1031_4th Exam_1040114

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

1) Give the approximate bond angle for a molecule with an octahedral shape.
A) 90° B) 120° C) 180° D) 105° E) 109.5°

Answer: A

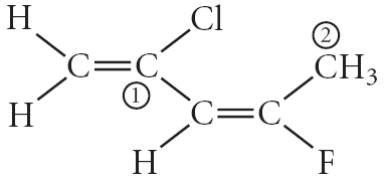
2) Determine the electron geometry (eg) and molecular geometry (mg) of CO_3^{2-}.
A) eg=tetrahedral, mg=trigonal pyramidal
B) eg=tetrahedral, mg=tetrahedral
C) eg=trigonal planar, mg=bent
D) eg=tetrahedral, mg=trigonal planar
E) eg=trigonal planar, mg=trigonal planar

Answer: E

3) The bond angle in NH_3 is
A) 120° B) 95° C) 104.5° D) 107° E) 109.5°

Answer: D

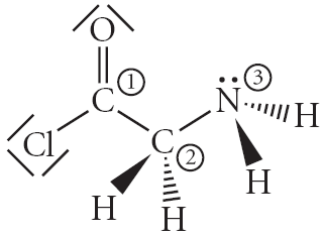
4) Consider the molecule below. Determine the molecular geometry at each of the 2 labeled carbons.



A) C1 = trigonal planar, C2 = tetrahedral
B) C1 = trigonal pyramidal, C2 = see-saw
C) C1 = tetrahedral, C2 = linear
D) C1 = bent, C2 = trigonal planar
E) C1 = trigonal planar, C2= bent

Answer: A

5) Consider the molecule below. Determine the molecular geometry at each of the 3 labeled atoms.



A) 1=trigonal planar, 2=tetrahedral, 3=tetrahedral
B) 1=tetrahedral, 2=tetrahedral, 3=trigonal planar
C) 1=trigonal planar, 2=trigonal pyramidal, 3=trigonal pyramidal
D) 1=tetrahedral, 2=tetrahedral, 3=tetrahedral
E) 1=trigonal planar, 2=tetrahedral, 3=trigonal pyramidal

Answer: E

6) Place the following in order of increasing F-A-F bond angle, where A represents the central atom in each molecule.

PF_3 OF_2 PF_4^+

A) $PF_3 < OF_2 < PF_4^+$
B) $PF_4^+ < PF_3 < OF_2$
C) $PF_4^+ < OF_2 < PF_3$
D) $OF_2 < PF_3 < PF_4^+$
E) $OF_2 < PF_4^+ < PF_3$

Answer: D

7) How many of the following molecules are polar?

$BrCl_3$ CS_2 SiF_4 SO_3

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

Answer: A

8) Place the following in order of increasing dipole moment.

I. BCl_3 II. BIF_2 III. $BClF_2$

A) II < III < I B) I < II < III C) II < I < III D) I < III < II E) I < II = III

Answer: D

9) Give the hybridization for the O in H_3O^+.

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

Answer: D

10) Give the hybridization for the S in SF_6.

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

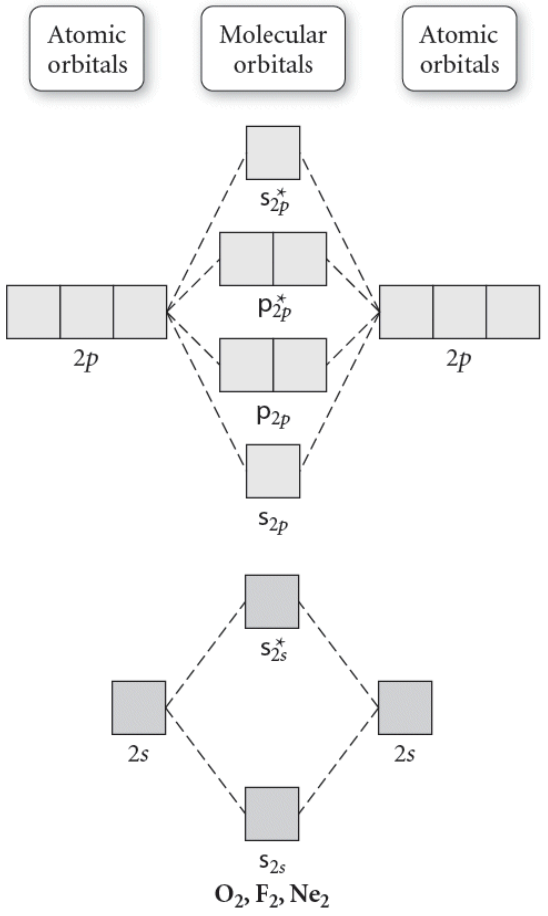
Answer: A

11) Which of the following statements is TRUE?

A) Electrons placed in antibonding orbitals stabilize the ion/molecule.
B) The total number of molecular orbitals formed doesn't always equal the number of atomic orbitals in the set.
C) A bond order of 0 represents a stable chemical bond.
D) When two atomic orbitals come together to form two molecular orbitals, one molecular orbital will be lower in energy than the two separate atomic orbitals and one molecular orbital will be higher in energy than the separate atomic orbitals.
E) All of the above are true.

Answer: D

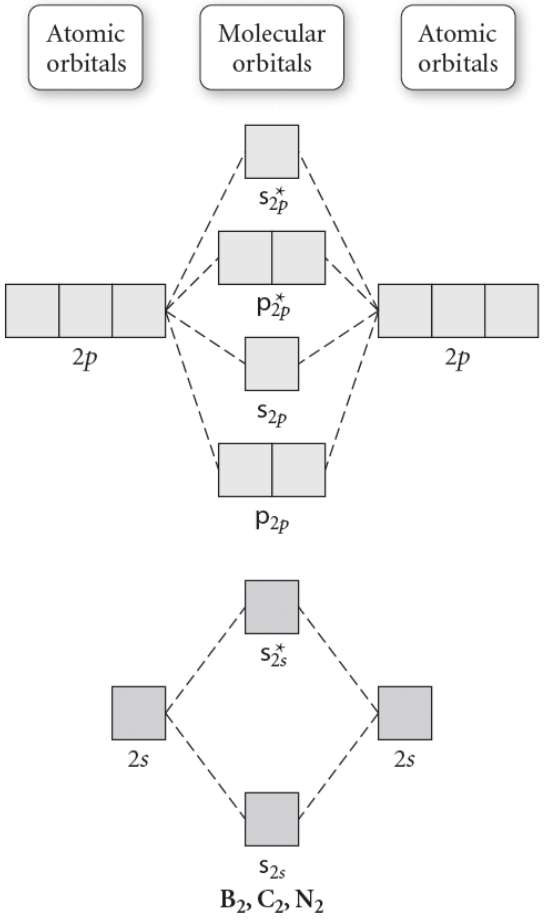
12) Use the molecular orbital diagram shown to determine which of the following is <u>most</u> stable.



A) Ne_2^{2+} B) F_2 C) F_2^{2-} D) F_2^{2+} E) O_2^{2+}

Answer: E

13) Use the molecular orbital diagram shown to determine which of the following are paramagnetic.



A) C_2^{2-} B) B_2^{2+} C) B_2 D) B_2^{2-} E) N_2^{2+}

Answer: C

14) Identify the characteristics of a liquid.
A) indefinite shape, but definite volume
B) indefinite shape and volume
C) definite shape and volume
D) none of the above
E) all of the above

Answer: A

15) Which of the following statements is TRUE?
A) Energy is given off when the attraction between two molecules is broken.
B) The potential energy of molecules decrease as they get closer to one another.
C) Intermolecular forces are generally stronger than bonding forces.
D) Increasing the pressure on a solid usually causes it to become a liquid.
E) None of the above are true.

Answer: B

16) What is the strongest type of intermolecular force present in NH_2CH_3?

A) hydrogen bonding
B) dispersion
C) dipole-dipole
D) ion-dipole
E) none of the above

Answer: A

17) The two strands in DNA are held together by _____.

A) dipole-dipole forces
B) dispersion forces
C) ion-dipole forces
D) hydrogen bonding

Answer: D

18) Place the following compounds in order of <u>decreasing</u> strength of intermolecular forces.

I. $CH_3CH_2CH_2CH_2CH_2CH_3$ II. $(CH_3)_3CCH_3$ III. $(CH_3)_3CCH_2CH_3$

A) III > I > II B) I > II > III C) I > III > II D) II > III > I E) III > II > I

Answer: C

19) Which of the following statements is TRUE?

A) Hydrogen bonds are stronger than covalent bonds.
B) Vapor pressure increases with temperature.
C) Intermolecular forces hold the atoms in molecules together.
D) Dispersion forces are generally stronger than dipole-dipole forces.
E) None of the above are true.

Answer: B

20) Give the term for the temperature at which the gas and liquid phases form a supercritical fluid.

A) critical temperature
B) solid temperature
C) definite temperature
D) absolute temperature
E) fluid temperature

Answer: A

21) Which of the following substances would you predict to have the highest ΔH_{vap}?

A) CH_3Cl
B) $HOCH_2CH_2OH$
C) HCl
D) $CH_3CH_2CH_2CH_3$
E) CH_3CH_2OH

Answer: B

22) How much energy is required to vaporize 98.6 g of ethanol (C_2H_5OH) at its boiling point, if its ΔH_{vap} is 40.5 kJ/mol?

A) 86.7 kJ B) 52.8 kJ C) 11.5 kJ D) 39.9 kJ E) 18.9 kJ

Answer: A

23) Place the following substances in order of increasing vapor pressure at a given temperature.

NF_3 NH_3 BCl_3

A) $BCl_3 < NF_3 < NH_3$
B) $NH_3 < BCl_3 < NF_3$
C) $BCl_3 < NH_3 < NF_3$
D) $NH_3 < NF_3 < BCl_3$
E) $NF_3 < NH_3 < BCl_3$

Answer: D

24) Determine the vapor pressure (in torr) of a substance at 36°C, whose normal boiling point is 84°C and has a ΔH_{vap} of 22.1 kJ/mol.

A) 98 torr B) 239 torr C) 41.8 torr D) 147 torr E) 31.8 torr

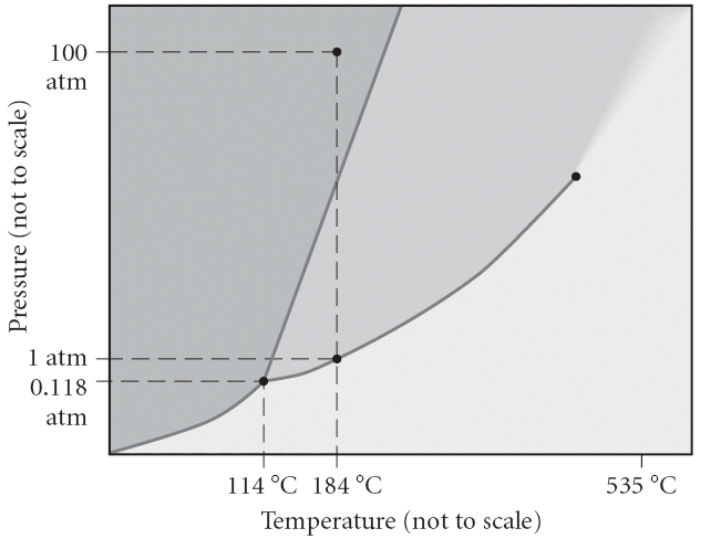
Answer: B

25) Define sublimation.

A) the phase transition from gas to solid
B) the phase transition from solid to gas
C) the phase transition from gas to liquid
D) the phase transition from liquid to gas
E) the phase transition from liquid to solid

Answer: B

26) Consider the phase diagram below. If the dashed line at 1 atm of pressure is followed from 100 to 500°C, what phase changes will occur (in order of increasing temperature)?



A) condensation, followed by vaporization
B) fusion, followed by vaporization
C) vaporization, followed by deposition
D) sublimation, followed by deposition
E) No phase change will occur under the conditions specified.

Answer: B

27) How much energy is required to heat 36.0 g H_2O from a liquid at 65°C to a gas at 115°C? The following physical data may be useful.

ΔH_{vap} = 40.7 kJ/mol
C_{liq} = 4.18 J/g °C
C_{gas} = 2.01 J/g °C
C_{sol} = 2.09 J/g °C
$T_{melting}$ = 0 °C
$T_{boiling}$ = 100 °C

A) 91.7 kJ B) 87.7 kJ C) 10.9 kJ D) 52.7 kJ E) 63.5 kJ

Answer: B

28) Choose the statement below that is TRUE.
A) A solution will form between two substances if the solute-solute interactions are strong enough to overcome the solvent-solvent interactions.
B) A solution will form between two substances if the solute-solvent interactions are small enough to be overcome by the solute-solute and solvent-solvent interactions.
C) A solution will form between two substances if the solute-solvent interactions are of comparable strength to the solute-solute and solvent-solvent interactions.
D) A solution will form between two substances only if the solvent-solvent interactions are weak enough to overcome the solute-solvent interactions.
E) None of the above are true.

Answer: C

29) Give the major force in seawater.
A) ion-ion
B) dipole-dipole
C) dispersion
D) hydrogen bonding
E) ion-dipole

Answer: E

30) Choose the situation below that would result in an exothermic $\Delta H_{solution}$.
A) When $|\Delta H_{solvent}| >> |\Delta H_{solute}|$
B) When $|\Delta H_{solute}|$ is close to $|\Delta H_{hydration}|$
C) When $|\Delta H_{solute}| > |\Delta H_{hydration}|$
D) When $|\Delta H_{solute}| < |\Delta H_{hydration}|$
E) There isn't enough information to determine.

Answer: D

31) A solution containing more than the equilibrium amount is called _____.
A) an unsaturated solution
B) a dilute solution
C) a saturated solution
D) a concentrated solution
E) a supersaturated solution

Answer: E

32) Determine the Henry's law constant for ammonia in water at 25°C if an ammonia pressure of 0.022 atm produces a solution with a concentration of 1.3 M.

A) 0.038 M/atm B) 59 M/atm C) 0.029 M/atm D) 0.017 M/atm E) 35 M/atm

Answer: B

33) Commercial grade HCl solutions are typically 39.0% (by mass) HCl (Mw: 36.5) in water. Determine the molarity of the HCl, if the solution has a density of 1.20 g/mL.

A) 12.8 M B) 7.79 M C) 9.35 M D) 13.9 M E) 10.7 M

Answer: A

34) A solution is prepared by dissolving 76.3 g NaI in 545 g of water. Determine the mole fraction of NaI if the final volume of the solution is 576 mL.

A) 8.84×10^{-2} B) 1.32×10^{-2} C) 1.65×10^{-2} D) 1.40×10^{-3} E) 6.04×10^{-3}

Answer: C

35) A 4.55 L sample of water contains 0.115 g of sodium ions. Determine the concentration of sodium ions in ppm if the density of the solution is 1.00 g/mL.

A) 25.3 ppm B) 52.3 ppm C) 13.2 ppm D) 12.7 ppm E) 36.5 ppm

Answer: A

36) Identify the colligative property.

A) boiling point elevation
B) vapor pressure lowering
C) osmotic pressure
D) freezing point depression
E) all of the above

Answer: E

37) Solutions having osmotic pressures less than those of body fluids are called _____.

A) isosmotic
B) magnosmotic
C) hyperosmotic
D) hyposmotic
E) neosmotic

Answer: D

38) Determine the vapor pressure of a solution at 25°C that contains 76.6 g of glucose ($C_6H_{12}O_6$) in 250.0 mL of water. The vapor pressure of pure water at 25°C is 23.8 torr.

A) 7.29 torr B) 72.9 torr C) 70.8 torr D) 22.9 torr E) 23.1 torr

Answer: E

39) Determine the freezing point depression of a solution that contains 30.7 g glycerin ($C_3H_8O_3$, molar mass = 92.09 g/mol) in 376 mL of water. Some possibly useful constants for water are K_f = 1.86°C/*m* and K_b = 0.512°C/*m*.

A) 1.65°C B) 0.654°C C) 3.33°C D) 3.33°C E) 0.887°C

Answer: A

40) Determine the vapor pressure of a solution at 55°C that contains 34.2 g NaCl in 375 mL of water. The vapor pressure of pure water at 55°C is 118.1 torr. The van't Hoff factor for NaCl is 1.9

A) 115 torr B) 92.8 torr C) 108 torr D) 112 torr E) 87.1 torr

Answer: D