Comprehensive Examination (7th December 2017, Thursday)
PART I: (CLOSED BOOK)

A

Max. Marks: 20;   Duration : 45 min

NOTE: 1. Q1 has negative marking. Each correct answer will carry 1 mark and each wrong answer will deduct 0.25 marks.
2. Write specific answers IN THE SPACE PROVIDED ONLY
3. SUBMIT PART I before proceeding to PART II

Name: _____   ID _____

Q1. Pick the correct answer of the following questions $(1 \times 10 = 10)$

(i) 1,3 butadiene shows $\bar{\upsilon}_{C=C}$ frequency in IR and wavelength λ_{max} in electronic spectra compared to 1-butene respectively at
(A) higher frequency and lower wavelength   (B) lower frequency and lower wavelength
(C) lower frequency and higher wavelength   (D) higher frequency and higher wavelength

(ii) For 2-methylpentane, the most abundant ion is expected to appear at m/z
(A) 43   (B) 71   (C) 57   (D) 29

(iii) To obtain γ-ray spectrum, target nucleus has to be bombarded with
(A) α particles   (B) neutrons   (C) electrons   (D) positrons

(iv) When a molecule absorbs energy to move to higher vibronic level of excited state and then comes back to the lower excited state, this overall process could lead to
(A) Raman scattering   (B) pre-resonance Raman scattering
(C) emission of IR frequency   (D) resonance scattering

(v) In NAA, Cadmium foil is used to allow
(A) thermal neutrons to pass   (B) thermal and fast neutrons to pass
(C) epithermal and fast neutrons to pass   (D) thermal and epithermal neutrons to pass

(vi) To obtain bond length of a molecule the most direct method is to use
(A) electronic spectroscopy   (B) vibrational spectroscopy
(C) rotational spectroscopy   (D) NMR spec

(vii) The resonance frequency for ^{31}P nuclei ($\gamma_N = 1.0841 \times 10^8$ T^{-1} s^{-1} when the nucleus spins in a 12 T magnetic field is

(A) 320 MHz   (B) 501 MHz   (C) 480 MHz   (D) 207 MHz

(viii) In affinity chromatography, the stationary phase is made up with glass beads attached with

(A) polar molecule   (B) complex molecule (C) ligand molecule   (D) chiral molecule

(ix) Calcium oxalate monohydrate in TGA analysis shows three steps. Considering the first loss is at the lowest temperature, these three steps respectively correspond to the loss of
(A) CO, CO$_2$, H$_2$O   (B) H$_2$O, CO$_2$, CO   (C) CO, H$_2$O, CO$_2$ (D) H$_2$O, CO, CO$_2$

(x) An electron accelerated at 5000 V striking a Cu target will be able to emit x-rays from the Cu target (Cu, K$_\alpha$= 1.542Å, K$_\beta$ = 1.392 Å and L$_\alpha$ = 13.357 Å, 1eV= 1.6 × 10^{-19}J)
(A) K$_\alpha$ (B) none   (C) K$_\beta$ (D) L$_\alpha$

Q2. Show the CsU and B/U behavior observed in chromatography in a plot of 'contribution to H' vs U (where H = plate height, U = linear velocity, Cs = mass transfer coefficient, B = longitudinal diffusion coefficient).
(2)

Q3. In a reverse-phase HPLC technique for the separation of benzoic acid, benzene, chlorobenzene and phenol provide the expected order of elution. What type of detector would be appropriate?. **(2+1)**

Q4. Explain the most probable fragmentation of $R_2CH_2CH_2CH_2COR_1$. **(2)**

Q5. Fill in the Blanks:

a. Fluorescence spectrum shows _____structure of _____state of a molecule. **(2)**

b. The sum of $(h^2 + k^2 + l^2) = 3,4,8,11,12,16....$indicate that the lattice is _____ **(1)**