Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
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Question Bank

Analytical Instrumentation

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION

ENGINEERING

UNIT I

ONE MARKS:

1. Wavelength of NMR spectroscopy is: **0.6-10m**
2. Log of reciprocal of transmittance is**absorbance**.
3. Unit of absorbvity constant: **L/mol/cm**
4. Give the relation between transmittance and absorbance.
   Log (Po/P) = εbc
5. Science of colour measurement is known as **colorimetry.**
6. Single beam UV spectrometer is otherwise known as **Beckman instrument**.
7. Which of the following is not a detector?
   - Bolometer
   - Pyrometer
   - Nernst glower
   - Golay cell

   Ans: Nernst glower
8. Give the optimum range of glass prism monochromator.
   300mμ - 2μ
9. Name the type of IR spectrometer based on wavelength concept.
   Fourier transform IR spectrophotometer
10. How the sensitivity of ATR technique be improved?
    By use of the multiple interval reflection.

TWO MARKS:

1. Mention the parameters or properties of electromagnetic radiation?

- Wavelength
- Frequency
- Velocity
- Wave number
- Amplitude

2. Define wavelength?

It is the distance between the two successive peaks of waves.

3. Define frequency?

It is the number of waves per second.
Frequency=speed of light/wavelength

4. Define transmittance and absorbance?

Transmittance:

It is the ratio of the radiant power transmitted by a sample to the radiant power incident on the sample.

Transmittance $T=P/P_o$

Absorbance:

It is the negative logarithm of transmittance.

Absorbance $A=-\log_{10} T$

5. Define wave number?

It is the number of waves spread in a length of one centimeter. It is the reciprocal of wavelength.

$\tilde{\nu} = 1/\lambda$

6**. State Beer's law.**

The dependence of radiant power on the concentration of absorbing species can be given by Beer's law.

In p0/p=k''C

Where p0 is the radiant power at c=0 and
p is the radiant power at c=c and
c is the concentration of absorbing species

7. State the process involved in AAS.

The AAS phenomenon can be divided into two major processes

1. The production of free atoms from the sample
2. The absorption of radiation from an external source by these atoms

8. Name the types of detectors used for IR spectrometry.

1. Thermal detectors 2. Photon detectors

9. Define spectroscopy.

Spectroscopy is the measurement and interpretation of radiation
Emitted, scattered or absorbed by different atoms, molecules & other chemical species

10. Name the different types of spectrophotometers.

1. UV_ visible spectrophotometers.
2. Infrared spectrophotometers.
3. FIFR spectrophotometers.
4. Atomic absorption spectrophotometers.
5. Flame emission spectrophotometers

11. What are the light sources used for AAS?

1. Hollow cathode lamp
2. Electrode less discharge lamp

12. Give any two applications of flame emission spectrometry.

1. FES is used in the determination of trace metals in liquid samples.
2. FES finds wide application in agricultural and environmental analysis, industrial analysis of ferrous metal, alloy as well as glasses.

13. Specify the classification of IR region of spectrum.

1. Photographic region
2. Very near IR region (overtone region)
3. near IR region (vibration rotation region)
4. Far IR region (rotation region)

14. Name the instruments used in IR spectrometry.

1. IR radiation sources
2. Monochromators
3. Sample cells
4. Detectors.

15. Name few IR radiation sources.

1. Incandescent source
2. Nernst glower
3. Globar source
4. Mercury arc.

16. Give the advantages of grating monochromators?

1. Gratings can be made with materials like aluminum which are not affected by Moisture.
2. Grating monochromators can be used over wide wavelength ranges

17. Give 4 different techniques used for sampling of solids.

1. Solids run in solution
2. Solid film techniques
3. Null techniques
4. Pressed pellet technique

18. Name two different types of IR spectrophotometers?

1. Optical null method
2. Radio recording method
3. Attenuated total reflection method
4. Fourier transforms IR spectrophotometers

19. Give the advantages and disadvantages of Fourier transform IR spectrometers.

Advantages:

1. FIFR methods are faster than dispersive instruments and hence especially useful in situations that require fast repetitive scanning.
2. FIFR provides increased energy throughput.

Disadvantages:

1. It is expensive than sequential dispersive instruments
2. For the precise movement of the mirror computer is also needed.

20. Specify the major design requirements of monochromators.

1. Simplicity
2. Resolution
3. Spectral range
4. Purity of exiting radiation
5. Dispersion

21. Name the different mountings used in grating monochromators.

1. Littrow mounting
2. Ebert mounting
3. Czerny_turnermounting

22. List the various types of detector used in IR spectrometry?

1. Bolometers
2. Thermocouples
3. Thermistor
4. Golay cell
5. Pyroelectric transducer
6. Photoconductivity cell

23. Define colorimeter? Mention its types?

Colorimetry is the science of color measurements. It is widely employed in the industries and the laboratory to express color in numerical terms and to measure the color differences between the specimens.

Types:

1. Single beam colorimeter
2. Double beam colorimeter

24. Mention the parts of emission system in the flame photometers?

1. Fuel gases and their regulation
2. Atomizer
3. Burner
4. Flame

25. Mention the advantages of Beer's Law?

It can be applied to a medium containing more than one kind of absorbing substances provided there should not be any interaction among the various species.

Detail questions:

1. Explain absorption spectroscopy and derive Beer's law?
2. Explain the single beam and double beam spectrophotometers?
3. Explain the single beam and double beam instruments used in UV spectrophotometer?
4. Discuss about the sample preparation in the IR spectrophotometers if it is the solid sample?
5. Draw and describe the arrangement of the major parts of the single beam atomic absorption spectrophotometers?
6. Draw and explain the schematic diagram of the typical double beam IR spectrophotometers?
7. Derive the Beer's law and discuss the reasons for derivation of Beer's law?
8. With the neat diagram explain the principle of IR spectrophotometry and also discuss about the detectors used?
9. With the neat diagram explain the Fourier Transform Infrared Spectrophotometers?
10. Explain the flame emission photometers with its instrumentation?

UNIT III

ONE MARK:

1.Who was invented of chromatography **Russian botanist Mikhail Tswett.**

2.Volume of added mobile phase a series of peaks is obtained and this is called a **Chromatogram.**

3.Chromatogram can be useful for analysis of **Qualitative and quantitative.**

4.Relative migration rate is otherwise called as **Selective factor.**

5.Distribution constant is otherwise called as **Partition ratio.**

6.Retention by the stationary phase **Inner molecular force.**

7.The time takes after sample injection for **Analyte peak** to reach the detector is called **retention time**.

8.The distance between **Point of injection** and **peak maximum** on the recorder chart is called the retention distance.

9. **Total porosity**($\boldsymbol{\xi tot}$) is the ratio of the interstitial volume of the packing to volume of the packing to the volume of its total mass.

10.The porous packing of total porosity is **0.70to0.90**

11.Retention factor is otherwise called as **Capacitor factor.**

12. **Retention factor** is used to determine the migration rates of solutes on the column.

13.Retention factor can also defined as ratio of **Distribution constant** to **volumetric phase ratio.**

14.The dead volume is otherwise called as **dead space.**

15. **Average linear rate of solute migration** is the ratio of length of column packing to the retention time.

16. **CmVm** is equal to the molar concentration of solute in mobile phase multiplied by the phase volume.

17.General equation of solute migrate rate is $\mathbf{L/t_R}$.

18. **Efficency** of chromatography column increases as the plate number becomes greater and as the plate height become smaller.

19.Efficiencies in terms of plate numbers can vary from a **Few hundred** to **several thousands.**

20.The plate model supposes that the chromatographic column contains a large number of separate layers called **Theoretical plates.**

21.Resolution can be calculated by measuring **Retentiontime** and **Bandwidth**

22.Gas chromatography can be separation of **Volatileorganic** and **inorganic** compounds.

23.gas chromatography techniques is applicable for separation **of Low molecular weight** gaseous species.

24.Inlet pressure can be usually ranges from the gas chromatography are **10to50psi.**

25.Most commonly used gas in gas chromatography are **Hydrogen.**

26.Sample can be introduced into **Hot zone** column.

27.Chromatography column can be constructed by **metal tubing**.

28.The commonly used solid support material is **Diatomaceous earth**.

29.The heated bead forms a plasma having temperature in between **600°Cto800°C.**

30. **Chemiluminescence** detector is mainly used for the detection and determination of sulphur.

31.High pressure liquid chromatography produce pressure of **6000psi**.

32.How many types of pumps available for use with HPLC analysis? **3**

33.Chromatogram recording is usually done on the **selfbalancing type** potentiometric recorder.

34.Which type chromatography can be used to seperate the high pressure species? **HPLC**

35.Displacement type pumps have a volume of **250-500ml.**

TWO MARKS

1. Define chromatography. (NOV/DEC-2010)

Chromatography is a physical or chemical methods of separation in which two mutually immiscible phases are brought into contact; one is stationary and other is mobile. A sample introduced into a mobile phase undergoes repeated interactions through the column. At the end of the process, separated components emerge in the order of increasing with the stationary phase.

2. What are the different chromatography techniques*?* (DEC- 2009)

Gas chromatography

1.Gas-chromatography 2.Gas-solid

Liquid chromatography

1. Liguid-liquid 2.Liquid-solid

3. What is the use of chromatography ? (DEC-2009)

The position of the peak in the time axis are used to identify the components of the sample, the areas under the peaks provide a quantitative measure of the amount of each component.

4. Define selectivity. (NOV-2010)

Selectivity is a measure of the preference of a stationary phase for one solute over another and is expressed as

$\alpha = K_1 / K_2$

where K_1 and K_2 are distribution co efficient for two different solutes.

5. Define distribution constant. (NOV-2010)

Distribution constant or partition ratio can be defined as

$$K=C_S/C_M$$

where C_S is the molar concentration of the solute in the stationary phase and C_M is its molar concentration in the mobile phase.

6. Define retention time. (NOV/DEC 2010)
The time it takes after sample injection for theanalyse peak to reach the detector is called the retention time.

7. What is the advantage of HPLC? (DEC-2009)
Its sensitivity ready adaptability to accurate quantitative determination, its suitability to non volatile species or thermally fragile ones and applicability to substances like amino acids, drugs, pesticides, antibiotics, steroids, metal species etc....

8. List out some of the ideal characteristics of a detector. (NOV-2010)
a. Adequate sensitivity
b. Good stability and reproducibility
c. Linear response of the solutes over several orders of magnitude
d. Temperature from room temperature to 400^0C
e. Short response time independent of flow rate
f. High reliability and ease of use.

9. Define dead time. (DEC-2009)
The dead time(t_m(or)t_0) is the time required for a molecule of a mobile phase to pass through column.

10. What are the requirements for pumping system in HPLC? (APRIL/MAY -2011)
- The generation of power up to 600 psi.
- Moderate flow rate of ml/min.
- pulse free output.
- corrosion resistant components.
- pump should have small hold up volume.

11. Name any four detectors used in liquid chromatography (APRIL/MAY- 2011)
- Ultraviolet- visible spectra photo metric detector.
- Fluorescence detector.
- refractive index detectors.
- electrochemical detectors.

12. **What are the pumps used in HPLC? (APRIL/MAY-2011)**
- Reciprocating piston pumps
- Syringe type pumps
- Constant pressure pump

16 MARKS
1. Illustrate with a block diagram, the operation of a HPLC? (NOV/DEC-2010) (APRIL/MAY -2011)
2. Explain the operation of any two detector used in gas chromatography. (DEC-2009)
3. With a neat diagram explain the various stages of gas chromatography and label the main instruments. (NOV/DEC -2010)
4. With a neat diagram, discuss the types of detectors used in liquid chromatography.(NOV/DEC-2010)

UNIT- V

ONE MARK
1) Gas analyzers used for
a) Single component analysis b) multi component analysis
c) Single and multi component analysis d) none of the above
2) What are the methods used for oxygen measurement?
Physical method and chemical method
3) In which one of the following gas is paramagnetic?
a)oxygen b)neon c)krypton d)argon

4) Example for the electro analytical method?
Hersch galvanic cell
5) chemiluninescent analyzer is used to
Analysis of nitrogen oxide
6) In microprocessor based electro chemical sensors the transmitter output should be
4 to 20Ma
7) Which of the following method uses the difference meter?
a)series mode 1 b)series mode 2 **c)parallel mode 1** d)parallel mode 2
8) Gold film sensors uses the principle of **absorption** for the measurement of hydrogen sulfide
9) Sulphur dioxide is measured using
Colourimetry ,iodimetry or turbidometry.
10)The standard method for the measurement of carbon monoxide is
Non dispersive infra red spectroscopy.
11) Example for reactive hydrocarbon is
Ethylene.
12) Example for Non reactive hydrocarbon is
Methane.
13)The detector used for measurement of reactive hydrocarbon is
Chemiluminescence Detector
14)Hydrocarbons which are emitted from heavy duty vehicles is determined by
NDIR method
15)Which provide proper operation and maintenance of particulate control equipment
Environmental Protection Agency
16) The electrical tpe of flow dust monitoring instrument uses the principle of **charging** to measure the amount of dust present in the gas.

16 MARK

1) With a neat diagram explain any two types of industrial analyzers.
2) Draw and explain the schematic representation of the method of measurement of dust concentration in stack.
3) Draw and explain the schematic diagram of a typical NO-NO2 analyzer.
4) Explain with neat diagram the method for measuring CO levels.
5) Explain anyone type of oxygen analyzer used in industrial application.
6) Explain any two types of hydrogen sulphide analyzer.
7) With a neat sketch explain IR analyzers and its types.
8) Write short notes about effects of air pollutants.
9) Explain the measurement of sulphur dioxide and carbon monoxide.
10) Explain the measurement of hydrocarbons and nitrogen oxide.

UNIT-IV

ONE MARKS:

1) What is the value of pH?
pH = -log[H+]
2) What is the concentration of the hydrogen ions in a solution?
The number of gram ions of hydrogen present in one liter of the solution is called the hydrogen ion concentration.
3) How the nature of the solution can be known?
The nature of the solution can be known by the concentration of H+ ions.
4) Who proposed the term pH and introduced a new scale to express the H+ ions concentration?
Sorensen
5) Pure water is known to be a _____ electrode?
Ans : weak electrode

6) Give the expression for the dissociation of water?
$H_2O = H^+ + OH^-$
7) The concentration of H+ & OH- ions in water at 25`C is _____?
1 X 10-14 moles2 /lit
8) Give the range of pH values for acidic, basic and neutral solutions?
0-7--------Acidic
7---------neutral
7-14--------Basic
9) What is a cation?
They are the positively charged ions.
10) What is an anion?
They are the negatively charged ions.
11) Define oxidation?
It is a process which involves the loss of electrons.
$Zn \rightarrow Zn^{2+} + 2e^-$
12) Define reduction?
It is process which involves the gain of electrons.

$Cu^{2+} + 2e^- \rightarrow Cu$
13) What is an electrode and give its types?
Electrode is a material or a metallic rod or bar or strip via which electrons flow.
Types:-
- **Anode**
- **Cathode.**

14) What is an anode and a cathode?
Anode is an electrode in which oxidation occurs. It is also called as an oxidizing electrode.
Cathode is an electrode in which reduction occurs & also called as reducing electrode.
15) What is an electrolyte?
Substances whose melts or aqueous solution conduct the electric current and which are decomposed by the passage of electric current are called electrolyte.
16) What is a cell?
It is a device consisting of anode and cathode dipped in electrolyte. The two electrodes are connected by a wire.
17) What is a half cell?
It is a part of a cell containing an electrode dipped in an electrolytic solution. If oxidation or reduction occurs at the electrode dipped in an electrolyte respectively, then it is called as anodic half or the cathodic half cell.
18) Give the types of electrodes?
- **Reference electrode**
- **Indicator electrode**

19) What are the two types of reference electrode?
- **Primary reference electrode**
- **Secondary reference electrode**

20) What is the potential of primary electrode at all temperatures?
Zero volt.
21) Give the advantages of hydrogen electrode?
- **Highly accurate**
- **No salt error**
- **Error due to leakage is negligible.**

22) What are the types of secondary reference electrode?
- **Calomel electrode**
- **Silver / silver chloride electrode.**

23) How are the modern pH meters classified?
- **The direct reading type**
- **The null detector type.**

24) What are the types of ion selective electrodes?
- **Glass membrane electrode**
- **Liquid membrane electrode**
- **Solid state membrane electrode**
- **Gas sensing electrode**
- **Biocatalytic electrode.**

25) Glass membrane electrode is very familiar for the measurement of _____?

Ans: measurement of pH.

26) The gas sensing electrode is used for th determination of _____?

Ans: carbon dioxide and ammonia.

27) The biocatalytic electrode is used for the determination of _____?

Ans: organic compounds such as glucose and urea.

28) What are the important sodium salts that will cause the corrosion?

Sodium hydroxide, sodium chloride, sodium sulphate.

29) Give the two ways by which the efficiency of the sodium analyzer system can be improved?
- **Standardization**
- **Cleaning process.**

30) What is the instrument used to measure the silica content in silica analyzer system?

Ans: silicometer .

31) What is the working principle of the silica analyzer?

Ans: molybdenum blue method.

TWO MARKS:

1) **What are the types of membrane sensor?**
*glass sensor
*solid state sensor
*solid matrix sensor

2) **How measurements are done in ion selective electrodes?**
Ion selective electrodes measure the thermodynamically effective free ion concentration. In dilute solutions, ion activity usually approaches ion concentration.

3) **Define conductivity of electrolyte?**
The conductivity of the electrolyte is the measure of the ability of the solution to carry electrri current. The current through the solution takes place through the movement of ions.

4) **Define pH?**
pH=-log[H+]
or
pH =log[1/H+]

5) **What are the methods of measuring conductance?**
- Null method
- Direct reading method

6) **Why the temperature compensation is necessary in conductivity measurement?**
The conductivity of the electrolytic solution varies with temperature because; the ionic mobility's are temperature dependent. The temperature co efficient is of the order of 1.5 to 2% at the room temperature. Thus the control of temperature is very1 essential.

7) Give the methods of measurements of oxygen?

Methods used to measure Oxygen are classified as either physical or chemical methods. Physical method uses the paramagnetic property of oxygen or thermal conductivity aas the basic for quantitative determination. Chemical method includes potent metric & catalytic combustion.

8) Give the working principle of electrical conductivity meter?

The instrument works on the following principle. That the conductivity of an aqueous solution depend on the inorganic impurity, & the instrument measures this in terms of resistance of a standard water column or tube through which the sample is passed the conductivity is the reciprocal of resistance.

9) What is the application of silicon analyzer?

In thermal power plants silica content is measured in steam before turbine. Silica analyzer is used for anion exchanger, effluent monitoring & effluents of mixed-bed exchangers.

10) What are two measurements made in silica analyzer?

*chemical blank measurements.
* Quantitative determination.

11) What is chemical blank measurement?

In this sequence the ammonia molybdate solution, sulphuric acid & reduction solution are simultaneously added to the mixing vessel. This solution is diluted with sample to a suitable volume & is then emptied to the measuring corvette where it is measured & drained away. This is known as chemical blank measurement.

12) What is the use of blank in silica analyzer?

The use of blank on each cycle is to give the analyzer long term stability by compensating for the effect of variables such as coloration of the sample or reagents, temperature or aging of the lamp of photo cell.

13) Give the application of sodium analyzer?

Sodium analyzer finds application in thermal power plants for determining sodium ion concentration in boiler water, monitoring carry over detection of condenser leaks & the exhaustion of water treatment plant cation exchange unit.

14) why ammonia gas is added to the sample in sodium analyser?

The sodium selective glass electrode carries out the measurement in buffered solution above 10PH,Where it responds specifically to value of the sample is sodium ion activity.So the PH must be adjusted to with in desired range.The PH value of the sample is maintained in the flow cell by adding ammonia gas to the sample.

15) **Give the different types of electrodes used for PH measurement?**

Hydrogen electrode
Glass electrode
Calomel electrode
Combination electrode.

16) Give the characteristics of glass electrode?

Sensitivity is above 95%
Low melting point
High horoscopy
Fast response
Relatively high electrical conductivity

17) Give the design criteria of PH meter?

Input impedance of PH meter should be very high
Current should not be drawn from the solution from the PH cell.
Temperature compensation must be provided with resistive thermometer or by thermistor.

18) Give the general classification of PH cell?

Null deflection type or potentiometric type.

Direct reading type.

19) How PH of a solution is measured & give the Nernst equation?

PH is measured by electrochemical cell,consist of two electrodes
Measuring electrode
Reference electrodes
Measuring electrode is sensitive to hydrogen ion &Ref: Electrode is not sensitive t o hydrogen ions.
The PH is calculated by Nernst equation NB BK N VG X43which is given as E=E0+2.303RT/F[PcH].Where PcH is the PH value.
R=Gas constant
T=Absolute temperature
F=Faradays constant.

16 MARKS:

1.Describe the construction details of any one type of reference electrode used for different P H ranges?
2.Explain with neat diagram a method for measuring oxygen dissolved in water.
3.With a neat diagram explain solid state electrode?
4.Explain the principle of gas sensing electrode?
5.Draw the flow diagram of industrial siica analyser and explain it in detail?
6.With a neat sketch explain the working and principle of calomel electrode?
7.With a suitable diagram explain the PH measurement?
8.Explain with neat diagram the construction and working of sodium analyser?
9.With chemical reactions ,explain about hydrogen electrode and also discuss the advantage and disadvantages?
10.Explain the working of a glass membrane electrode?

UNIT III

ONE MARKS

1) NMR spectroscopy uses **(RF frequency)** to induce transistion between nuclear spin.
2) Nuclear spin takes of samples in a_____
3) NMR spectroscopy can be used for_____
4) RF transmitting system produces nearly_____
5) Gamma rays are **_____(highly penetrating)** & alpha particles have **_____(low penetrating)** power
6) Geiger muller counter is used to measure intensity of radioactive radiation_____
7) In proportional counters the output pulse are **_____(proportional to thye intensity of the radiation)** falling them.
8) The proportional counter filled with a heavier gas like **_____(xenon or krypton)**
9) The Gamma camera produces a **_____(position intensity picture of a radioactive area)** by using multiple scintillation detector
10) The main disadvantage of solid state detector is **_____(it should be maintained in low temperature)** to minimize the noise
11) The scintillator output in response to **_____(incident gamma radiation)**
12) X-ray are **_____(short wavelength electromagnetic radiation)**
13) The wavelength of X-ray ranges of **10^-5Å to 100Å**

14) X-rays can be employed **_____(absorption ,fluroscene, diffraction)**
15) X-ray diffraction meters are used to identify **_____(physical properties of materirl&other solids)**
16) Mass spectrometer determines the **_____(relative mass of atoms&molecules)**
17) Mass spectro meter seperates the ions on basis of their **_____(mass/charge ratio)**
18) A record of the no.of different kinds of ions is called the**_____(mass spectrometer)**
19) **_____(4 parallel cylinder)** rods is the heart of quardra pole mass spectrometer.
20) Bragg's law is **_____(nλ=2dsinθ).**
21) **_____(debye cherrer camera)**is the example of photo graphic method.
22) Molecular formula can be determined exactly from the**_____(mass spectrum).**
23) Mass spectrometry is the best method of**_____(detection of impurities).**
24) **_____ (polytetra fluroethylene)**is used as insulator between the electrodes of ion chamber.
25)Scintillation is the process of turning _____ **(radioactive energy)** into _____ (light) using a scintillator .
26)Gamma spectroscopy is based on the use of _____ **.(semiconductor device)**

TWO MARKS:

1. What is proportional counter?

When the electric field at the centre electrode of an ionization chamber is increased above the saturation level, but under that of the geiger region, the size of the output pulse from the chamber starts to increase but remains proportional to the initial ionization. A device operated in this principle is called a proportionalcounter.

(OR)

The proportional counter is an ionization chamber that is operated at voltages beyond the ordinary ionization chamber region,but below that of Geiger region.These counters are proportional to the intensity of the radiation falling on them.This counter is filled with a heavier gas like xenon or krypton.

2. Give a note on Diffractometers

x-ray diffractometers are basically analogous to an optical grating spectrometer,with the difference that lenses and mirrors are not used with x-rays.it is used to identify the physical properties of metals,polymeric materials and other solids.Diffractometers are also provides qualitative and quantitative information about the compounds present in a solid sample.eg:Debye-scherrer powder camera used for powder diffraction.

1. Mass spectrum

In mass spectrometers ,the sample to be analyzed is first bombared with an electron beam to produce ionic fragments of the original molecule.These ions are then sorted out by accelerating them through electric and magnetic fields ,according to their mass/charge ratio.A record of the number of different kinds of ions is called mass spectrum.

2. What is gamma camera?

A gamma camera is an imaging device,most commonly used as a medical imaging device in nuclear medicine.It produces imaging of the distribution of Gamma ray emitting radio nuclides.
The gamma camera produces a position intensity picture of a radio active area,by using multiple scintillation detector.

3. What are applications of NMR Spectrometers?

NMR spectroscopy is used for structural identification of organic,metal&chemical molecules.
it analyses of hydroxyl groups in alcohols,aldehydes,amins&amides.it is used for MRI

4. What are the different types of Mass Spectrometers?

* Magnetic Deflection mass spectrometer
* Time of flight
* Radiofrequency mass spectrometer
* Quadrupole Mass spectrometer

5. What are the applications of Mass Spectrometry?

The mass spectrum of pure compound provides valuable information of qualitative and quantitative identification. Molecular mass can be accurately determined by the mass spectrometry. If a molecule contains any number of chlorine,bromine,silicon or sulphur atoms,this fact is immediately apparent from the mass spectrum. it is used to determined the amount of component of a complicated mixture &kinetic ,mechanistic reaction studies.

6. Define Absorption ,Fluorescence, Diffraction in X-ray Spectrometers?

Absorption of X-rays gives the information about the absorbing material just as in other regions of the spectrum.

Fluorescence emission of X-rays enables to identify and measure heavy elements in the presence of each other and in any matrix.

Diffraction of X-rays enables analysis of crystalline materials with a high degree of specificity and accuracy.

7. What is the dead time in GM counter ?

When the electron avalanche is collected on the anode,the positive ions, being much heavier,progress only a short distance on their way to cathode.. Their time travel is about 200s. During most of this time their presence as a virtual sheath around the anode efficiently lowers the potential gradient to a point where the counter is insensitive to the entry of more ionizing particle. This time is called dead time of GM counter.

(OR)

The conduction of electricity through a chamber operated in Geiger region and in Proportional region is not continous.The reason is the positive ions produced by the ionisation of gas are much heavier and move very slowly towards the cathode.The travelling time may be 200Micro sec.During this period ,the positive ions from a sheath around the central anode wire and the flow of electronics to the anode.The net effect is a pulse of current followed by an interval during which the tube does noy conduct.This is called dead time of a Geiger Mullar counter.

8. Diffraction

Diffraction is a wave property of electromagnetic radiation that causes the radiation to bend as it passes by an edge or through an aperture.Diffraction effects an increase as the phyysical dimension of the aperture approaches the wavelength of the radiation.

11. What are the basic instrumentation of X-ray spectrometer

1.X-ray generating equipment
2.Collimator
3.Monochromator
4.Detector

12. Why do we go for a solid state detector instead of scintillation detector,etc?

The elecrical output from the solidstate is smaller hence a high gain, low noise amplification is required. To diminish noise pickup a preamplifier is generally located to the detector.Also scintilation counters sufer from poorer energy resolution.therefore,solid state detectors are mostly used.

13. How can we obtain the NMR absorption spectra?

NMR absorption spectra can be obtained either by changing the freqauency of the Radio frequency oscillator or by changing the spacings of the energy levels by varying the magntic field.

14.What are the various parts of the Mass spectrometer?

1.Sample inlet system.
2.Ion source.
3. Ion acceleration and Mass analyser.
4. Ion collection system

5.Data handling system.
6.Vaccum system.

15. Mention the advantages of Mass spectrometry.

1.Better Sensitivity.
2. More detailed understanding of kinetics and mechanisms of unimolecular decomposition of molecules.
3. Improved Speicificity in identifying unknowns or confirming the presence of suspected components.

16. What is Mass Spectrometry?

Mass spectrometry is the most commonly used method which provides qualitative and quantative information about the atomic and molecular composition of organic and inorganic materials.It produces charged particles that consist of the parent ion and ionic fragments of the original molecule,and it sorts these ions acording to their mass/charge ratio.

17. What are the basic components of NMR Spectrometry?

The basic components of the NMR spctrometry are:
· A Magnet,produces magnetic field in the range 10,000 to 25,000 guass
· Radio frequency transmitting system.
· The signal amplifier and detector.
· A display device, which may be a recorder or an oscilloscope.
· A non-magnetic sample holder ,which holds ths sample.

18. Define NMR?

The study of absorption of radio frequency radiation by nuclei in amagnetic field ia called Nuclear Magnetic Rsonance(NMR).The expression for the chemical shift is

H sample - H TMSi *106
Ù = H 1

where H sample and HTMSi are the positions of the absorption peaks for the sample and reference mate.

19.List out some X-ray detectors

GM counter
Proportional counter
Ionization chamber
Solid state counter
Phton counting

20.Resonance condition

when alternating radio frequency field,super imposed over the stationary magnetic field,rotates at exactly frequency of an energy level.The nuclic will be provided enough energy to undergo a transistion from a lower energy level to higher energy level

▲E= μβ Ηo/I

21.what are the nuclear radiation detectors?

ionization chamber
GM counter
proportional counter
scintilation chamber
semi conductor devices

22.Describe scintilation counter?

scintilaters are chemicals used to convert radiant energy into light.(scintilators like,sidium iodide crystals,stilbene,anthracene terphenyl,napthalene etc.). These scintilators are followed by photomultiplier tube.The combination of scintilators and PMT is called scitilation counter.

Advatage:

This dead time is smaller than the gas filled detectors

This used for counting of high rates.

23. What are the two types of Semiconductor detectors?

1.Surface barrier Silicon detector.

2.Lithium drifted Silicon and Germanium detectors.

24. What is the principle behind the GM counter?

When an ionizing particle enters the counter, collision with the filling gas produces ion pairs. The formed ion pairs move towards the appropriate electrode under the voltage gradient. The mobility of electron is high and under this potential gradient it acquires sufficient velocity to produce new ion pairs by collision with atoms of argon. Repeating of this process produces an avalanche of electron moving towards anode. Electrons when striking generates ionization throughout the tube, called discharge. Each discharge builds a constant pulse counted by scale counter.