1. The vibrational normal mode(s) that is (are) infrared active in SO$_2$ molecule is (are)

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

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*All three modes*

2. The number of genuine vibrational modes in the molecule $HC≡C−HC≡C−HC≡C−HC≡C−CH_3$ is

- 30
- 29
- 31
- 33

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

31

3. The infrared inactive mode(s) in CO$_2$ molecule is (are)

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

**Score: 0**

**Accepted Answers:**
4) The zero point vibrational energy of carbon dioxide is given as

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
Symmetric stretch mode only

5) NH₃ has two degenerate normal vibrational modes each having the same frequency \( \nu \). The two modes are denoted by quantum numbers \( v_1 \) and \( v_2 \). When one quantum of radiation with the frequency \( \nu \) is absorbed by the molecule from its ground state, the quantum numbers of the excited states are

- \((v_1=0, v_2=1)\) and \((v_1=1, v_2=0)\)
- \(v_1=1, v_2=0\) only
- \(v_1=0, v_2=1\) only
- \(v_1=0, v_2=1\) only

No, the answer is incorrect.
Score: 0
Accepted Answers:
\((v_1=0, v_2=1)\) and \((v_1=1, v_2=0)\)

6) The normal vibrational modes of CS₂ 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 CS₂, it will result in

- Exciting one degenerate vibration by two quanta to \( v=2 \) level
- Exciting each mode of CS₂ by one quantum to \( v=1 \) level
- Exciting both bending modes to \( v=2 \) 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,

\[
\text{HCl} (2989 \text{ cm}^{-1}) + \text{D}_2 (3119 \text{ cm}^{-1}) \rightarrow \text{DCI} (2119 \text{ cm}^{-1}) + \text{HD} (3817 \text{ cm}^{-1}).
\]

The enthalphy for the reaction in wave number units is

- \(172 \text{ cm}^{-1}\)
- \(-172 \text{ cm}^{-1}\)
- \(-86 \text{ cm}^{-1}\)
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 freedom of the molecule $HC \equiv C - (C \equiv C)_n - C \equiv CH_{\text{are}}$

- 3 (T), 3 (R) and 6n+12 (V)
- 3 (T), 2 (R) and 6n+13 (V)
- 2 (T), 2 (R) and 6n+14 (V)
- 2 (T), 3 (R) and 6n+5 (V)

No, the answer is incorrect.
Score: 0
Accepted Answers:
3 (T), 2 (R) and 6n+13 (V)

1.9) A linear molecule AB$_2$ may have either of the two possible structures A-B-B and B-A-B. The number of infrared active modes for each of them, are, respectively,

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
4 and 3

10) A linear molecule A$_2$B$_2$ has been assigned one of the possible structures, A-B-, B-A, A-B-A-B, B-A-A-B or B-A-B-A. The molecule has two bending modes which are degenerate and all the seven nodes are IR active. The correct structure is likely to be

- A-B-B-A only
- B-A-A-B only
- Both A-B-A-B and B-A-B-A

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both A-B-A-B and B-A-B-A