

Name:
Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, July 2020

Course: Spectrochemical methods of analysis

Program: M Sc. Chemistry

Course Code: CHEM7012

Semester: II

Time 03 hrs.

Max. Marks: 100

Instructions: Attempt All Questions

PART-A

Spectroscopic Methods of Analysis (CHEM7012)

End sem Examination (online) Max Marks : 60 (each question carries 2 marks)

1. According to Beer's law for a colored solution, which one of the following statements is False?

- (a) The percent transmission is not directly proportional to the concentration.
- (b) The absorbance is directly proportional to the concentration.
- (c) The absorbance does not change when the cell path length (cell thickness) increases.
- (d) When the concentration of the unknown sample is higher than the highest concentration in the calibration range, the sample should be diluted.

2. Deuterium and tungsten lamps are used as a light source in one of the following techniques.

- (a) ICP-Optical Emission Spectrometer
- (b) Flame Photometer
- (c) IR- spectrometer
- (d) Uv/Visible spectrophotometers

3. The energy associated with Infrared radiation is enough to make which of the following?

- a- electronic transitions
- b- vibrational and rotational transitions
- c- a full separation of the electron in the outer shell

d- an electron move from an inner orbital

4. Narrow line spectra in a spectrum are in general emitted by which of the following species?

- (a) hot solids
- (b) excited polyatomic molecules
- (c) molecules in the ground molecular state
- (d) excited atoms

5. An important advantage of a double-beam spectrophotometer over a single-beam spectrophotometer is that

- (a) it permits cancellation of slow variations of the source power
- (b) it requires same light source for UV, Visible and Infrared radiation
- (c) it can be used in conjunction with rapid response detection systems
- (d) a greater range of wavelengths can be used

6. The wavenumber of a transition is 2000 cm^{-1} . In what part of the electromagnetic spectrum does this come?

- a. Infrared.
- b. Radiowave.
- c. Microwave.
- d. Ultraviolet-visible.

7. The frequency of a transition is $5.4 \times 10^{15} \text{ Hz}$. What is the corresponding wavelength?

- a. $5.6 \times 10^{-6} \text{ m}$
- b. 560 nm
- c. $5.6 \times 10^{-8} \text{ m}$
- d. $180\,000 \text{ cm}^{-1}$

8. According to the Beer-Lambert Law, on which of the following does absorbance not depend?

- a. Extinction coefficient of the sample.
- b. Colour of the solution.
- c. Distance that the light has travelled through the sample.
- d. Solution concentration.

9. A solution of X of concentration $0.010 \text{ mol dm}^{-3}$ gives an absorbance of 0.5. What concentration is a solution of X which gives an absorbance reading of 0.25? Assume that the same optical cell is used for both readings.

- a. $0.050 \text{ mol dm}^{-3}$
- b. $0.020 \text{ mol dm}^{-3}$
- c. $0.010 \text{ mol dm}^{-3}$
- d. $0.0050 \text{ mol dm}^{-3}$

10. The dichromate ion absorbs light of wavelength close to 500 nm. Based on this information, what can you conclude?

- a. Solutions of the dichromate ion are colorless.
- b. The dichromate ion absorbs within the visible region.
- c. The dichromate ion absorbs in the ultraviolet region.
- d. The dichromate ion absorbs outside the visible region.

11. Which of the following is the principle of Flame emission photometers?

- 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 and wavelength of the flame is measured
- d) Only wavelength of the flame is measured

12. In Flame emission photometers, the measurement of _____ is used for qualitative analysis.

- a) Colour
- b) Intensity
- c) Velocity
- d) Frequency

13. Which of the following is not an advantage of Laminar flow burner used in Flame photometry?

- a) Noiseless
- b) Stable flame for analysis
- c) Efficient atomization of sample
- d) Sample containing two or more solvents can be burned efficiently

14. Which of the following is the advantage of prism monochromators?

- a) Dispersion is non-overlapping
- b) Dispersion occurs in non-linear manner
- c) Dispersion is overlapping
- d) Dispersion occurs in a linear manner

15. Which of the following is not an application of Flame emission photometers?

- a) Analysis of biological fluids
- b) Determination of sodium, potassium in soil
- c) Determination of metals such as Mn, Cu
- d) Analysis of complex mixtures

16. Which of the following components of the X-ray fluorescent spectrometer induces fluorescent radiation?

- a) Excitation source
- b) Energy analyser
- c) X-ray spectrometer
- d) Detection System

17. Why is a mono-energetic radiation source required in X-ray fluorescent spectrometer?

- a) To provide good sensitivity
- b) To provide high accuracy
- c) To provide a proper range
- d) To reduce unwanted background

18. Which of the following does not make the X-ray tube nearly monochromatic?

- a) Transmission-anode X-ray tube
- b) Secondary fluorescence target
- c) Slit
- d) Filters

19. The analysis of X-ray beam by diffraction is similar to spectrum analysis carried out with a diffraction grating.

- a) True
- b) False

20. Which of the following can be done to avoid loss of intensities of X-rays due to the absorption of long wavelength X-rays?

- a) Apparatus must be contained in a chamber
- b) Air in the chamber must be replaced by helium
- c) Inert gas atmosphere must be provided
- d) Proper slits must be used

21. 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

22. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

- a) Tungsten lamp

- b) Xenon mercury arc lamp
- c) Hydrogen or deuterium discharge lamp
- d) Hollow cathode lamp

23. In Atomic Absorption Spectroscopy, with what material is the cathode in Hollow cathode lamp constructed?

- a) Tungsten
- b) Quartz
- c) Element to be investigated
- d) Aluminium

24. How can the intensity of radiation be increased in Hollow cathode lamp?

- a) Addition of non-conductive protective shield of mica
- b) Addition of nitrogen to neon or argon in the lamp
- c) Increasing the pressure of the filling gas
- d) Changing the metal of the anode

25. Which of the following is the function of the chopper in Atomic Absorption Spectroscopy?

- a) To split the beam into two
- b) To break the steady light into a pulsating light
- c) To filter unwanted components
- d) To reduce the sample into atomic state

26. Which of the following is the function of the Flame or Emission system in Atomic Absorption Spectroscopy?

- a) To split the beam into two
- b) To break the steady light into pulsating light
- c) To filter unwanted components
- d) To reduce the sample into atomic state

27. Which of the following is not a component of the emission system in Flame photometer?

- a) Burner
- b) Atomiser
- c) Fuel gases and their regulation
- d) Chopper

28. Which of the following is not a fuel used in flame photometry?

- a) Acetylene
- b) Propane
- c) Hydrogen
- d) Camphor oil

29. Which of the following is not the requirement of a good flame in flame photometer?

- a) Liquid sample must be evaporated to form solid residue
- b) Solid residue must decompose to form atoms
- c) Atoms must be produced such that they have the ability to get excited to higher states
- d) Atoms must be produced such that they are in stable state

30. Which of the following options explains the process of 'sputtering' that occurs in Hollow Cathode Lamp?

- a) Positive ions collide with cathode surface and metal atoms from cathode are ejected

- b) Negative ions collide with cathode surface and metal atoms from anode are ejected
- c) Positive ions collide with negative ions and metal atoms from anode are ejected
- d) Positive ions collide with negative ions and photons are ejected

PART-B

COURSE : SPECTROCHEMICAL METHODS OF ANALYSIS (CHEM7012)

Max. Marks :40

1. Discuss the features of the instrument and operating conditions to be considered for atomic emission method using a flame.
2. Describe the structural components and operating principles of X-ray fluorescence spectrometer
3. Describe the theoretical principles of Inductively coupled plasma generation. In your answer, draw an energy level diagram and show on it the transition, which takes place to generate plasma.
4. Discuss how would you select whether a line or continuous source of radiation would be more appropriate for atomic absorption process and give advantages of each of them.
5. How would you perform atomization? Give sequence of steps of atomization by giving appropriate example as analyte?

ANSWERS

1. C
2. D
3. B
4. D
5. A, D
6. A
7. C
8. A

9. D
10. B
11. C
12. A
13. D
14. A
15. D
16. A
17. D
18. C
19. A
20. B
21. A
22. D
23. C
24. A
25. B
26. D
27. D
28. D
29. D
30. A