

UPES SAP ID No.:



**UNIVERSITY OF PETROLEUM AND ENERGY
STUDIES**

Examination, July 2020

Programme: B.Tech GSE	Semester : VI
Course Name: Analytical Method in Geoscience	Max. Marks : 100
Course Code: CHCE 3009	Attempt Duration : 2
Hrs. No. of page/s: 10	

Note:

1. Read the instruction carefully before attempting.
2. This question paper has two section, Section A and Section B.
3. There are total of seven questions in this question paper. **One** in **Section A** and **six** in **Section B**
4. **Section A** consist of multiple choice based questions and has the total weightage of 60%.
5. **Section A** will be conducted online on BB Collaborate platform
6. **Section B** consist of long answer based questions and has the total weightage of 40%.
7. The maximum time allocated to **Section A** is two Hrs.
8. **Section B** to be submitted within 24 hrs from the scheduled time (*exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
9. No submission of **Section B** shall be entertained after 24 Hrs.
10. **Section B** should be attempted after **Section A**
11. **The section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)
12. Both section A & B should have questions from entire syllabus.
13. The COs mapping, internal choices within a section is same as earlier

Section A [60 marks]

Attempt all questions. Each question carry one mark.

1. X-ray diffractometers are not used to identify the physical properties of which of the following?
 - a) Metals
 - b) **Liquids**
 - c) Polymeric materials
 - d) Solids
2. X-ray diffractometers provide information about the compounds present in a solid sample as
 - a) Quantitative
 - b) Qualitative
 - c) **Quantitative and qualitative**
 - d) Either quantitative or qualitative
3. Which of the following is instrument for photographic recording of diffraction patterns, click all that apply?
 - a) Debye-Scherrer powder camera
 - b) Gamma camera
 - c) Geiger tube
 - d) **All**
4. Which equation calculate lattice distance from a known wavelength of the source and measured angle?
 - a) Miller equation
 - b) **Bragg's equation**
 - c) Debye equation
 - d) Snell equation
5. Identification of sample compound in XRD can be done by its
 - a) Number, length
 - b) Number, intensity
 - c) Position, length
 - d) **Position, intensity**
6. In Diffractometers, the intensities of the diffraction peaks of a given compound in a mixture are proportional to the fraction of the material in the mixture.
 - a) **True**
 - b) False
7. Which wavelength is most suitable for XRD analytical?
 - a) 0.1 angstrom

- b) **0.1 nm**
- c) 0.1 mm
- d) 0.1 cm

8. If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a short time, the phenomenon is termed as which of the following?
- a) Luminescence
 - b) **Fluorescence**
 - c) Phosphorescence
 - d) Spontaneous emission
9. The measurement of intensity of fluorescent X-rays provide a simple and destructive way of quantitative analysis.
- a) True
 - b) **False**
10. The Intensity of the emitted X-rays depends upon the concentration of atoms
- a) **True**
 - b) False
11. Beer Lambert's law gives the relation between which of the following?
- a) Reflected radiation and concentration
 - b) Scattered radiation and concentration
 - c) **Energy absorption and concentration**
 - d) Energy absorption and reflected radiation
12. In UV Visible Spectrometers Absorption is directly proportional to
- a) Concentration
 - b) Path length
 - c) Transmittance
 - d) **concentration and path length**
13. In which of the following ways, absorption is related to transmittance?
- a) Absorption is the logarithm of transmittance
 - b) Absorption is the reciprocal of transmittance
 - c) Absorption is a multiple of transmittance
 - d) **None of these**
14. The representation of Beer Lambert's law is given as $A = abc$. If 'b' represents distance, 'c' represents concentration and 'A' represents absorption, what does 'a' represent?
- a) Intensity
 - b) Transmittance
 - c) **Absorptivity**
 - d) Admittance
15. The maximum number of electrons present in M shell will be
- a) 8
 - b) 16

- c) **18**
 - d) 32
16. The process by which photons are emitted by an electron is known as
- a) Vaporization
 - b) Absorbance
 - c) **Bremsstrahlung**
 - d) Radiation
17. The study of ground state atoms achieved through vaporization of sample is known as atomic absorption
- a) **True**
 - b) False
18. The study of excited state atoms achieved through vaporization of sample is known as atomic absorption
- a) **True**
 - b) False
19. Energy dispersive system uses which of the following detectors?
- a) Optical detector
 - b) **Semiconductor detector**
 - c) Photodetector
 - d) ICP
20. The x-ray beam produced by the primary x-ray tube passes through which of the following components to produce the incident radiation?
- a) Detector
 - b) **Slit-collimator arrangement**
 - c) Sample reflector
 - d) Monochromator
21. Which of the following components are used as the sample carrier?
- a) Curvette
 - b) Flask
 - c) Capillary tube
 - d) **Float glass**
22. Scanning electron microscope (SEM) is a type of electron microscope that produces images of a sample by scanning the surface with a focused beam of electrons (T/F)
23. In wavelength dispersive spectrometers (WDX or WDS), the photons are separated by diffraction on a single crystal before being detected (T/F)
24. In energy-dispersive spectrometers (EDX or EDS), the detector allows the determination of the energy of the photon when it is detected (T/F)
25. Which of the following is the principle of Atomic Absorption Spectroscopy?
- a) **Radiation is absorbed by non-excited atoms in vapour state and are excited to higher states**
 - b) Medium absorbs radiation and transmitted radiation is measured
 - c) Colour is measured

- d) Colour is simply observed
26. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?
- Tungsten lamp
 - Xenon mercury arc lamp
 - Hydrogen or deuterium discharge lamp
 - Hollow cathode lamp**
27. In Atomic Absorption Spectroscopy, with what material is the cathode in Hollow cathode lamp constructed?
- Tungsten
 - Quartz
 - Element to be investigated**
 - Aluminum
28. Which of the following is the function of the Flame or Emission system in Atomic Absorption Spectroscopy?
- To split the beam into two
 - To break the steady light into pulsating light
 - To filter unwanted components
 - To reduce the sample into atomic state**
29. Which of the following is not a component of the emission system in Flame photometer?
- Burner
 - Atomiser
 - Fuel gases
 - Detector**
30. ICP's principle is similar to which of the following?
- Flame emission spectroscopy
 - Fourier transforms spectroscopy
 - Atomic emission spectroscopy**
 - Absorption spectroscopy
31. Liquid samples are introduced into the ICP spectrometer using which of the following?
- Nebulizer**
 - Curvette having glass windows
 - Probe
 - Laser ablation system
32. Atomisation or ionisation occurs at which of the following conditions?
- Vacuum pressure
 - Atmospheric pressure

- c) Low pressure
 - d) **High pressure**
33. Mass spectrometers are used to determine which of the following?
- a) Composition in sample
 - b) Concentration of elements in sample
 - c) **Relative mass of atoms**
 - d) Properties of sample
34. In mass spectrometer, the sample that has to be analysed is bombarded with which of the following?
- a) Protons
 - b) **Electrons**
 - c) Neutrons
 - d) Alpha particles
35. Mass spectrometer separates ions on the basis of which of the following?
- a) Mass
 - b) Charge
 - c) Molecular weight
 - d) **Mass to charge ratio**
36. In mass spectrometer, the ions are sorted out in which of the following ways?
- a) By accelerating them through electric field
 - b) By accelerating them through magnetic field
 - c) **By accelerating them through electric and magnetic field**
 - d) By applying a high voltage
37. The procedure for mass spectroscopy starts with which of the following processes?
- a) The sample is bombarded by electron beam
 - b) The ions are separated by passing them into electric and magnetic field
 - c) **The sample is converted into gaseous state**
 - d) The ions are detected
38. Which of the following ions pass through the slit and reach the collecting plate?
- a) Negative ions of all masses
 - b) Positive ions of all masses
 - c) Negative ions of specific mass
 - d) **Positive ions of specific mass**
39. Chromatography is a physical method that is used to separate and analyse
- a) Simple mixtures
 - b) **Complex mixtures**
 - c) Viscous mixtures
 - d) Metals
40. In which type of chromatography, the stationary phase held in a narrow tube and the mobile phase is forced through it under pressure?
- a) **Column chromatography**

- b) Planar chromatography
- c) Liquid chromatography
- d) Gas chromatography

41. In chromatography, the stationary phase can be _____ supported on a solid.
- a) **Solid or liquid**
 - b) Liquid or gas
 - c) Solid only
 - d) Liquid only
42. In chromatography, which of the following can the mobile phase be made of?
- a) Solid or liquid
 - b) **Liquid or gas**
 - c) Gas only
 - d) Liquid only
43. Which of the following types of chromatography involves the separation of substances in a mixture over a 0.2mm thick layer of an adsorbent?
- a) Gas liquid
 - b) Column
 - c) **Thin layer**
 - d) Paper
44. In Column chromatography, the stationary phase is made of solid and the mobile phase is made of gas
- a) True
 - b) **False**
45. In Thin layer chromatography, the stationary phase is made of liquid and the mobile phase is made of liquid (**True/False**)
46. In which of the following type of paper, chromatography does the mobile phase move horizontally over a circular sheet of paper?
- a) Ascending paper chromatography
 - b) Descending paper chromatography
 - c) **Radial paper chromatography**
 - d) Ascending – descending chromatography
47. Gas chromatography can be gas-solid chromatography or liquid-liquid or gas-liquid phase (True / **False**)
48. Which of the following types of chromatography involves the process, where the mobile phase moves through the stationary phase by the influence of gravity or capillary action?
- a) Column Chromatography
 - b) High Pressure Liquid Chromatography
 - c) Gas Chromatography
 - d) **Planar Chromatography**

49. Which of the following is the disadvantage of helium, which can be used as carrier gas in gas chromatography?
- a) Dangerous to use
 - b) **Expensive**
 - c) Reduced sensitivity
 - d) High density
50. Which of the following is the commonly used support material for the packed column in gas chromatography?
- a) Glass
 - b) Metal
 - c) **Diatomaceous earth**
 - d) Stainless steel
51. Gas-solid chromatography is based on which of the following processes?
- a) Partition of the analyte between a gaseous mobile phase and a stationary liquid phase
 - b) **Adsorption of gaseous substances on solid surface**
 - c) Ion exchange
 - d) Large molecules cannot penetrate through the gel
52. Which of the following columns can be used in Gas-solid chromatography?
- a) **Open tubular column**
 - b) Analytical column
 - c) Separation column
 - d) Guard column
53. Which of the following is used in electron microscope?
- a) electron beams
 - b) magnetic fields
 - c) light waves
 - d) **electron beams and magnetic fields**
54. Scanning Electron Microscope can give a magnification up to
- a) **500,000X**
 - b) 100,000X
 - c) 15000X
 - d) 100X
55. Scanning Electron Microscope can be done on living cell (True/**False**)
56. Only very thin specimens can be observed in the conventional electron microscope (**True / False**)

57. Which among the following helps us in getting a three-dimensional picture of the specimen?
- a) Transmission Electron Microscope
 - b) **Scanning Electron Microscope**
 - c) Compound Microscope
 - d) Simple Microscope
58. Neutron activation analysis (NAA) is the nuclear process used for determining the concentrations of elements in a vast amount of material (**True/False**)
59. Delayed gamma ray emission take place from
- a) Target nucleus
 - b) Radioactive nucleus
 - c) **Excited nucleus**
 - d) Stable nucleus
60. Which statement about Neutron activation analysis is not true
- Matrix is not disturbed
 - Bulk analysis can be done without changing its forms
 - Sample gets radioactive for very short duration**
 - Not suitable for low half life nucleoids

SECTION B [40 marks]

Answer all questions. Each question carry 10 marks.

1. How surface topography and composition of sample can be analyzed using Scanning electron microscope? Explain in detail with sketch diagram
2. Evaluate in detail on ion-exchange chromatography. Compare its demerits/merits with gas chromatography
3. Compare the similarity and difference of wavelength dispersive spectrometer vs energy dispersive spectrometer. Draw a suitable diagram of their (WDX and EDX) functioning.
4. Evaluate in detail of paper/thin layer chromatography with suitable sketch diagram. Compare its demerits/merits with ion-exchange chromatography.