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MLS 410 ASSIGNMENT

1. A light microscope is a biology laboratory instrument or tool that uses visible light to detect and magnify very small objects, and enlarging them. They use lenses to focus light on the specimen, magnifying it thus producing an image. The specimen is normally placed close to the microscopic lens. Microscopic magnification varies greatly depending on the types and number of lenses that make up the microscope. Depending on the number of lenses, there are two types of microscopes i.e. Simple light microscope (it has low magnification because it uses a single lens) and the compound light microscope (it has a higher magnification compared to the simple microscope because it uses at least two sets of lenses, an objective lens, and an eyepiece). The lenses are aligned in that, they can be able to bend light for efficient magnification of the image. The functioning of the light microscope is based on its ability to focus a beam of light through a specimen, which is very small and transparent, to produce an image. The image is then passed through one or two lenses for magnification for viewing. The transparency of the specimen allows easy and quick penetration of light. Specimens can vary from bacterial to cells and other microbial particles.

 As mentioned earlier, light microscopes visualize an image by using a glass lens and magnification is determined by, the lens’s ability to bend light and focus it on the specimen, which forms an image. When a ray of light passes through one medium into another, the ray bends at the interface causing refraction. The bending of light is determined by the refractive index, which is a measure of how great a substance slows the speed of light. The direction and magnitude of the bending of the light are determined by the refractive indexes of the two mediums that form the interface. A medium with a lower refractive index such as glass to air, it normally speeds up the light penetration and making light bend away from the normal and when light is passed through a medium with a greater refractive index such as air to glass, it normally slows down and bends towards the normal, perpendicularly to the surface. If an object is put between these two mediums i.e. between water and air, in this case, a prism, the prism will bend the light at an angle. This is how the microscopic lenses work, they bend the light at an angle. The lens (convex) on receiving the light rays, it focuses the rays at a specific point known as the focal point (F-point). The measure of distance from the center of the lens and the focal point is known as the focal length. A microscope uses lenses whose strength is predetermined, in that, the strength of a lens is directly related to the focal length i.e. short focal length magnifies objects more than lenses with a long focal length.

 Microscopy works strictly with a factor of resolution whereby resolution being the ability of a lens to be able to differentiate small objects that are closely packed together. The resolution of a light microscope is determined by a numerical aperture of its lens system and by the wavelength of the light it employs; a numerical aperture a definition of the light wavelengths produced when the specimen is illuminated. A minimum distance (d) between two objects that distinguishes then to be two separate entities, determined by the wavelengths of the light can be calculated by an Abbe equation using the wavelength of the light that illuminated the specimen (Lambda, λ) and the numerical aperture (NA, n sin Ɵ) i.e. d=0.5 λ/n sin Ɵ.

 

2.)

 A.) CENTRIFUGE

 A centrifuge is a laboratory device that is used for the separation of fluids, gas or liquid, based on density. Separation is achieved by spinning a vessel containing material at high speed; the centrifugal force pushes heavier materials to the outside of the vessel. This apparatus is found in most laboratories from academic to clinical to research and used to purify cells, subcellular organelles, viruses, proteins, and nucleic acids. There are multiple types of centrifuge, which can be classified by intended use or by rotor design.

PRINCIPLE

* In a solution, particles whose density is higher than that of the solvent sink (sediment), and particles that are lighter than it floats to the top.
* The greater the difference in density, the faster they move. If there is no difference in density (isopycnic conditions), the particles stay steady.
* To take advantage of even tiny differences in density to separate various particles in a solution, gravity can be replaced with the much more powerful “centrifugal force” provided by a centrifuge.
* A centrifuge is a piece of equipment that puts an object in rotation around a fixed axis (spins it in a circle), applying a potentially strong force perpendicular to the axis of spin (outward).
* The centrifuge works using the sedimentation principle, where the centripetal acceleration causes denser substances and particles to move outward in the radial direction.
* At the same time, objects that are less dense are displaced and move to the center.
* In a laboratory centrifuge that uses sample tubes, the radial acceleration causes denser particles to settle to the bottom of the tube, while low- density substances rise to the top.

CARE AND MAINITENANCE

 There are several important cleaning and safety procedures that should be used to ensure a centrifuge works properly. First, you should clean your centrifuge daily. This includes cleaning both the exterior and the interior of the centrifuge. A sponge, warm water, and a mild detergent can be used to clean the centrifuge. Do not use caustic detergents or a product that contains chlorine ions. A plastic scrub brush should be used to avoid damaging the coatings. When you are finished cleaning the centrifuge you should use a centrifuge lubricant to lubricate the bucket grooves and rubber seals. You should also use approved disinfectants and/or “spill” kits to disinfect the centrifuge on a regular basis. In addition to cleaning the centrifuge, you should also check for residue and corrosion on the rotors on a weekly or monthly basis.

 Scheduling regular preventive maintenance with a trained technician for your centrifuge is vital because it increases the durability and functionality of the centrifuge. Regular preventive maintenance also ensures accurate results and reliable performance, which will benefit your research. Regular preventive maintenance includes the inspection of the physical condition, inspection of the electrical condition, cleaning, and testing of the centrifuge.

COST

 The cost of a standard centrifuge is between ₦15,000 to ₦100,000.

B.) AUTOMATIC TISSUE PROCESSOR

 This processor is used to process animal and human tissues automatically. It is accurate and easy to use and maintain. It is an excellent choice for histology and pathology labs of hospitals and research institutions. This automatic tissue processor combines proven technology and modern design, for automated animal and human tissue processing. There are twelve cylinders in this device, nine glass cylinders and three wax cylinders which are twelve processing stages.

PRINCIPLE

 The time required for tissue processing may be considerably reduced when tissue is suspended in fluid, continuously agitated, moved from one reagent to another whenever desired, not restricted by working hours. Processors are configured with preset interval for different schedules of suspension, agitation, and automatic changeover.

CARE AND MAINTENANCE

* Any spillage or overflow should be cleaned immediately.
* Accumulation of wax on any surface should be removed.
* The temperature of the paraffin wax bath should be set to 30C above the melting point of wax.
* Timings should be checked when placing the cassettes in the processor.

COST

The cost of a standard automatic tissue processor is between ₦1,500,000 to ₦2,000,000.

C.) MICROTOME

 Microtome is an instrument with the help of which sections of tissues are cut and the process of cutting thin sections is known as Microtomy. The thickness of sections produced during microtomy may be between fractions of 50-100 nm, in ultramicrotomy, to several 100 microns. The common range is between 5-10m but both the maximum and minimum thickness is limited by the consistency of relation of the thickness of sections to the nature of tissues. These sections are stained using suitable staining techniques followed by observing them under the microscope. The types include rotary microtome, sliding or base sledge microtome, Cambridge rocking microtome, freezing 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.

CARE AND MAINTENANCE

 The microtome knife/blade can be a hazard in the laboratory. Personnel should be made aware of the dangers and observe the following warnings:

 a.) DO NOT leave the microtome unattended with an exposed knife/blade in position. Remove the knife/blade, or cover with the guards or visor provided.

 b.) DO NOT leave unboxed knives/blades lying around. Place knives/blades that are not in use in their boxes or packets.

 c.) DO NOT carry knives/blades unless secure in the box or packet provided.

 d.)DO NOT clean the knife/blade along its length. Wipe the knife/blade from the back edge to the cutting edge.

 e.) REMEMBER that even used knives and blades are dangerous. They are still sharp and may have been used to cut potentially infectious specimens.

 f.) DISPOSE of used knives and blades with the same care as other sharp objects. On no account should use knives or blades be placed in waste bins.

COST

 The cost of a standard microtome is between ₦780,000 to ₦936,000.