

1061-3rd Chem Exam-1070110(A)

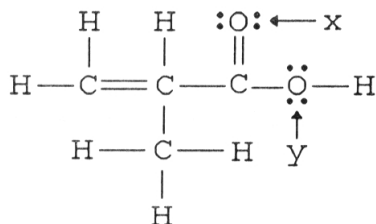
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) ClF_3 has "T-shaped" geometry. There are _____ non-bonding domains in this molecule.

- A) 1 B) 3 C) 4 D) 2 E) 0

Answer: D

2) The hybridization of the oxygen atom labeled y in the structure below is _____. The C-O-H bond angle is _____.



- A) sp^3d^2 , 90° B) sp, 90° C) sp^2 , 109.5° D) sp^3 , 109.5° E) sp, 180°

Answer: D

3) There are _____ σ bonds and _____ π bonds in $\text{H}_3\text{C}-\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\text{C}\equiv\text{CH}$.

- A) 10, 3 B) 12, 2 C) 14, 2 D) 13, 2 E) 16, 3

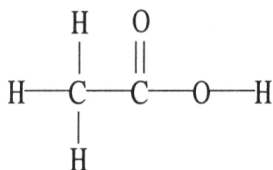
Answer: E

4) The O-C-O bond angle in the CO_3^{2-} ion is approximately _____.

- A) 109.5° B) 60° C) 120° D) 180° E) 90°

Answer: C

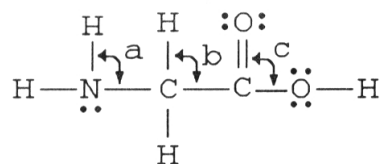
5) The molecular geometry of the left-most carbon atom in the molecule below is _____.



- A) octahedral
 B) trigonal bipyramidal
 C) trigonal planar
 D) tetrahedral
 E) T-shaped

Answer: D

6) The bond angles marked a, b, and c in the molecule below are about _____, _____, and _____, respectively.



- A) 120° , 109.5° , 120°
- B) 90° , 180° , 90°
- C) 109.5° , 109.5° , 109.5°
- D) 109.5° , 109.5° , 90°
- E) 109.5° , 109.5° , 120°

Answer: E

7) Of the molecules below, only _____ is polar.

- A) CH_4
- B) SeF_4
- C) SiCl_4
- D) CCl_4

Answer: B

8) The hybridization of nitrogen in the $\text{H}-\text{C}\equiv\text{N}$: molecule is _____.

- A) sp^2
- B) sp
- C) s^2p
- D) s^3p
- E) sp^3

Answer: B

9) In comparing the same two atoms bonded together, the _____ the bond order, the _____ the bond length, and the _____ the bond energy.

- A) smaller, greater, greater
- B) greater, greater, greater
- C) greater, longer, greater
- D) smaller, longer, smaller
- E) greater, shorter, greater

Answer: D, E

10) Based on molecular orbital theory, the bond order of the C—C bond in the C_2 molecule is _____.

- A) 0
- B) 1
- C) 2
- D) 3
- E) 4

Answer: C

11) Based on molecular orbital theory, there are _____ unpaired electrons in the OF^+ ion.

- A) 1/2
- B) 1
- C) 2
- D) 3
- E) 0

Answer: C

12) Of the following, _____ has a slight odor of bitter almonds and is toxic.

- A) CO
- B) HCN
- C) N_2O
- D) NH_3
- E) CH_4

Answer: B

13) How many moles of gas are there in a 45.0 L container at 25.0°C and 500.0 mm Hg? (1 atm = 760 mm Hg; $R = 0.08206 \text{ L}\cdot\text{atm}/\text{Mol}\cdot\text{K}$)

- A) 6.11
- B) 18.4
- C) 207
- D) 1.21
- E) 0.630

Answer: D

- 14) The volume of a sample of gas (2.49 g) was 752 mL at 1.98 atm and 62 °C. The gas is _____.
- A) NH₃ B) NO₂ C) SO₃ D) SO₂ E) Ne

Answer: B

- 15) 10.0 grams of argon and 20.0 grams of neon are placed in a 1200.0 ml container at 25.0 °C. The partial pressure of neon is _____ atm. (atomic mass of argon is 39.948; atomic mass of neon is 20.180)
- A) 8.70 B) 5.60 C) 20.4 D) 0.700 E) 3.40

Answer: C

- 16) Which of the following equations shows an incorrect relationship between pressures given in terms of different units?
- A) 1.0 torr = 2.00 mm Hg
B) 1.00 atm = 760 torr
C) 1.20 atm = 122 kPa
D) 152 mm Hg = 2.03×10^4 Pa
E) 0.760 atm = 578 mm Hg

Answer: A

- 17) The pressure exerted by a column of liquid is equal to the product of the height of the column times the gravitational constant times the density of the liquid, $P = gh\rho$. How high a column of methanol ($d = 0.79$ g/mL) would be supported by a pressure that supports a 713 mm column of mercury ($d = 13.6$ g/mL)?
- A) 713 mm
B) 9.7×10^3 mm
C) 1.2×10^4 mm
D) 17 mm
E) 41 mm

Answer: C

- 18) According to kinetic-molecular theory, in which of the following gases will the root-mean-square speed of the molecules be the highest at 200 °C?
- A) HCl
B) SF₆
C) H₂O
D) Cl₂
E) None. The molecules of all gases have the same root-mean-square speed at any given temperature.

Answer: C

- 19) At 333 K, which of the pairs of gases below would have the most nearly identical rates of effusion?
- A) N₂O and NO₂
B) CO and CO₂
C) CO and N₂
D) NO₂ and N₂O₄
E) N₂ and O₂

Answer: C

20) A real gas will behave most like an ideal gas under conditions of _____.

- A) low temperature and low pressure
- B) high temperature and high pressure
- C) low temperature and high pressure
- D) STP
- E) high temperature and low pressure

Answer: E

21) Which one of the following gases would deviate the least from ideal gas behavior?

- A) Kr
- B) Ne
- C) CO₂
- D) F₂
- E) CH₃Cl

Answer: B

22) Of the following substances, only _____ has London dispersion forces as its only intermolecular force.

- A) CH₃OH
- B) HCl
- C) CH₄
- D) NH₃
- E) H₂S

Answer: C

23) Of the following substances, _____ has the highest boiling point.

- A) CO₂
- B) NH₃
- C) Kr
- D) CH₄
- E) H₂O

Answer: E

24) When NaCl dissolves in water, aqueous Na⁺ and Cl⁻ ions result. The force of attraction that exists between Na⁺ and H₂O is called a(n) _____ interaction.

- A) ion-dipole
- B) dipole-dipole
- C) London dispersion force
- D) ion-ion
- E) hydrogen bonding

Answer: A

25) As a solid element melts, the atoms become _____ and they have _____ attraction for one another.

- A) larger, greater
- B) more separated, less
- C) closer together, less
- D) more separated, more
- E) closer together, more

Answer: B

26) Heat of sublimation can be approximated by adding together _____ and _____.

- A) heat of fusion, heat of vaporization
- B) heat of freezing (solidification), heat of condensation
- C) heat of freezing (solidification), heat of vaporization
- D) heat of fusion, heat of condensation
- E) heat of deposition, heat of vaporization

Answer: A

27) Based on the following information, which compound has the strongest intermolecular forces?

Substance	ΔH_{vap} (kJ/mol)
Argon (Ar)	6.3
Benzene (C ₆ H ₆)	31.0
Ethanol (C ₂ H ₅ OH)	39.3
Water (H ₂ O)	40.8
Methane (CH ₄)	9.2

A) Methane

B) Ethanol

C) Benzene

D) Water

E) Argon

Answer: D

28) Which one of the following exhibits dipole-dipole attraction between molecules?

A) BCl₃

B) Cl₂

C) AsH₃

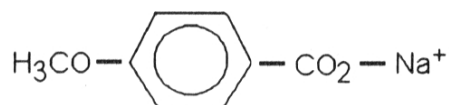
D) XeF₄

E) CO₂

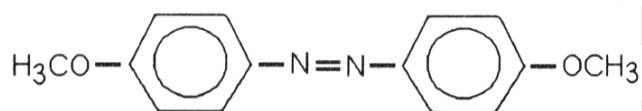
Answer: C

29) Which of the following is most likely to exhibit liquid-crystalline behavior?

A)



B)



C) CH₃CH₂-C(CH₃)₂-CH₂CH₃

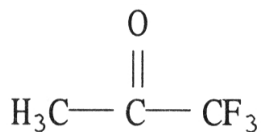
D) CH₃CH₂CH₂CH₂CH₂⁻ Na⁺

E) CH₃CH₂CH₂CH₂CH₂CH₂CH₂CH₃

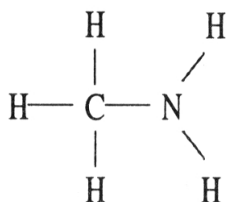
Answer: B

30) Which one of the following substances will have hydrogen bonding as one of its intermolecular forces?

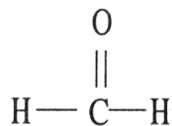
A)



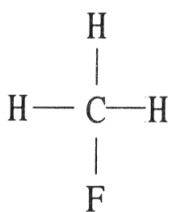
B)



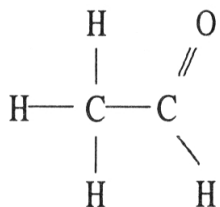
C)



D)



E)



Answer: B

31) _____ is the energy required to expand the surface area of a liquid by a unit amount of area.

- A) Viscosity
- B) Capillary action
- C) Volatility
- D) Meniscus
- E) Surface tension

Answer: E

32) The critical temperature and pressure of CS₂ are 279 °C and 78 atm, respectively. At temperatures above 279°C and pressures above 78 atm, CS₂ can only occur as a _____.

- A) liquid
- B) solid
- C) liquid and gas
- D) supercritical fluid
- E) gas

Answer: D

33) Which of the following is not a type of solid?

- A) supercritical
- B) metallic
- C) covalent-network
- D) molecular
- E) ionic

Answer: A

34) The scattering of light waves upon passing through a narrow slit is called _____.

- A) diffusion
- B) incidence
- C) adhesion
- D) grating
- E) diffraction

Answer: E

35) Heterogeneous alloys

- A) have properties that depend on the manner in which the melt is solidified.
- B) have properties that depend on composition.
- C) have properties that depend on the manner in which the solid is formed.
- D) All of the above are true.

Answer: C

36) Of the following, only _____ is not a polymer.

- A) protein
- B) cellulose
- C) stainless steel
- D) nylon
- E) starch

Answer: C

37) Which of the following is not classified as a nanomaterial?

- A) carbon nanotubes
- B) isoprene
- C) buckminsterfullerene
- D) graphene
- E) All of the above are classified as nanomaterials

Answer: B

- 38) If the electronic structure of a solid substance consists of a valence band that is completely filled with electrons and there is a large energy gap to the next set of orbitals, then this substance will be a(n) _____.
- A) semiconductor
 - B) nonmetal
 - C) insulator
 - D) alloy
 - E) conductor

Answer: C

- 39) NaCl crystallizes in a face-centered cubic cell. What is the total number of ions (Na^+ ions and Cl^- ions) that lie within a unit cell of NaCl?

A) 5 B) 4 C) 6 D) 2 E) 8

Answer: E

- 40) Inorganic compounds that are semiconductors have an average of _____ valence electrons.

A) 4 B) 1 C) 5 D) 2 E) 3

Answer: A