Physics 07 **HW CH 29 Quantum Molecules**

Name_____

1) Covalent bonding is due to
A) unequal charge distributions around neutral molecules.
B) atoms bonding to hydrogen molecules.
C) the transfer of electrons between atoms.
D) the sharing of electrons between atoms.

2) Ionic bonding is due to
A) atoms bonding to hydrogen molecules.
B) the transfer of electrons between atoms.
C) unequal charge distributions around neutral molecules.
D) the sharing of electrons between atoms.

3) Van der Waals bonding is due to
A) the sharing of electrons between atoms.
B) the transfer of electrons between atoms.
C) atoms bonding to hydrogen molecules.
D) unequal charge distribution around neutral molecules.

4) In general, which of the following is usually the strongest bond?
A) ionic bond B) van der Waals bond C) hydrogen bond

5) In general, which of the following is usually the weakest bond?
A) ionic bond B) covalent bond
C) hydrogen bond D) van der Waals bond

6) For a diatomic quantum mechanical rotator, the energy difference between adjacent energy levels
A) decreases as L increases. B) increases as L increases.
C) is constant for all L. D) varies randomly as L increases.

7) A diatomic quantum mechanical rotator in the $L = 1$ quantum state has energy E. The same rotator in the $L = 2$ quantum state will have energy equal to
A) $2E$. B) $6E$.
C) $3E$. D) none of the given answers.

8) In its lowest quantum state, the energy of a diatomic harmonic oscillator having frequency f is
A) $hf/2$. B) hf. C) $3hf/2$. D) $hf/4$.

9) For a diatomic quantum mechanical vibrator, the energy difference between adjacent quantum states
A) is constant for all values of the integer v. B) varies randomly as the integer v increases.
C) decreases as the integer v increases. D) increases as the integer v increases.

10) In its lowest quantum state, a diatomic quantum mechanical rotator has a rotational energy of
A) $\frac{\hbar^2}{2I}$ B) zero.
C) $\frac{\hbar^2}{I}$. D) none of the given answers.

11) If a diatomic quantum mechanical vibrator in its ground state has energy E, what is its energy in its second state above the ground state?

A) $9E$. B) $3E$. C) E. D) $7E$. E) $5E$.

12) Metallic bonding is due to

A) the transfer of electrons between atoms.
B) the sharing of electrons by all atoms.
C) unequal charge distributions around neutral molecules.
D) atoms bonding to hydrogen molecules.

13) In a good conductor, the highest energy band containing electrons is

A) only partially filled. B) completely empty. C) completely filled.

14) In a good insulator, the highest energy band containing electrons, called the valence band, is

A) completely filled. B) only partially filled. C) completely empty.

15) A diatomic quantum mechanical oscillator has a moment of inertia of 7.73×10^{-45} kg • m^2. What is the rotational energy when it is in the quantum state characterized by $L = 2$? (1 eV = 1.60×10^{-19} J, $h = 6.626 \times 10^{-34}$ J • s)

16) A diatomic molecule has 2.6×10^{-5} eV of rotational energy in the $L = 2$ quantum state. What is its rotational energy in the $L = 1$ quantum state? (1 eV = 1.60×10^{-19} J, $h = 6.626 \times 10^{-34}$ J • s)

17) A diatomic molecule has 18×10^{-5} eV of rotational energy in the $L = 2$ quantum state. What is its rotational energy in the $L = 0$ quantum state? (1 eV = 1.60×10^{-19} J, $h = 6.626 \times 10^{-34}$ J • s)

18) Estimate the maximum rotational energy (in electron–volts) for a free and freely–spinning diatomic hydrogen molecule in the $L = 2$ quantum state. The equilibrium separation for the atoms in the H_2 molecule is 0.075 nm. (1 eV = 1.60×10^{-19} J, $m_{\text{proton}} = 1.67 \times 10^{-27}$ kg, $h = 6.626 \times 10^{-34}$ J • s)

19) A diatomic molecule is vibrating in the $v = 1$ quantum state with a frequency of 2.0×10^{13} Hz. What is its vibrational energy? (1 eV = 1.60×10^{-19} J, $h = 6.626 \times 10^{-34}$ J • s)

20) The energy gap between the valence and conduction bands in a certain semiconductor is 1.25 eV. What is the threshold wavelength for optical absorption in this substance? ($c = 3.00 \times 10^8$ m/s, $h = 6.626 \times 10^{-34}$ J • s)

Answer Key
Testname: CH29_QUANTUM_MOLECULES

1) D
2) B
3) D
4) A
5) D
6) B
7) C
8) A
9) A
10) B
11) E
12) B
13) A
14) A
15) 2.70×10^{-5} eV
16) 8.7×10^{-6} eV
17) 0 eV
18) 0.044 eV
19) 0.12 eV
20) 994 nm