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Courses » Chemistry - II

Announcements

Course

Ask a Question

Progress

Mentor

Unit 5 - Week 4

Course outline

How to access the portal

Week 1

Week 2

Week 3

Week 4

● Lecture 12 :
Normal
Vibrational
modes
Triatomic
molecules

● Lecture 13 :
Normal
Vibrational
modes
Polyatomic
molecules

● Lecture 14 :
Vibrational
Polyatomic
Infrared
Spectroscopy
Local Modes
and Group
Frequencies

● Lecture 15:
Microwave
spectra of di-
atomic
molecules

● Lecture 16:
Diatomic
Molecules
Microwave
Energies and
Transitions

○ Quiz :
Assessment 6

Week 5

Week 6

Assessment 6

The due date for submitting this assignment has passed. **Due on 2016-03-18, 23:59 IST.**

Submitted assignment

1) The vibrational normal mode(s) that is (are) infrared active in H₂O molecule is (are) **1 point**

- Symmetric stretch mode only
- Asymmetric stretch mode only
- Bending only
- All three modes

No, the answer is incorrect.

Score: 0

Accepted Answers:

All three modes

2) The infrared active mode(s) for normal vibrations in CO₂ molecule is (are) **1 point**

- Asymmetric stretch mode only
- Degenerate bending modes only
- Asymmetric and degenerate bending modes
- Symmetric and asymmetric stretching modes

No, the answer is incorrect.

Score: 0

Accepted Answers:

Asymmetric and degenerate bending modes

3) The number of genuine vibrational modes in the molecule **1 point**
 $HC \equiv C - C \equiv C - C \equiv CH$ is

- 24
- 19
- 18
- 5

No, the answer is incorrect.

Score: 0

Accepted Answers:

19

4) The zero point vibrational energy of carbon dioxide is given as **1 point**

-
- $\frac{1}{2} \hbar \omega_{Sym.stretch} + \frac{1}{2} \hbar \omega_{Asym.stretch}$
-

Week 7

Week 8

$$\frac{1}{2} \hbar \omega_{\text{Sym.stretch}} + \frac{1}{2} \hbar \omega_{\text{Asym.stretch}} + \frac{1}{2} \hbar \omega_{\text{Bend}}$$



$$\frac{1}{2} \hbar \omega_{\text{Sym.stretch}} + \frac{1}{2} \hbar \omega_{\text{Asym.stretch}} + \hbar \omega_{\text{Bend}}$$



$$2\hbar \omega_{\text{Bend}}$$

No, the answer is incorrect.**Score: 0****Accepted Answers:**

$$\frac{1}{2} \hbar \omega_{\text{Sym.stretch}} + \frac{1}{2} \hbar \omega_{\text{Asym.stretch}} + \hbar \omega_{\text{Bend}}$$

5) BF_3 has two degenerate vibrational modes each having the same frequency ν . The two modes are denoted by quantum numbers ν_1 and ν_2 . When two quanta of radiation with the frequency ν are absorbed by the molecule, the possible quantum numbers of the excited states are **1 point**

- ($\nu_1=0, \nu_2=2$) and ($\nu_1=2, \nu_2=0$) only
- $\nu_1=2, \nu_2=0$ only
- $\nu_1=0, \nu_2=2$ only
- ($\nu_1=0, \nu_2=2$), ($\nu_1=1, \nu_2=1$) and ($\nu_1=2, \nu_2=0$)

No, the answer is incorrect.**Score: 0****Accepted Answers:**

($\nu_1=0, \nu_2=2$), ($\nu_1=1, \nu_2=1$) and ($\nu_1=2, \nu_2=0$)

6) The normal vibrational modes of CS_2 have two degenerate bending modes each with a frequency corresponding to 397 cm^{-1} . If a light of frequency corresponding to 794 cm^{-1} is used to excite ground state CS_2 , it will result in **1 point**

- Exciting one degenerate vibration by two quanta to $\nu=2$ level
- Exciting each mode of CS_2 by one quantum to $\nu=1$ level
- Exciting both bending modes to $\nu=2$ level
- Will not result in any absorption in the limit of harmonic oscillator model.

No, the answer is incorrect.**Score: 0****Accepted Answers:**

Will not result in any absorption in the limit of harmonic oscillator model.

7) The fundamental frequencies of vibrations of the diatomic molecule are given in brackets in the following reaction scheme, **1 point**



- 172 cm^{-1}
- -172 cm^{-1}
- -86 cm^{-1}
- 86 cm^{-1}

No, the answer is incorrect.**Score: 0****Accepted Answers:**

-86 cm^{-1}

8) The number of translational (T), rotational (R) and vibrational (V) degrees of the freedom of the molecule $\text{HC} \equiv \text{C} - (\text{C} \equiv \text{C})_5 - \text{C} \equiv \text{CH}$ **1 point**

- 3 (T), 3 (R) and 18 (V)
- 3 (T), 3 (R) and 42 (V)
- 2 (T), 2 (R) and 44 (V)
- 3 (T), 2 (R) and 43 (V)

No, the answer is incorrect.

Score: 0

Accepted Answers:

3 (T), 2 (R) and 43 (V)

9) A linear molecule AB_2 may have either of the two possible structures A-B-B and B-A-B. **1 point**
The number of infrared active modes for each of them, are ,respectively

- 4 and 3
- 4 and 2
- 3 and 3
- 4 and 4

No, the answer is incorrect.

Score: 0

Accepted Answers:

4 and 3

10) A linear molecule A_2B_2 has been assigned one of the possible structures, A-B-B-A, A-B-A-B, **1 point**
B-A-A-B or B-A-B-A. The molecule has two bending modes which are degenerate and all the seven modes are IR active. The correct structure is

- A-B-B-A only
- B-A-A-B only
- Both A-B-A-B and B-A-B-A are possible
- Both A-B-A-B and B-A-A-B are possible

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both A-B-A-B and B-A-B-A are possible

Previous Page

End

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