Summer – 16 EXAMINATION

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the *model answer scheme.*

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1A Attempt any three. **(12)**

a) State and explain Beer lamberts law. Give the two equipment based on it.

(State 02 mark, 02 marks for two application)

Ans: Beer lamberts law:

The amount of energy absorbed or transmitted by a solution is proportional to the solution's molar absorptivity and the concentration of solute. In simple terms, a more concentrated solution absorbs more light than a more dilute solution does. Mathematical statement of Beer's law is $A = \varepsilon lc$, where: A = absorption; ε = molar absorptivity (amount of energy absorbed per moleof substance dissolved), l = path length (the thickness of the solution), and c = concentration of the solution.

Equipment based on Beer lamberts law:

1) Colorimeter 2) Spectrophotometer. 3) Flame photometer 4) Glucose meter.

b) State (Any 04 points) Give constructional diagram of any one sterilizer.

(Importance of sterilizer-02 marks, Diagram -02marks)

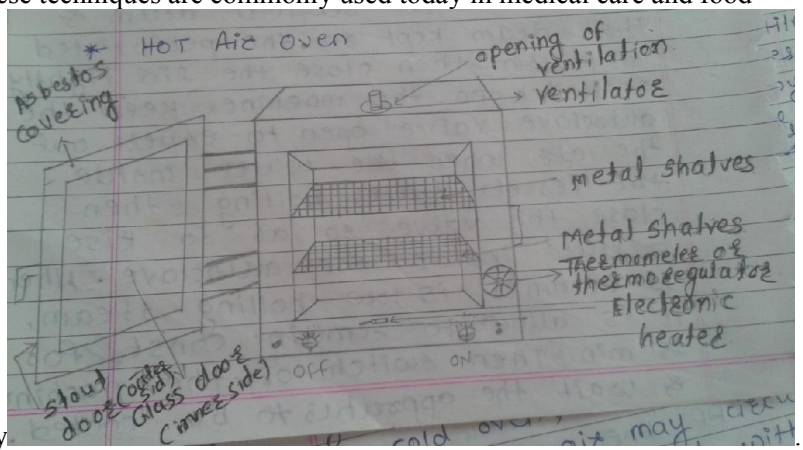
Ans: Importance of sterilization

1 Sterilization is a process in which all the living microorganisms, including bacterial spores are killed.

2. Sterilization can be achieved by physical and chemical methods.

3. A method employed to minimize the growth of organisms and transmission of disease from one individual to another.

4. In the environment the use of disinfection techniques decreases the growth of bacteria on surfaces, which leads to the decrease in transmission of organisms amongst the population.

These techniques are commonly used today in medical care and food industry 

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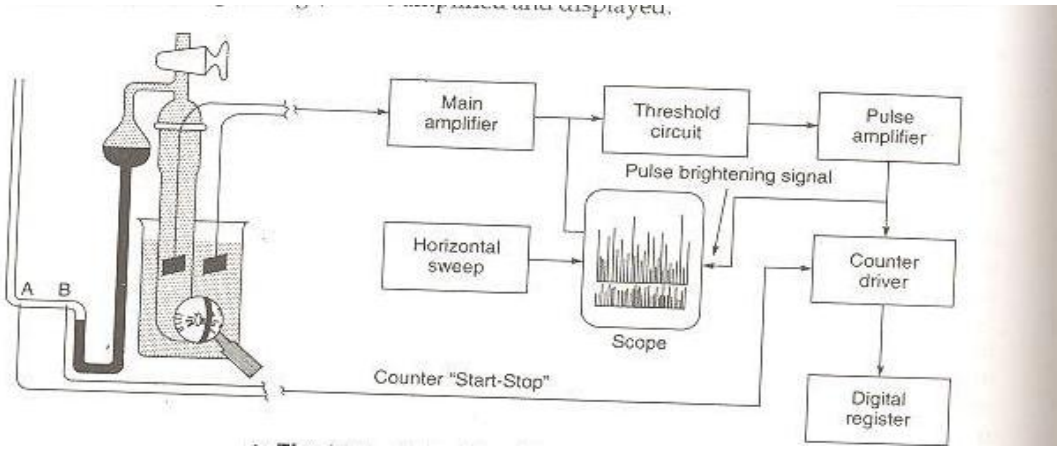
Note: Any sterilizer should get the mark.

c) State the working principle of electro conductive blood cell counter with the help of it's constructional diagram

(02marks for diagram; 02 marks for principle)

Ans: Blood cell counters operating on the principle of conductivity change which occurs each time a cell passes through an orifice are generally known as coulter counters. The technique is extremely useful for determine the number and size of the particles suspended in an electrically conductive liquid.

The principle of the measurement is that blood is a poor conductor of electricity whereas certain diluents are good conductors. For a cell count, blood is diluted and the suspension is drawn through a small orifice. By means of a constant current source a direct current is maintained between two electrodes located on either side of the orifice. As a blood cell is carried through the orifice, it displaces some of the conductive fluid and increases the electrical resistance between the electrodes. A voltage pulse of magnitude proportional to the particle volume is thus produced. The resulting series of pulses are electronically amplified, scaled and displayed on a suitable display



d) Draw constructional diagram of TEM, label the different parts

(04 mark for complete diagram)

Ans:

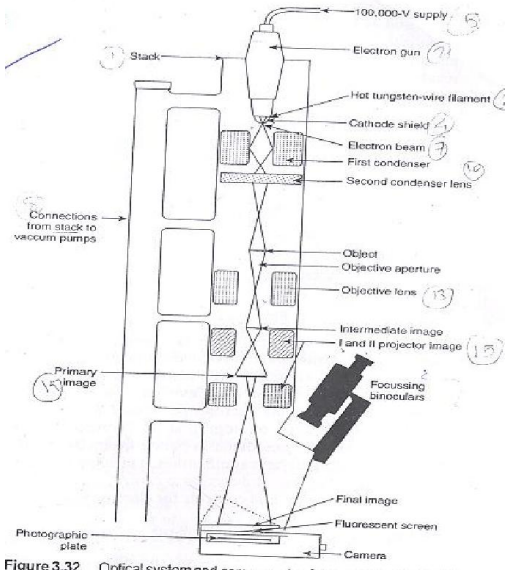


Figure 3.32 Optical system and ...

B) Attempt any one **(06)**

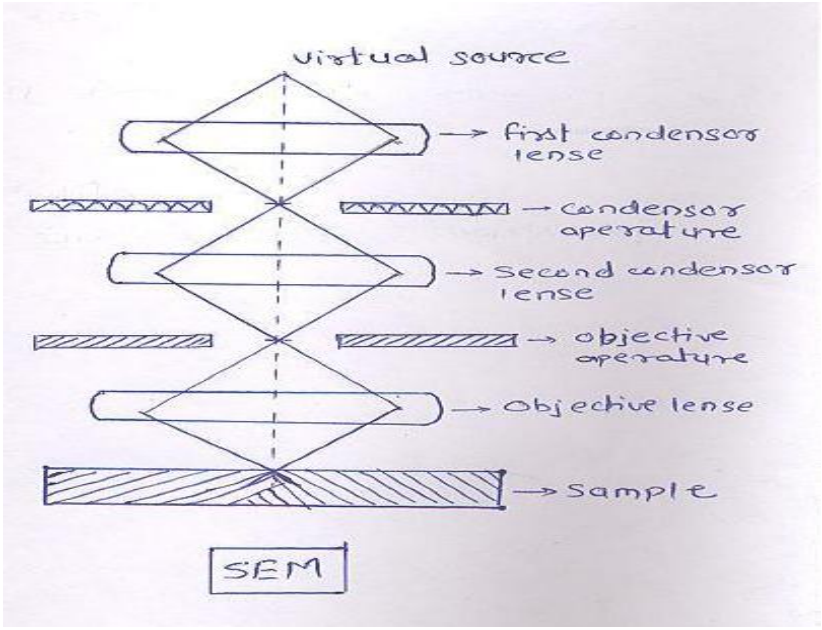
a) With the help of suitable diagram explain the working of SEM.

(Diagram- 04 marks; Explanation -02 marks)

Ans: Working: Description:

With the help of SEM we can get three dimensional image of a cell.

In SEM, the electron beam does not pass through the SEM instead of this the surface of the cell is coated with heavy metal and beam and electrons is used to scan across the specimen. Electrons that are scattered are collected to generate a 3 dimensional image as the electron beam moves across the cell because the resolution of the scanning electron microscopy is only about 10 mm is used



b) State the principle of autoclave. List four applications of the same.

(Principle- 02 marks.; four applications -4 marks)

Ans:Principle: Autoclaves work in a similar way, like pressure cooker but they're typically used in a more extreme form of cooking: to blast the bugs and germs on things with steam long enough to sterilize them. The extra pressure in an autoclave means that water boils at a temperature higher than its normal boiling point—roughly 20°C hotter—so it holds and carries more heat and kills microbes more effectively. A lengthy blast of high-pressure steam is much more effective at penetrating and sterilizing things than a quick wipe in ordinary hot water!

Application: 1.Autoclaves are widely used to cure composites and in the vulcanization of rubber.

2. Autoclaves are used for pre-disposal treatment and sterilization of waste materials.

3. Autoclaves are used to sterilize the equipment's in the hospitals.

4. Autoclaves are also used for sterilization of materials like gowns, dressing, gloves, ect

Q.2. Attempt any four of the following. 16 mark

a) Define chromatography and electrophoresis. Give two example of each.

(Define-02 marks, Example- 02 Marks)

Ans:.1)Chromatography: Chromatography is a physical method of the separation of the components of mixture by distribution between two phase of which one is stationary which is having large surface area and other is fluid phase that percolate through the stationary phase

Eg:1)Gas Chromatography 2)Liquid Chromatography

2) **Electrophoresis:** is the motion of dispersed particles relative to a fluid under the influence of a spatially uniform electric field.

OR

The migration of charged colloidal particles or molecules through asolution under the influence of an ap plied electric field usually providedby immersed electrodes. Also called *ionophoresis, apheresis.*

A method of separating substances, especially proteins, and analyzingmolecular structure based on the r ate of movement of eachcomponent in a colloidal suspension while under the influence of an electric field.

Eg.1) Paper Electrophoresis

2) Cellulose Electrophoresis

3) Gel Electrophoresis

4) Micro immune Electrophoresis

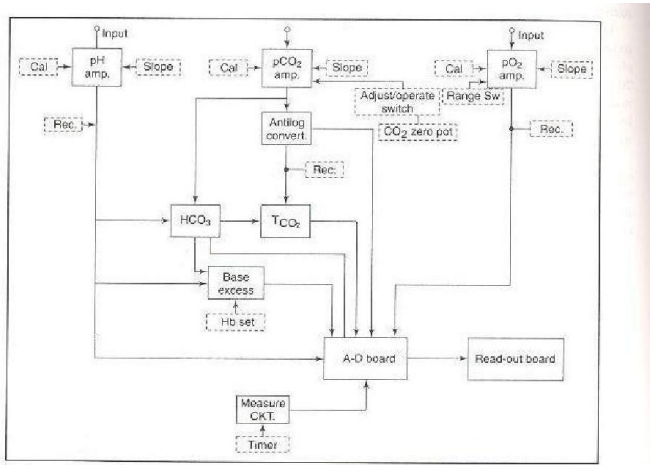
5) Thin layer Electrophoresis

b) State different types of cells present in the blood .Draw constructional diagram of blood gas analyzer. Label it.

(Describe -02 marks Diagram -02 marks)

Ans: A **blood cell**, also called a **hematopoietic cell**, **hemolytic**, or **hepatocyte**, is a cell produced through hematopoiesis and found mainly in the blood. In mammals, these fall into three general categories:

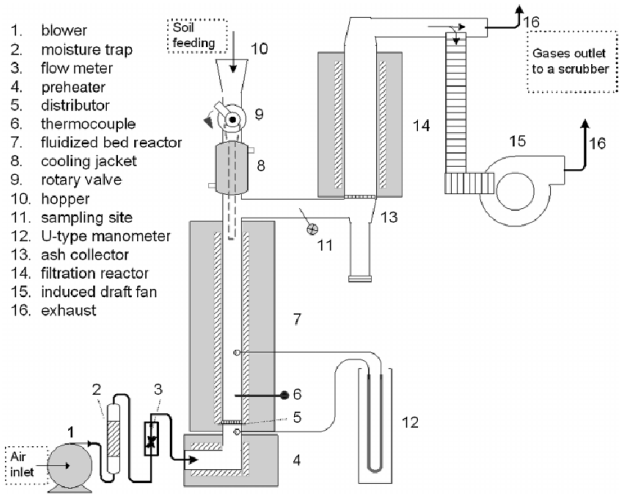
- Red blood cells – Erythrocytes: It primarily carry oxygen and collect carbon dioxide through the use of hemoglobin, and have a lifetime of about 120 days.
- White blood cells – Leukocytes are cells of the immune system involved in defending the body against both infectious disease and foreign materials. :
- Platelets – Thrombocytes.- yellow blood cells, are very small, irregularly shaped clear cell fragments (i.e. cells that do not have a nucleus containing DNA), 2–3 μm in diameter, which derive from fragmentation of precursor megakaryocytes.
- Block diagram of blood gas analyzer:



c) Draw labeled diagram of incinerator.

(Diagram -04 marks,)

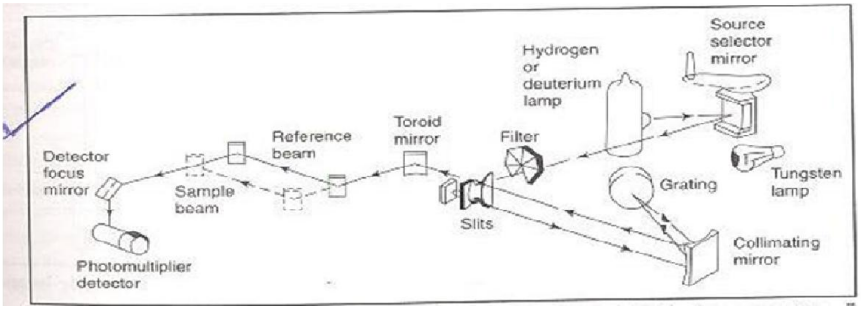
Ans:



Note: Any other diagram related to this should be considered.

d) Draw constructional diagram of dual beam spectrophotometer and give it's working (Diagram -02 marks; Working -02 marks)

Ans:

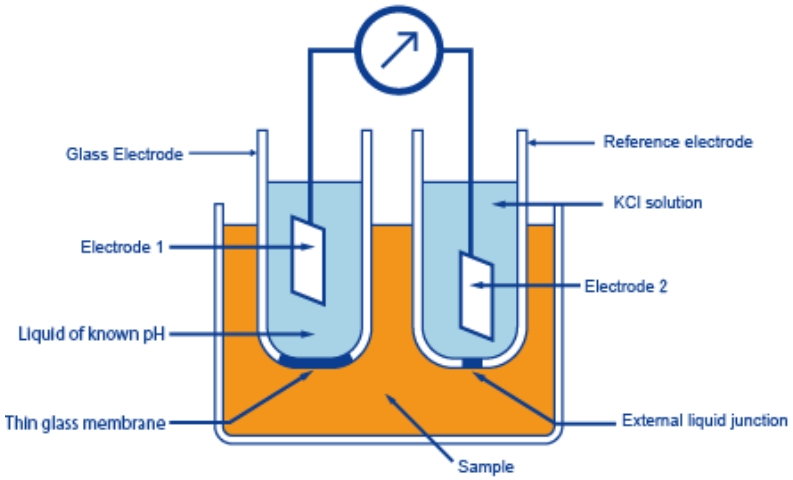


Working: Energy of appropriate wavelength is produced by the appropriate source lamp. This energy is converted to monochromatic light by using filter-grating optical system. The filters are necessary to eliminate unwanted orders from the gating. Six different filters cover the wavelength regions from 300 to 900nm.The filter wheel is driven by a dc motor, which is synchronized with the wavelength cam.

As the wavelength cam moves, it causes the filter motor to drive till the correct filter comes into position. The wavelength cam drives the wavelength arm which causes the grating to pivot on its own axis. It causes the wavelength of light coming out of the monochromatic to change. The monochromatic light is then directed to the sample and reference via a vibrating mirror bridge, which vibrates horizontally at a certain frequency. This bridge allows light to pass into sample and reference cell holders alternately, with a frequency equal to displacement frequency of the bridge. The vibrating bridge is controlled by the bridge drive circuitry. The reference and sample pulse train is then passed to the photomultiplier tube, which converts the monochromatic light pulses to current pulses.

e) State the procedure for measurement of PH of blood.
(procedure-04 Marks)

Ans:



Procedure for blood PH measurment:
1) First take syringe electrode.
2) Take 20 to 25 microliter. Of blood
3) The electrode is enclosed in a water jacket, with a circulating water at 38 degree. The water contains one percent nacl
4) The reference electrode is connected to a small pool of saturated KCL.
Accuracy of 0.001ph is achived with the help of this technic.

The measurement set up is as shown.

f) State the working principle of PAGE.

Ans: **Polyacrylamide gel electrophoresis** working principle: PAGE is working upon the principle in which, the charged molecule will migrate towards the oppositive charged electrode through highly cross linked matrix. Separation occurs due to different rates of migration occurs by the magnitude of charge and frictional resistance related to the size.

PAGE (Polyacrylamide Gel Electrophoresis), is an analytical method used to separate components of a protein mixture based on their size. The technique is based upon the principle that a charged molecule will migrate in an electric field towards an electrode with opposite sign. The general electrophoresis techniques cannot be used to determine the molecular weight of biological molecules because the mobility of a substance in the gel depends on both charge and size. To overcome this, the biological samples needs to be treated so that they acquire uniform charge, then the electrophoretic mobility depends primarily on size. For this different protein molecules with different shapes and sizes, needs to be denatured(done with the aid of SDS) so that the proteins lost their secondary, tertiary or quaternary structure .The proteins being covered by SDS are negatively charged and when loaded onto a gel and placed in an electric field, it will migrate towards the anode (positively charged electrode) are separated by a molecular sieving effect based on size. After the visualization by a staining (protein-specific) technique, the size of a protein can be calculated by comparing its migration distance with that of a known molecular weight ladder (marker).

Q.3 Attempt any four **(16)**

a) Describe working of flame photometer with suitable diagram.

(Diagram- 02 marks, Working- 02 marks)

Ans:

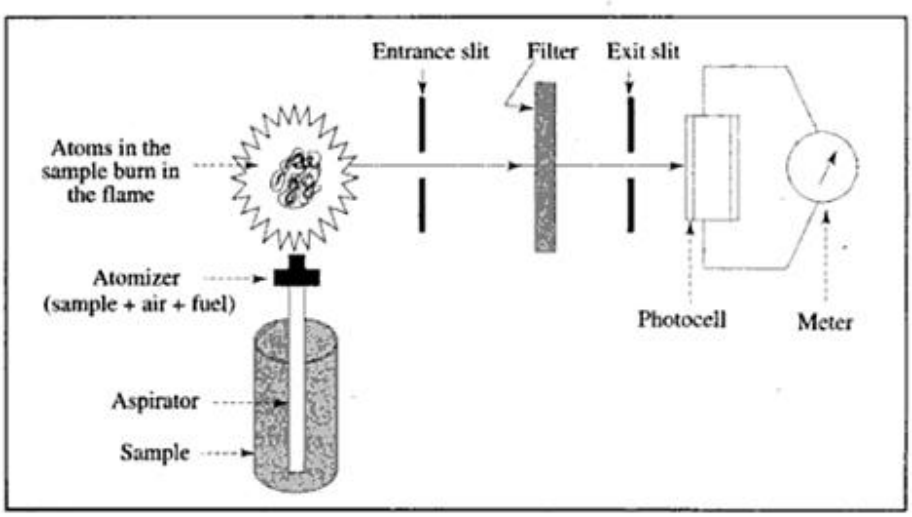


Fig. 7.1 *Working principle of a flame photometer*

Working: The working principle of Emission Flame Photometry is that using compressed air, the diluted sample (often 1:100 or 1:200) is sprayed as fine droplets into a non-luminous gas flame which becomes colored by the characteristic emission of potassium metallic ions in the sample. Using a light filter or prism system, the light of wavelength corresponding to the metal being estimated, is selected. The amount of light emitted depends on the concentration of metallic ions present in the sample.

Basic Constituents of a Flame Photometer:

1. Nebulizer
2. Mixing chamber with baffles
3. Burner
4. Photosensitive element
5. Wavelength selector

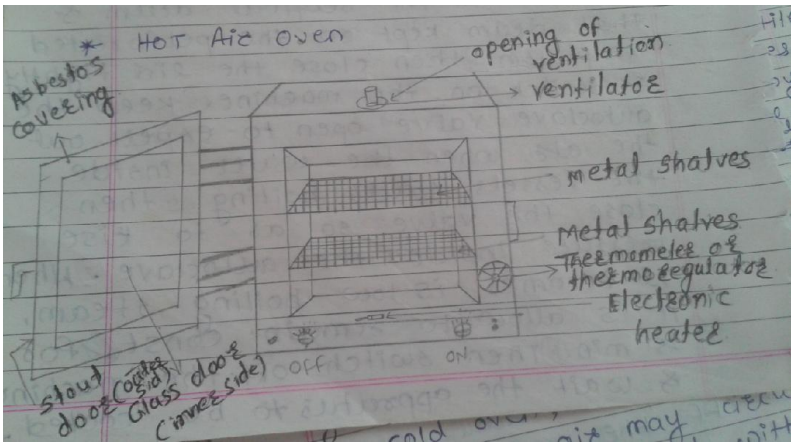
b) **Draw constructional diagram of hot air oven and give two applications of it.**
(Diagram-02 Marks; Applications -02 Marks)

Ans: **Construction**:- It is double walled still glass l chamber with a stout outside & glass door inner side .outer door covered with asbestos covering. The inner sides of the hot air oven have one or more perforated metal shalves**.**

Application:

1. Hot air ovens are electrical devices used in sterilization. It uses dry heat to sterilize articles.

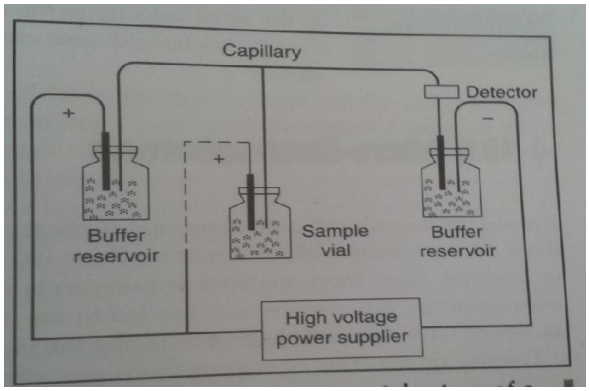
2. These are widely used to sterilize articles that can with stand high temperatures and not get burnt like glass wares and powders.



c) **Explain working principle of the capillary electrophoresis. Give two specifications.**

(Working principle-02 Marks; two specifications)

Ans: Fig shows the basic instrumental set of a capillary electrophoresis apparatus .It consist of high voltage power supply (0 to 30KV), a fused silica (s1 o2) capillary ,two buffer reservoirs ,two electrodes ,and an on column detector. Sample injection is done by temporarily replacing one of the buffer reservoirs with a sample vial. A specific amount of sample is introduced by control lining either the injection voltage or the injection pressure. Capillary are typically of 50 micrometer inner diameter and 0.5 to 1 m in length. Capillary electrophoresis uses an electromotive force rather than the pump, to drive the mobile phase through the capillary. Due to electro-osmotic flow, all sample components migrates towards the negative electrode. A small volume of sample (10 nl) is injected at the positive end of the capillary and the separated components are detected near the negative end of the capillary



Specifications:

1. Pressure system

Programmable with – 100 to +100mbar on inlet flushing with 1bar or high pressure 2 – 12bar

Vial pressurization with high pressure 2 – 12bar on inlet and outlet.

2. Power Requirements

Line voltage & line frequency 230 V, 50Hz

3. Temperature – 5 to 40 ^{0}C

4. Humidity

Up to 80% relative humidity at 31^{0}C

5. Detector – Real time UV –visible diode aryy detector.

d) **State two applications of the following analytical equipment**.

1) Colorimeter

2) Autoanalyser

3) Freezer

4) Autoanalyser

(½ Mark each application)

Ans: 1) Colorimeter:

01. Chemistry section deals with the analysis of blood, urine, cerebrospinal fluid ((csf) and other fluids determine the quantity of various important substances they contain.
02. Hematology section deals with the determination of the number and characteristics of the can statements of the constituents of the blood particularly the blood cells.
03. Microbiology section is which studies are performed on various body tissues and fluids to determine the presence of pathological miro-organisms

2) Autoanalyser:

1.These instruments typically determine levels of albumin, alkaline phosphatase, aspartate transaminase (AST), blood urea nitrogen, bilirubin, calcium, cholesterol,creatinine, glucose, inorganic phosphorus, proteins, and uric acid in blood serum or other bodily samples.

2. Auto analyzers are also commonly used in soil testing laboratories,

3. Fertilizer analysis,

4. Process control, seawater analysis, air contaminants,

5. Tobacco leaf analysis.

3) Freezer:

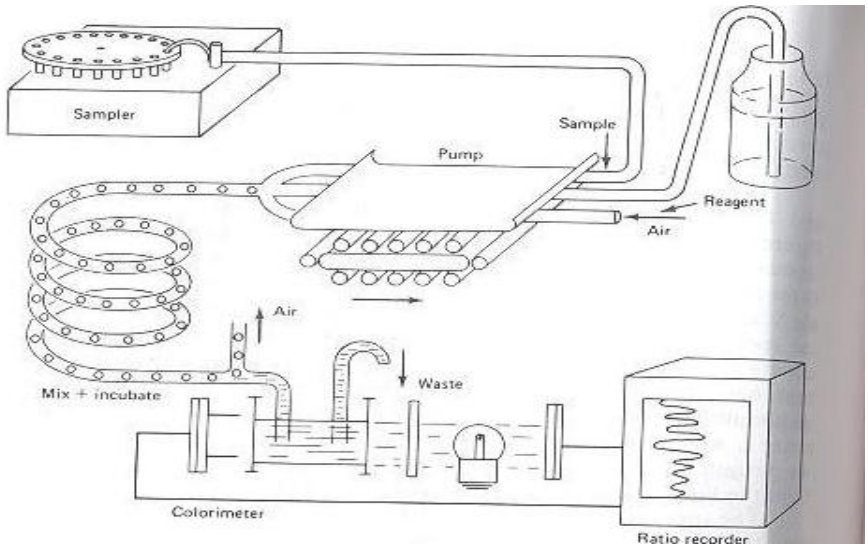
1. For maintaining temperature of medicine.

2. For maintaining blood samples.

e) **Draw and explain the working principle of Autoanalyser.**

(Diagram-02 Marks; working principle-02 Marks)

Ans:



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Working: Working/Operation:-

1) Sampler:- It fits the sample into analyzer in a particular time sequence.
2) Proper pump:-It is basically a simple peristaltic pump working simultaneously on a number of with certain ratio of diameter is used to meter the sample & regent.
3) Mixing: - mixing is achieved by injecting air bubbles the mixture is incubated while flowing through heated coils. The air bubbles are removed & the solution finally throws the Cavite of colorimeter or is aspired in to flame photometer.
4) Recorder:- An electronic ratio recorder compares the output the reference & sample photocell. The recording shows the individual samples as peak s of a continuous transmittance or absorbance recording. T

The samples of a “run” are preceded by a number of standards that cover the useful concentration range of the test. The concentration of the samples is determined from the recording by comparing the peak o f the samples with the peaks of the standards. n this way the effects of errors are eliminated because they affect standards and samples in the same way. The smallest models of the Auto analyzer perform a single test at a rate up to 120 samples per hour. Large later models performs u[12 different tests on each of 90 samples per hour.

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