16/ mhs06 /034

Mls 410: biomedical engineering

Assignment answers

**1**

**Physics of a light microscope**

The optical microscope, also referred to as a light microscope, is a type of microscope that commonly uses visible light and a system of lenses to generate magnified images of small objects. Optical microscopes are the oldest design of microscope and were possibly invented in their present compound form in the 17th century.

Light microscopes, in many of their configurations, are complex tools with many adjustable components. Good alignment is essential for good image quality, especially for quantitative studies. This chapter provides a few simple guidelines for the best alignment of all those components of a light microscope that can be focused or centered. A better understanding of the function of these components and how their control influences the image has become critical for electronic imaging. Although analog or digital image processing can, to a small extent, compensate for poor mechanical and optical alignment, the best end result, free of artifacts, is derived from the best possible optical image. When all the microscope's controls are routinely set correctly, the video image will be at its best.

**Principles**

The light [microscope](https://www.sciencedirect.com/topics/nursing-and-health-professions/microscope) is an instrument for visualizing fine detail of an object. It does this by creating a magnified image through the use of a series of glass lenses, which first focus a beam of light onto or through an object, and convex objective lenses to enlarge the image formed. In the majority of light [microscopes](https://www.sciencedirect.com/topics/nursing-and-health-professions/microscope), the image is viewed directly through binocular eyepieces that act as a secondary lens in the form of a magnifying glass to observe the projected image. Such instruments are termed ‘compound microscopes,’ and the total magnification is the sum of the objective magnification and the eyepiece magnification. The magnification range extends from ×10 to ×1000, with a resolving power of the order of 0.2 μm, depending on the type and numerical aperture (area available for passage of light) of the objective lenses.

**Reflection**

When a ray of light strikes a surface at an angle and it bounces back at an angle of equal size, it is said to be reflected. Reflection not only occurs when light passes through air and strikes an object, but it also when strikes an interface between air and glass. Stray reflections inside the microscope interfere with the parts of light rays and degrade the sharpness of the image.

Light they emit, or, more often, by the light they reflect. Reflected light obeys the law of reflection, that the angle of reflection equals the angle of incidence.



**Refraction**

Refraction of light is an important aspect in the physics of lenses, especially with regards to how a single lens or multi-lens system is designed and constructed. In a simple convex lens, light waves reflected from the object are collected by the lens and refracted towards the optical axis to converge on the rear focal point.

Refraction is simply depending of light ray from the normal when it passes into different optical medium .a normal line is the line perpendicular to the flat surface. Refraction is caused by changes in the speed of light while passing from one medium into another of different optical density.

**INDEX OF REFRACTION**

n=CV



**2**

**A: centrifuge**

**Principle**

The principle is that the centrifuge exerts a centrifugal force (CF),which is greater than that of gravity ,and causes particles in a fluid to sediment .the greater CF, the faster and more effective the sedimentation. This centrifugal force, which is outward pull due rotation, is relative to the speed of centrifuging in revolutions per minute (rpm).the actual sedimentation achieved, however, depends on the radius of the centrifuge. The radius of the centrifuge distances between the center of the centrifuge shaft and the tip of the centrifuge tube. The relative centrifugal (RCF) is calculated from the knowledge of the rpm and the radius (r);

RCF=rw^2

 g

Where:

{\displaystyle \textstyle g}g: is earth's [gravitational acceleration](https://en.wikipedia.org/wiki/Standard_gravity),

{\displaystyle \textstyle r}r: is the rotational radius,

{\displaystyle \omega }w: is the [angular velocity](https://en.wikipedia.org/wiki/Angular_velocity) in radians per unit time

RCF (g) =1.12×10^5=r (in cm) × (rmp) ^2

**Brand**

* Brand: Esel : Clinical Centrifuge
* STANDARD STEEL:s TANDARD STEEL Mild Steel Doctor Centrifuge Machine,
* DIDAC: Laboratory Centrifuge, Speed: 5200 RPM
* Remi: REMI Refrigerated Centrifuges PLUS, Capacity: 1200 ml

**Care and maintenance**

1. Clean the **centrifuge** daily, or at least weekly.
2. Remove the rotor and any sample or container holders.
3. Interior cleaning includes the interior bucket, specimen holder, rotor and supports.
4. Use a sponge, warm water and a mild detergent such as dishwashing liquid.

**Cost**

Range price depending on brand $1500-$10,300

B

**Automatic tissue processor**

**Principle**

The tissue basket oscillates up and down in each station at three-second intervals to ensure thorough and even mixing of the reagents and optimum tissue infiltration. Infiltration time is separately programmable for each station. Up to nine programs may be run with immediate or delayed starting times. When it’s time for tissue to be transferred to the next beaker or jar, the cover of the machine is raised up, and the lifting mechanism carefully removes the tissue basket and gently transfers it to the next beaker When the infiltration time for any particular station is exceeded, a warning message will display, indicating the station number and excess time. Controls are arranged by functionality with an LCD to indicate operational parameters. Reagent container lids have seals to minimize operator exposure to hazardous fumes. Tissue basket immediately immerses in a station in the event of power loss to protect samples from drying out. When power is restored, program will resume. In the event of long-term power failure, wax is liquefied. Capacity of tissue basket is 80 cassettes. Vacuum configurations hasten infiltration, allowing pressure to be applied to any station in either manual or automatic operation. Fume control configurations extract fumes with a fan and pass them through an internal carbon filter. For added efficiency, these models feature a two-part containment shield surrounding the reagent container platform.

**BRANDS**

* Leica tp 1020 automatic tissue processor
* Excelsior AStissue processor
* Kedee-ts6b ,automatic vacuum tissue processor

**Care and maintance**

1. Any spillage or overflow should be cleaned immediately.
2. Accumulation of wax on any surface should be cleaned
3. The temp of the paraffin wax bath should be set at 36℃ above the melting point of wax
4. Timings should be checked when placing the cassettes in the processor

**Cost**

Ranging from $6,550.00-$14,800 depending on the brand

C

**Microtome**

**PRINCIPLE:**

 Microtome is a sectioning instrument that allows the cutting of extremely thin slices of a material known as section. Microtome are used in microscopy, allowing for the preparation of sample for observation under transmitted light or electrons radiation. It is a method for the preparation of thin section for materials such as bones, minerals, and teeth.

This device operates with a staged rotary action such that the cutting is part of the rotary motion. In a rotary microtome, blade is fixed in horizontal position. through the motion of the sample holder, the sample is cut by the knife position , at which point the fresh section remains on the knifes , at the highest point of the rotary motion , the sample holders is advanced by the same thickness as the section that is to be made , allowing for the next section to be made.

The flywheel is many microtomes can be operated by hands. This has the advantages that clean cut be made, as the relatively large mass of the fly wheel prevents the sample from being stopped during the sample cut. It cuts thickness between 1 and 60 micron meter. For hard material, its cits a semi thin section with a thickness of as low as .5 micron meter.

**Brands**

Leica microtomes.

Leica microtome cryostats.

Thermo Scientific laboratory shakers.

**Care of microtomes**

* Cover properly
* Avoid rust
* Removing of wax
* Applying oil
* Cleaning of metallic parts

**Cost**

Range $1500-$10,300

References

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