

## Unit 5 - Week 4

## Course outline

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- Vibrational, Rotational-Vibrational, Raman Spectroscopy- II

- Vibrational, Rotational-Vibrational, Raman Spectroscopy- III

- Problems on Rotational, Vibrational & Raman Spectroscopy

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## Assignment 4

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2019-08-28, 23:59 IST.

1) Which of the following is not true for vibrational spectroscopy:

1 point

- Vibration must cause change in dipole moment of molecule
- $\Delta l = \pm 1$ , only these transitions are allowed
- Homonuclear diatomic molecules are IR active
- Permanent dipole moment is not necessary for a molecule to be IR active

No, the answer is incorrect.

Score: 0

Accepted Answers:

Homonuclear diatomic molecules are IR active

2) Vibrational spectroscopy involves the transition falling in the spectral range of:

1 point

- 100-1000  $cm^{-1}$
- 200-2000  $cm^{-1}$
- 600-6000  $cm^{-1}$
- 400-4000  $cm^{-1}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 400-4000  $cm^{-1}$ 

3) In which region of IR every molecule show its characteristic spectrum:

1 point

- Fingerprint region
- Functional group region
- Far IR region
- None of the mentioned

No, the answer is incorrect.

Score: 0

Accepted Answers:

Fingerprint region

4) Which of the following molecule is IR inactive :

1 point

- $CO_2$
- $H_2$
- $HCl$
- $NO$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $H_2$ 

 5) How many vibrational degrees of freedom are available for  $CO_2$ :

1 point

- 4
- 3
- 6
- 2

No, the answer is incorrect.

Score: 0

Accepted Answers:

4

6) According to Hooke's law, what is the correct relation between restoring force F and displacement x?

1 point

- $F = -kx$
- $F = -kx^2$
- $F = kx$
- $F = kx^2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $F = -kx$ 

7) Vibrational stretching frequency of a diatomic molecule is directly proportional to:

1 point

- Square Root of Force constant
- Square Root of Reduced mass
- Atomic population
- Temperature

No, the answer is incorrect.

Score: 0

Accepted Answers:

Square Root of Force constant

 8) The force constant of CO is 1840  $Nm^{-1}$ , what is the vibrational frequency in  $cm^{-1}$ 

1 point

- 2134  $cm^{-1}$
- 1750  $cm^{-1}$
- 2150  $cm^{-1}$
- 2250  $cm^{-1}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 2134  $cm^{-1}$ 

9) What is the order of increasing vibrational frequency for C-Cl, C-Br, C-C, C-O and C-H:

1 point

- C-Br < C-Cl < C-O < C-C < C-H
- C-Cl < C-Br < C-O < C-C < C-H
- C-H < C-C < C-O < C-Cl < C-Br
- C-H < C-O < C-C < C-Br < C-Cl

No, the answer is incorrect.

Score: 0

Accepted Answers:

C-Br &lt; C-Cl &lt; C-O &lt; C-C &lt; C-H

 10) What is the correct decreasing order of stretching frequencies for  $C \equiv C$ ,  $C=C$  and  $C-C$ :

1 point

- $C=C > C \equiv C > C-C$
- $C \equiv C > C=C > C-C$
- $C-C > C \equiv C > C=C$
- $C-C > C=C > C \equiv C$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $C \equiv C > C=C > C-C$ 

 11) What is the approximate vibrational frequency of carbonyl group ( $C=O$ ):

1 point

- 3400-3600  $cm^{-1}$
- 2100-2250  $cm^{-1}$
- 1600-1750  $cm^{-1}$
- 1200-1000  $cm^{-1}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 1600-1750  $cm^{-1}$ 

 12) What is the zero point vibrational energy of the HCl if  $k=516 \text{ Nm}^{-1}$ :

1 point

- $1.96 \cdot 10^{-20} \text{ J}$
- $1.96 \cdot 10^{-19} \text{ J}$
- $2.96 \cdot 10^{-19} \text{ J}$
- $2.96 \cdot 10^{-20} \text{ J}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $2.96 \cdot 10^{-20} \text{ J}$ 

 13) What is the transition energy, from  $v=0$  to  $v=1$  transition for HCl when oscillation frequency is  $8.667 \cdot 10^{13} \text{ s}^{-1}$ ?

1 point

- $2.24 \cdot 10^{-20} \text{ J}$
- $5.74 \cdot 10^{-20} \text{ J}$
- $5.74 \cdot 10^{-21} \text{ J}$
- $2.24 \cdot 10^{-19} \text{ J}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $5.74 \cdot 10^{-20} \text{ J}$ 

14) Raman spectroscopy is due to which type of interaction between matter and EMR:

1 point

- Scattering
- Absorption
- Reflection
- Transmission

No, the answer is incorrect.

Score: 0

Accepted Answers:

Scattering

15) What is the correct order of intensity of observed transitions?

1 point

- Rayleigh » Antistokes » Stokes
- Stokes » Antistokes » Rayleigh
- Rayleigh » Stokes = Antistokes
- Rayleigh » Stokes » Antistokes

No, the answer is incorrect.

Score: 0

Accepted Answers:

Rayleigh » Stokes » Antistokes

16) Homonuclear diatomic molecules can be observed through:

1 point

- Microwave spectroscopy
- IR spectroscopy
- Raman Spectroscopy
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Raman Spectroscopy

17) Raman intensity depends on:

1 point

- Polarizability of the molecule
- Intensity of the source
- Conc. of the active group
- All of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

All of the above

18) Which molecule obeys Mutual Exclusion principle:

1 point

- $CNS$
- $HCN$
- $H-C \equiv C-Cl$
- $CO_2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $CO_2$ 

 19) For  $CO_2$ , how many vibrational modes are Raman and IR active respectively:

1 point

- 1 and 3
- 2 and 2
- 3 and 1
- 0 and 4

No, the answer is incorrect.

Score: 0

Accepted Answers:

1 and 3

20) What is wavenumber of vibration band when the molecule was irradiated with laser of wavelength 514.5 nm and Raman line appeared at 564.8 nm:

1 point

- 1810  $cm^{-1}$
- 1750  $cm^{-1}$
- 1730  $cm^{-1}$
- 1900  $cm^{-1}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 1730  $cm^{-1}$