



# UNIVERSITY OF THE PUNJAB

Seventh Semester – 2019

Examination: B.S. 4 Years Program

Roll No. in Fig. ....

Roll No. in Words. ....

**PAPER: Analytical Chemistry (Sp. Theory-II)**  
**Course Code: CHEM-413 Part-I (Compulsory)**

**MAX. TIME: 15 Min.**  
**MAX. MARKS: 10**

.....  
Signature of Supdt.:

**Attempt this Paper on this Question Sheet only.**

**Please encircle the correct option. Division of marks is given in front of each question.**

**This Paper will be collected back after expiry of time limit mentioned above.**

**Q.1. Encircle the right answer, cutting and overwriting is not allowed. (1x10=10)**

- (i)- If there is 1% transmittance, what is the value of absorbance  
(a) 99                      b) zero                      c) 100                      d) 2
- (ii)- Which of the following molecules will not show an infrared spectrum?  
(a) N<sub>2</sub>                      b) CO<sub>2</sub>                      c) CO                      d) H<sub>2</sub>O
- (iii)- Which substance is both IR & Raman active  
(a) CO<sub>2</sub>                      b) CH<sub>4</sub>                      c) N<sub>2</sub>                      d) H<sub>2</sub>
- (iv)- The time required for vibrational relaxation is  
(a) 10<sup>-2</sup> to 10<sup>-1</sup> sec                      (b) 10<sup>11</sup> to 10<sup>14</sup> sec  
(c) 10<sup>-14</sup> to 10<sup>-11</sup> sec                      d) 10<sup>12</sup> to 10<sup>13</sup> sec
- (v) In ICP-AES, Nebulizer convert liquid into  
(a) aerosol                      (b) droplet                      c) solid particles                      d) all
- (vi) Vibrational stretching frequency depends upon:  
(a) atomic population                      b) temperature  
(c) magnetic field                      (d) Force constant
- (vii) Scattering efficiency in Raman increases in presence of  
(a) red light                      b) Blue light                      c) orange light                      (d) green light
- (viii) What is the wavelength range of H<sub>2</sub> and D<sub>2</sub> lamp?  
(a) 07-10 um                      b) 0.1A<sup>o</sup>-0.3A<sup>o</sup>                      (c) 200-1000 nm                      (d) 160-380 nm
- (ix) Which of the following source is suitable only for UV molecular absorption?  
(a) D<sub>2</sub> lamp                      (b) Tungsten/halogen lamp  
(c) Xenon arc lamp                      (d) Tungsten lamp
- (x) Only one vibration exists in  
(a) Diatomic molecule                      (b) Linear triatomic molecule  
(c) Nonlinear triatomic molecule                      (d) Single atom



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**PAPER: Analytical Chemistry (Sp. Theory-II)**

**Course Code: CHEM-413 Part – II**

**MAX. TIME: 2 Hrs. 45 Min.**

**MAX. MARKS: 50**

**ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED**

- Q.2 Attempt all Short questions (2x10=20)**
- (i) Distinguish between Raman scattering and Rayleigh scattering.
  - (ii) Differentiate between vibrational deactivation and internal conversion.
  - (iii) How axial torch and radial torch in ICP-AES differ?
  - (iv) What is meant by allowed transitions and forbidden transitions in UV/Visible spectroscopy?
  - (v) Write down the advantages and disadvantages of ICP-AES.
  - (vi) Give the disadvantages of coloured glass filters in UV spectroscopy.
  - (vii) What are the differences between IR spectrum and Raman spectrum?
  - (viii) Explain that mostly IR active vibrational modes are Raman inactive and vice versa?
  - (ix) How thermal detectors and photon detectors differ in their operation in FTIR spectroscopy?
  - (x) Describe Kasha's Rule and Mirror Image Rule in Fluorescence?
- Q.3(a) Explain various components of Raman spectrometer. (5)**
- (b) Write down the quantitative applications of UV/Visible spectroscopy. (5)**
- Q.4(a) Draw Jablonski energy diagram and discuss it's various phenomena. (5)**
- (b) Explain different zones present in ICP plasma. (5)**
- Q.5(a) Discuss the working and advantages of Photo multiplier tubes detector. (5)**
- (b) Discuss the working of FTIR Spectrometer. (5)**