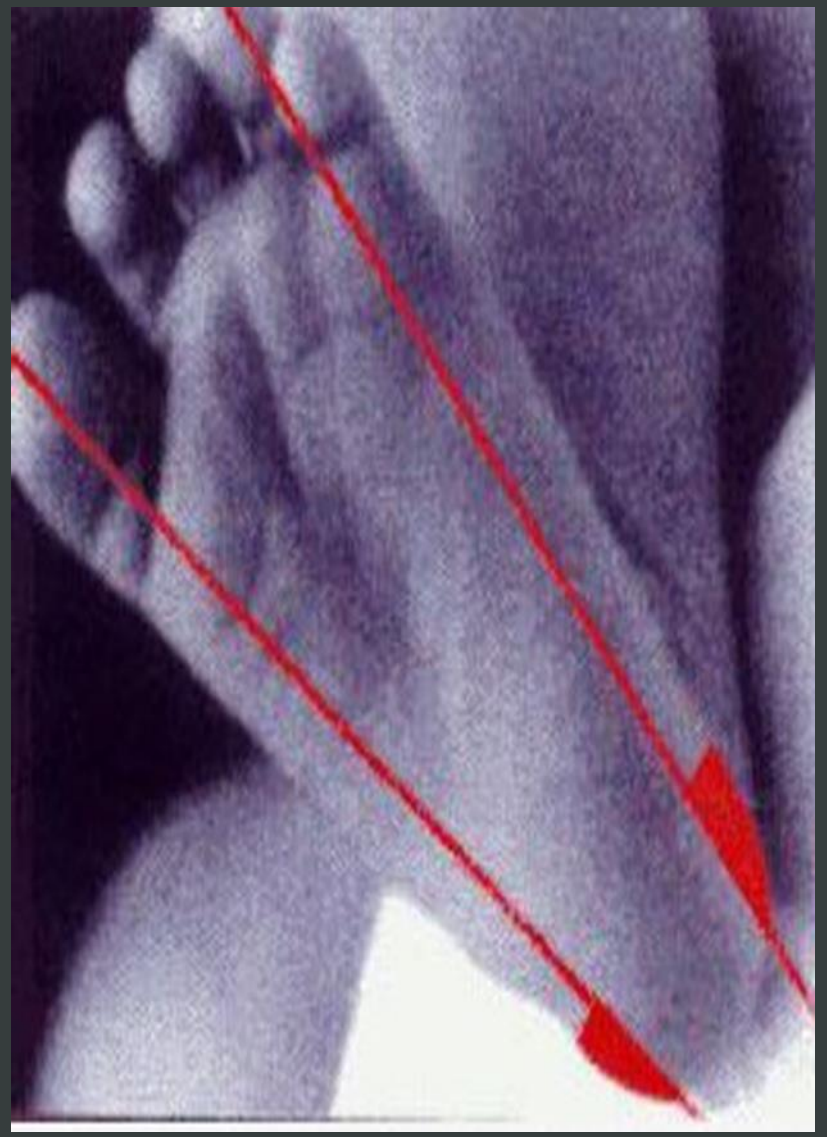
Other ways to venipuncture !!

Vacutainer system

evacuated tubes

Butterfly

Neonatal blood sampling



Arteial Blood Gases Sampling

Hematoma

Specimen Rejection

- Hemolysis / lipemic
- Clots present in an anticoagulated specimen
- Non fasting specimen when test requires fasting
- Improper blood collection tube
- wrong sample volume
- Improper transport conditions (as in blood gases)
- Unlabeled or mislabeled specimen
- A specimen is unsuitable for testing because it has been stored incorrectly, or is too long in transit before it reaches the laboratory.

Hematoma is just a bruise like any other bruise and can appear with the most skillful phlebotomist.

Causes of Hematoma:

- Penetration of vein.
- Slow flow.
- Bending the arm after sampling.
- Patients with bleeding disorder and those taking anticoagulant therapy.

How to avoid Hematoma:

- Use the major superficial veins.
- Don’t penetrate the vein from the side.
- Remove tourniquet before removing the needle.
- Don’t bend arm before sampling
- Apply pressure to the vein by a cotton after sampling.

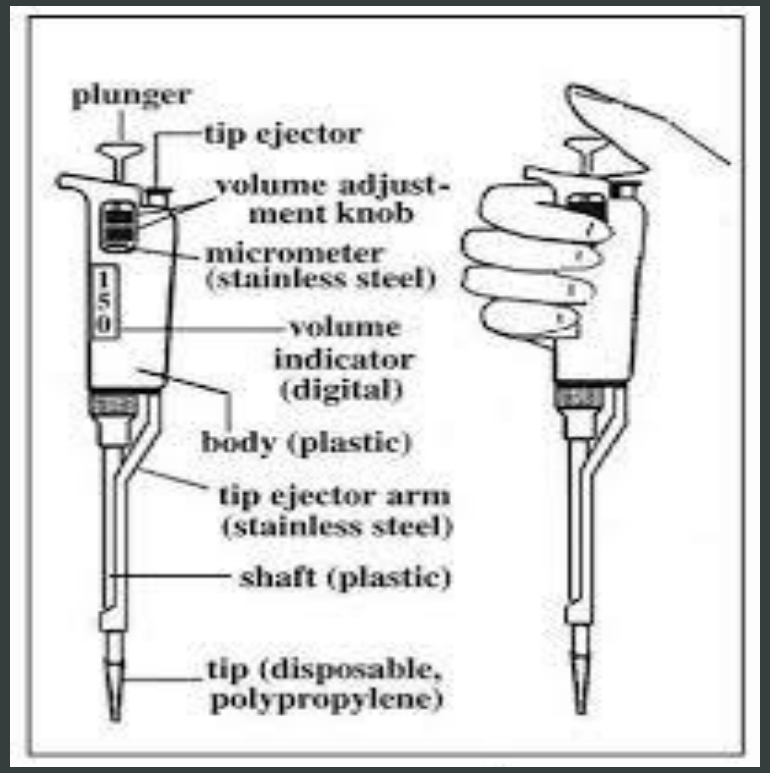
Techniques & instruments

Devices :

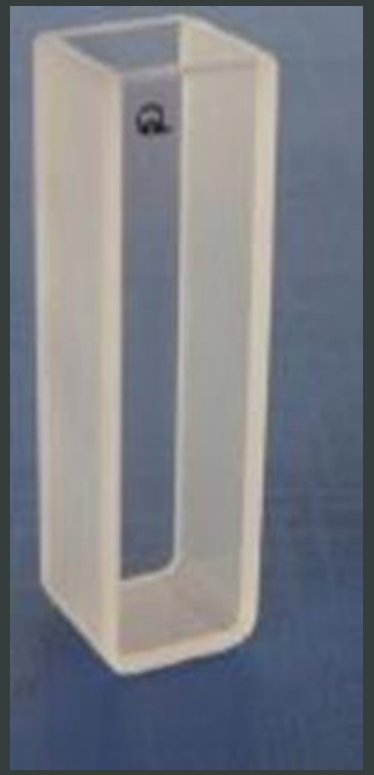
incubator

Centrifuge

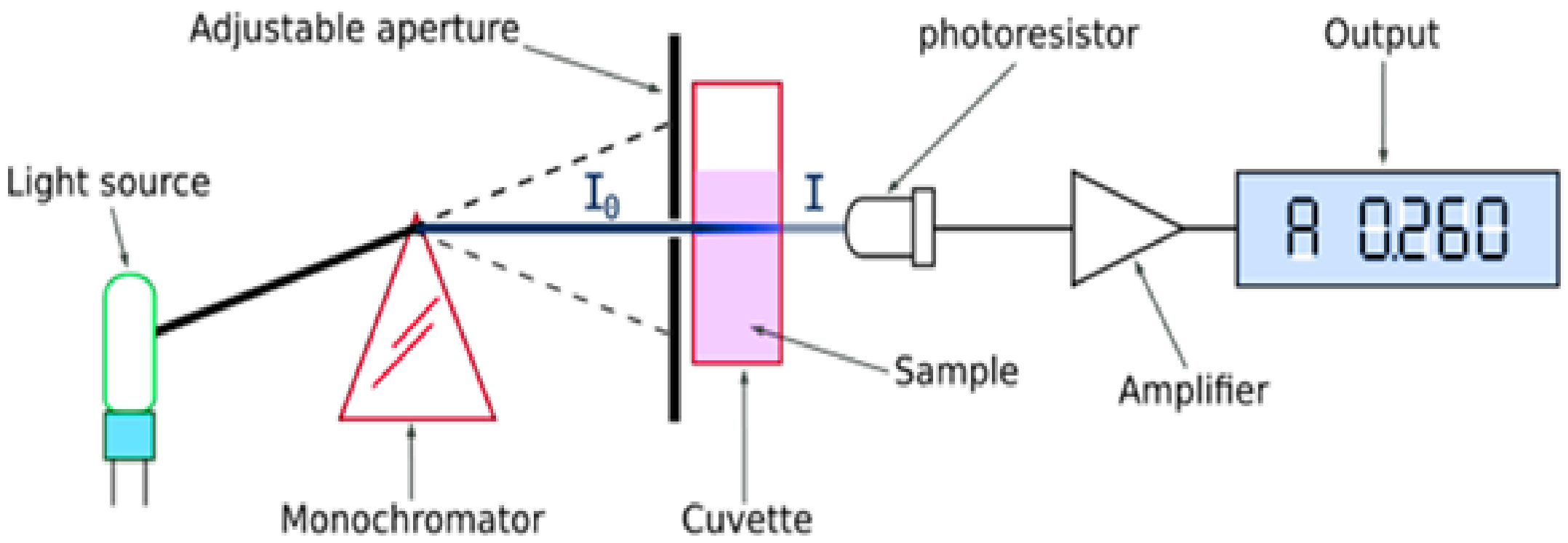
Micropipette



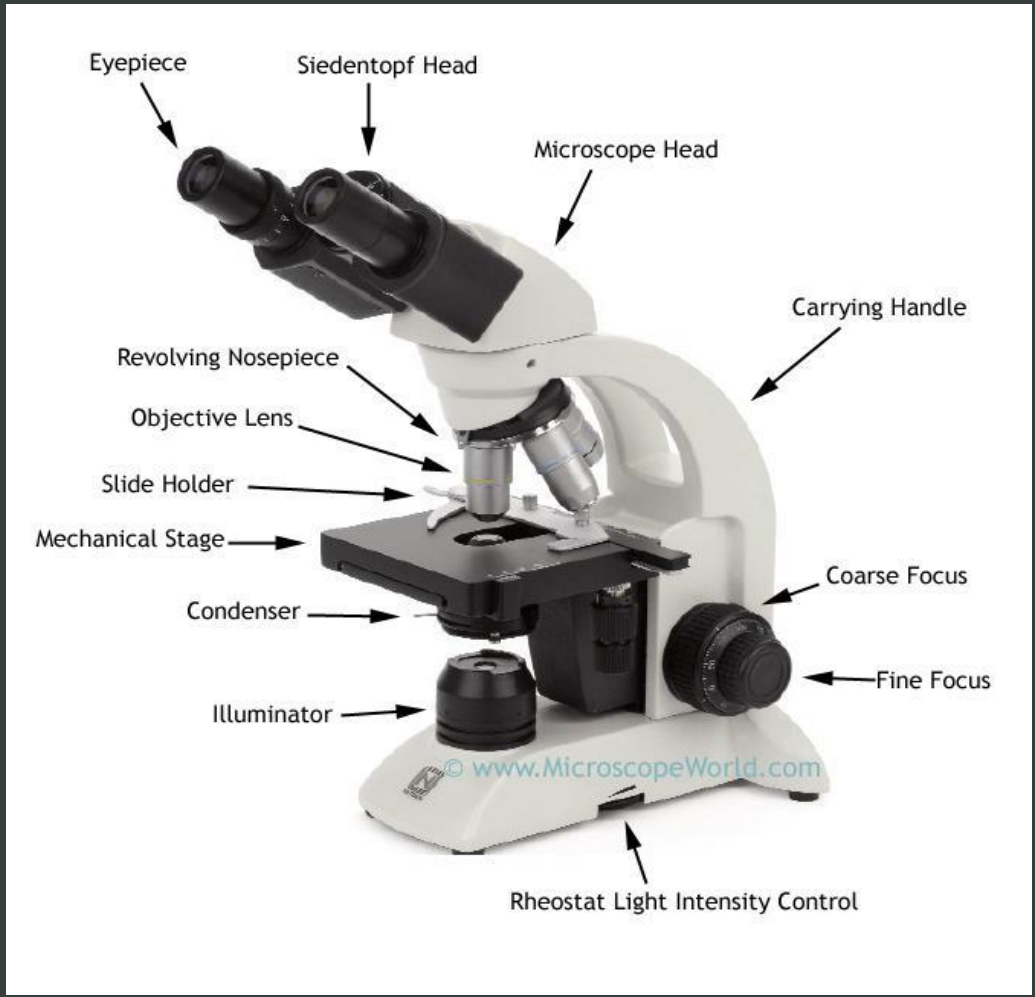
Chemistry



SPECTROPHOTOMETER



Hematology


Eyepiece
Siedentopf Head
Microscope Head
Carrying Handle
Revolving Nosepiece
Objective Lens
Slide Holder
Mechanical Stage
Coarse Focus
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That’s all for today ☺

Thanks for attention