University of Technology
Department of Applied Sciences
Branch of Material Science

Final Examination
2017 - 2016

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Branch: Material+Physics
Subject: Spectroscopy
Examiner: Dr. Mohammed Radhi

Class : 4th year
Time : 3 hours
Date : 7/6/2017

Note: Answer only four questions(each has same mark)

Q1- a)State factors effecting intensity of spectral lines.

b)If the rotational and distortion constants are 10.6 cm^{-1} and $5.3*10^{-4}$ cm^{-1} respectively of $^{1}H^{35}Cl$ then calculate,1)the wavenumber of J=4 rotational level.2)the wavenumber of absorption line starting from J=6.

Q2- a)State regions of electromagnetic radiation in order from high to low energy.

b)If the rotational spectral lines are equally spaced by 7.26 cm^{-1} for C^{12} O^{16} molecule then ,calculate; 1)rotational constant. 2)bond length. 3)the most populated rotational level at temperature of 500K. 4)the wavenumber of most intensive spectral line at this temperature.

Q3- a)State all allowed electronic transitions of molecule,with a diagram showing regions of these transitions.

b)The fundamental and 1st overtone are central at 1876 cm^{-1} ,and 3724 cm^{-1} respectively of $^{14}N^{16}O$,then calculate; 1-the wavenumber of equilibrium vibration. 2-the force constant. 3-the wavenumber of 4th overtone band,4-anharmonic constant,and 5-dissociation energy. D_o

Q4- a)state selection rules of an allowed electronic transition for atom.

b)Calculate wavenumbers of high and low edges of Paschen , and Brackett serisses ,then convert any wavenumber into ,1-wavelenth(nm) ,2-energy(eV) ,3-energy(Jouls),and4-frequency(MHz).

Q5- a)State all spectroscopic prosses of molecule,with a diagram.

b)Prove that the ΔU_{max} between R- and P- branches at temperature T is giving by ,

$$\Delta U_{max} \approx \sqrt{\frac{8kTB}{hc}}$$

Usefull constants:-

$C = 3 \times 10^{10}$ cm/s $k = 1.38 \times 10^{-23}$ J/k $\mu_B = 9.27 \times 10^{-24}$ J/T

$h = 6.62 \times 10^{-34}$ J.s $m_u = 1.67 \times 10^{-27}$ Kg $R = 1.0967 \times 10^{5}$ cm^{-1}

$e = 1.6 \times 10^{-19}$ C

GOOD LUCK