

1051-3rd Chem Exam_1060111(A)

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

- 1) The molecular-orbital model for Ge shows it to be
- A) a conductor, because all the lower energy band orbitals are filled and the gap between the lower and higher bands is large.
 - B) a semiconductor, because the gap between the filled lower and empty higher energy bands is relatively small.
 - C) a conductor, because its lower energy band orbitals are only partially filled.
 - D) a semiconductor, because the gap between the filled lower and empty higher energy bands is large.
 - E) an insulator, because all the lower energy band orbitals are filled and the gap between the lower and higher bands is large.

Answer: B

- 2) The empirical formula of an addition polymer _____.
- A) is the same as that of the monomer from which it is formed except that 2 H and 1 C have been added
 - B) is the same as that of the monomer from which it is formed except that 2 H and 1 O have been added
 - C) is the same as that of the monomer from which it is formed except that 2 H and 1 C have been subtracted
 - D) is the same as that of the monomer from which it is formed except that 2 H and 1 O have been subtracted
 - E) is the same as that of the monomer from which it is formed

Answer: E

- 3) Natural rubber is too soft and chemically reactive for practical applications. Vulcanization of natural rubber entails _____.
- A) conversion of a condensation polymer to an addition polymer
 - B) increasing the average molecular weight of a condensation polymer
 - C) crosslinking reactive polymer chains with sulfur atoms
 - D) decreasing the average molecular weight of an addition polymer
 - E) conversion of an addition polymer to a condensation polymer

Answer: C

- 4) Crystalline solids differ from amorphous solids in that crystalline solids have _____.
- A) atoms, molecules, or ions that are close together
 - B) much larger atoms, molecules, or ions
 - C) no orderly structure
 - D) a long-range repeating pattern of atoms, molecules, or ions
 - E) appreciable intermolecular attractive forces

Answer: D

- 5) Which one of the following cannot form a solid with a lattice based on the sodium chloride structure?
- A) NaBr B) LiF C) CuO D) CuCl₂ E) RbI

Answer: D

- 6) CsCl crystallizes in a unit cell that contains a Cs⁺ ion at the center of a cube and a Cl⁻ ion at each corner. The unit cell of CsCl is _____.
- A) primitive cubic
 - B) close packed
 - C) amorphous
 - D) body-centered cubic
 - E) face-centered cubic

Answer: A, D

7) Potassium metal crystallizes in a body-centered cubic structure with a unit cell edge length of 5.31 Å. The radius of a potassium atom is _____ Å.

- A) 1.33 B) 2.30 C) 2.66 D) 1.88 E) 5.31

Answer: B

8) 18 karat gold contains _____% gold.

- A) 25 B) 1.0×10^2 C) 18 D) 75 E) 89

Answer: D

9) When the size of a semiconductor particle or crystal _____, the band gap energy _____.

- A) increases, increases
B) decreases, increases
C) decreases, decreases
D) decreases, remains the same
E) decreases, goes to zero

Answer: B

10) The _____ lattice is one of the seven primitive three-dimensional lattices in which the relationship between the lattice vectors a , b , and c can be written as: $a \neq b \neq c$

- A) hexagonal
B) cubic
C) monoclinic
D) rhombohedral
E) tetragonal

Answer: C

11) Which of the following statements about gases is false?

- A) All gases are colorless and odorless at room temperature.
B) Gases are highly compressible.
C) Gases expand spontaneously to fill the container they are placed in.
D) Distances between molecules of gas are very large compared to bond distances within molecules.
E) Non-reacting gas mixtures are homogeneous.

Answer: A

12) Of the following, _____ is a correct statement of Boyle's law.

- A) $\frac{V}{T} = \text{constant}$
B) $\frac{P}{V} = \text{constant}$
C) $\frac{V}{P} = \text{constant}$
D) $\frac{n}{P} = \text{constant}$
E) $PV = \text{constant}$

Answer: E

- 13) 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 water ($d = 1.0 \text{ g/mL}$) would be supported by a pressure that supports a 713 mm column of mercury ($d = 13.6 \text{ g/mL}$)?
- A) $1.2 \times 10^4 \text{ mm}$
 - B) 14 mm
 - C) $9.7 \times 10^3 \text{ mm}$
 - D) 713 mm
 - E) 52 mm

Answer: C

- 14) Of the following, _____ is a valid statement of Charles' law.

- A) $PV = \text{constant}$
- B) $V = \text{constant} \times P$
- C) $V = \text{constant} \times n$
- D) $\frac{V}{T} = \text{constant}$
- E) $\frac{P}{T} = \text{constant}$

Answer: D

- 15) Arrange the following gases in order of increasing average molecular speed at 25 °C.

He, O₂, CO₂, N₂

- A) CO₂ < N₂ < O₂ < He
- B) He < N₂ < O₂ < CO₂
- C) He < O₂ < N₂ < CO₂
- D) CO₂ < He < N₂ < O₂
- E) CO₂ < O₂ < N₂ < He

Answer: E

- 16) A mixture of carbon dioxide and an unknown gas was allowed to effuse from a container. The carbon dioxide took 1.25 times as long to escape as the unknown gas. Which one could be the unknown gas?

- A) SO₂
- B) H₂
- C) Cl₂
- D) CO
- E) HCl

Answer: D

- 17) A gas mixture of N₂ and CO₂ has a total pressure of 8.00 atm and contains 12.5 mol of gas. If the partial pressure of N₂ is 3.69 atm, how many moles of CO₂ are in the mixture?

- A) 6.73
- B) 5.77
- C) 3.69
- D) 11.0
- E) 4.31

Answer: A

- 18) The volume of a sample of gas (2.49 g) was 752 mL at 1.98 atm and 62 °C. The gas is _____.

- A) SO₃
- B) SO₂
- C) Ne
- D) NH₃
- E) NO₂

Answer: E

19) The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because _____.

- A) the gas molecules collide more frequently with the wall
- B) the gas molecules collide more energetically with the wall
- C) the average kinetic energy of the gas molecules decreases
- D) the gas molecules collide less frequently with the wall
- E) both the gas molecules collide more frequently with the wall and the gas molecules collide more energetically with the wall

Answer: E

20) Which one of the following is a valid statement of Avogadro's law?

- A) $\frac{P}{T} = \text{constant}$
- B) $V = \text{constant} \times P$
- C) $\frac{V}{T} = \text{constant}$
- D) $V = \text{constant} \times n$
- E) $PV = \text{constant}$

Answer: D

21) In liquids, the attractive intermolecular forces are _____.

- A) very weak compared with kinetic energies of the molecules
- B) strong enough to keep the molecules confined to vibrating about their fixed lattice points
- C) not strong enough to keep molecules from moving past each other
- D) strong enough to hold molecules relatively close together but not strong enough to keep molecules from moving past each other
- E) strong enough to hold molecules relatively close together

Answer: D

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

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

Answer: B

23) Which of the following statements is false?

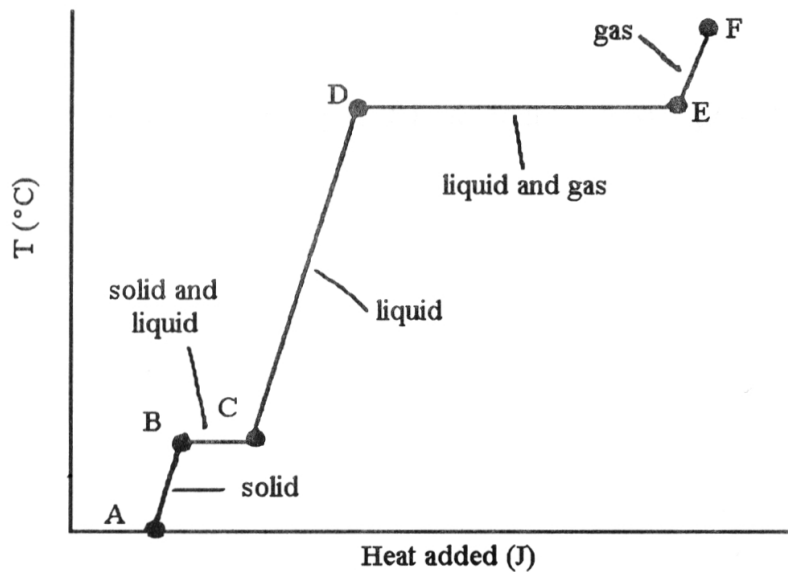
- A) The absolute value of the heat of sublimation is equal to the absolute value of the heat of deposition.
- B) The absolute value of the heat of deposition is equal to sum of the absolute value of the heat of vaporization and the absolute value of the heat of freezing.
- C) The absolute value of the heat of sublimation is equal to the absolute value of the sum of the heat of condensation and the heat of freezing.
- D) The heat of sublimation is equal to the sum of the heat of vaporization and the heat of melting.
- E) The heat of sublimation is equal to the sum of the heat of vaporization and the heat of freezing.

Answer: E

24) Large intermolecular forces in a substance are manifested by _____.

- A) high boiling point
- B) low vapor pressure
- C) high critical temperatures and pressures
- D) high heats of fusion and vaporization
- E) all of the above

Answer: E



- 25) The phase changes B → C and D → E are not associated with temperature increases because the heat energy is used up to _____.
- increase the velocity of molecules
 - increase distances between molecules
 - increase the density of the sample
 - rearrange atoms within molecules
 - break intramolecular bonds

Answer: B

- 26) What intermolecular force is responsible for the fact that ice is less dense than liquid water?
- dipole-dipole forces
 - ion-dipole forces
 - hydrogen bonding
 - London dispersion forces
 - ionic bonding

Answer: C

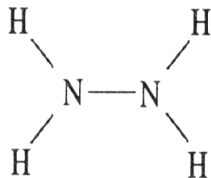
- 27) Which statements about viscosity are true?
- Viscosity increases as temperature decreases.
 - Viscosity increases as molecular weight increases.
 - Viscosity increases as intermolecular forces increase.

A) (i) only B) (i) and (iii) C) (ii) and (iii) D) none E) all

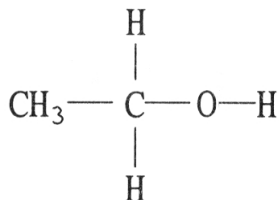
Answer: E

28) Which one of the following substances will not have hydrogen bonding as one of its intermolecular forces?

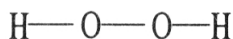
A)



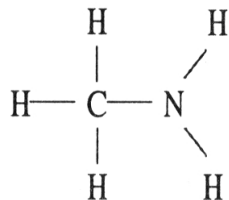
B)



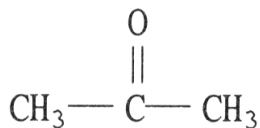
C)



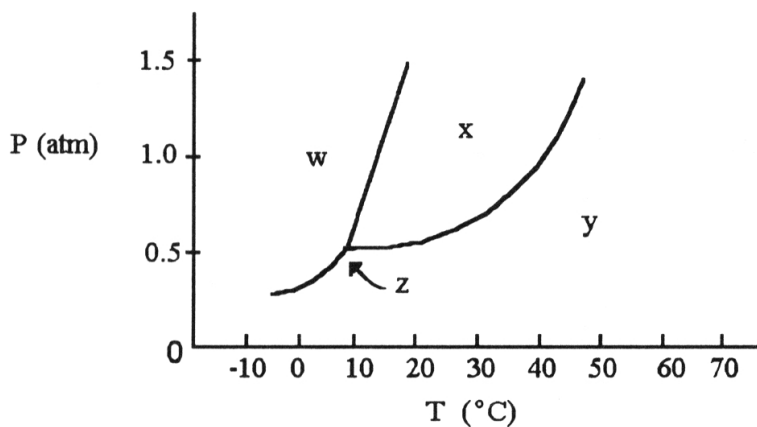
D)



E)



Answer: E

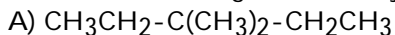


29) The phase diagram of a substance is given above. This substance is a _____ at -10°C and 1.0 atm .

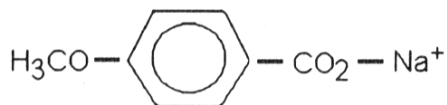
- A) solid
- B) gas
- C) liquid
- D) supercritical fluid
- E) crystal

Answer: A

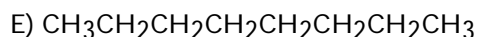
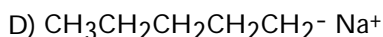
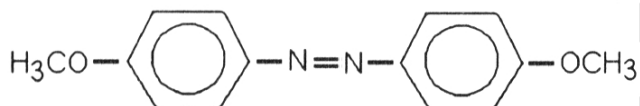
30) Which of the following is most likely to exhibit liquid-crystalline behavior?



B)



C)



Answer: C

31) The basis of the VSEPR model of molecular bonding is _____.

A) hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry

B) regions of electron density on an atom will organize themselves so as to maximize s-character

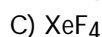
C) electron domains in the valence shell of an atom will arrange themselves so as to minimize repulsions

D) atomic orbitals of the bonding atoms must overlap for a bond to form

E) regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap

Answer: C

32) The electron-domain geometry of _____ is tetrahedral.



E) all of the above except XeF_4

Answer: E

33) The central Xe atom in the XeF_4 molecule has _____ unbonded electron pairs and _____ bonded electron pairs in its valence shell.

A) 4, 0

B) 2, 4

C) 4, 1

D) 1, 4

E) 4, 2

Answer: B

34) The molecular geometry of the PF_3 molecule is _____, and this molecule is _____.

A) trigonal planar, polar

B) trigonal pyramidal, polar

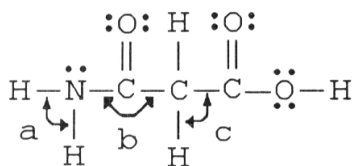
C) trigonal planar, nonpolar

D) tetrahedral, unipolar

E) trigonal pyramidal, nonpolar

Answer: B

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



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

Answer: C

36) The hybridizations of iodine in IF_3 and IF_5 are _____ and _____, respectively.

- A) sp^3d^2 , sp^3d^2
- B) sp^3 , sp^3d
- C) sp^3d , sp^3
- D) sp^3d^2 , sp^3d
- E) sp^3d , sp^3d^2

Answer: E

37) Based on molecular orbital theory, the bond orders of the H—H bonds in H_2 , H_2^+ , and H_2^- are _____, respectively

- A) 1, $1/2$, and 0
- B) 1, $1/2$, and $1/2$
- C) 1, 0, and $1/2$
- D) 1, 0, and 0
- E) 1, 2, and 0

Answer: B

38) A molecule has the formula AB_3 and the central atom is in a different plane from the surrounding three atoms. Its molecular shape is _____.

- A) bent
- B) tetrahedral
- C) trigonal pyramidal
- D) T-shaped
- E) linear

Answer: C

39) PCl_5 has _____ electron domains and a _____ molecular arrangement.

- A) 5, square pyramidal
- B) 6, trigonal bipyramidal
- C) 6, tetrahedral
- D) 5, trigonal bipyramidal
- E) 6, seesaw

Answer: D

40) Three monosulfur fluorides are observed: SF₂, SF₄, and SF₆. Of these, _____ is/are polar.

- A) SF₂ only
- B) SF₄ only
- C) SF₂, SF₄, and SF₆
- D) SF₆ only
- E) SF₂ and SF₄ only

Answer: E