108-3rd Chem Exam (A)

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

1) Which of the following is not a type of solid?
   A) covalent-network
   B) ionic
   C) molecular
   D) metallic
   E) supercritical

   Answer: E

2) The scattering of light waves upon passing through a narrow slit is called _____.
   A) diffusion B) incidence C) diffraction D) adhesion E) grating

   Answer: C

3) What fraction of the volume of each corner atom is actually within the volume of a face-centered cubic unit cell?
   A) 1 B) 1/2 C) 1/4 D) 1/8 E) 1/16

   Answer: D

4) 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) nonmetal
   B) semiconductor
   C) insulator
   D) alloy
   E) conductor

   Answer: C

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

   Answer: B

6) Inorganic compounds that are semiconductors have an average of _____ valence electrons.
   A) 1 B) 4 C) 5 D) 3 E) 2

   Answer: B

7) The process of doping can produce a _____ which can greatly _____ intrinsic conductivity.
   A) n-type semiconductor, increase
   B) p-type semiconductor, decrease
   C) allotrope, diminish
   D) non-metal, decrease
   E) non-metal, increase

   Answer: A

8) The formation of a condensation polymer generally involves _____.
   A) the vaporization of a plasticizer
   B) the mixing of sulfur with an addition polymer
   C) the elimination of a small molecule
   D) the formation of significant crosslinking
   E) the addition of a plasticizer

   Answer: C

9) Which of the following is not classified as a nanomaterial?
A) buckminsterfullerene
B) graphene
C) isoprene
D) carbon nanotubes
E) All of the above are classified as nanomaterials

Answer: C

10) 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 = *ghd*. How high a column of water (d = 1.0 g/mL) would be supported by a pressure that supports a 713 mm column of mercury (d = 13.6 g/mL)?
A) 9.7×10^3 mm
B) 1.2×10^4 mm
C) 713 mm
D) 14 mm
E) 52 mm

Answer: A

11) The volume of an ideal gas is zero at _____.
A) -273 °C B) -45 °F C) -363 K D) -273 K E) 0 °C

Answer: A

12) Standard temperature and pressure (STP), in the context of gases, refers to _____.
A) 298.15 K and 1 atm
B) 273.15 K and 1 pascal
C) 273.15 K and 1 atm
D) 273.15 K and 1 torr
E) 298.15 K and 1 torr

Answer: C

13) The reaction of 50 mL of Cl_2 gas with 50 mL of C_2H_4 gas via the equation:

$$Cl_2\,(g) + C_2H_4\,(g) \rightarrow C_2H_4Cl_2\,(g)$$

will produce a total of _____ mL of products if pressure and temperature are kept constant.
A) 150 B) 100 C) 50 D) 25 E) 125

Answer: C

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) NH_3 B) Ne C) SO_2 D) NO_2 E) SO_3

Answer: D

15) The density of NO_2 in a 4.50 L tank at 760.0 torr and 25.0 °C is _____ g/L.
A) 9.30 B) 3.27 C) 1.68 D) 1.88 E) 1.64

Answer: D

16) Of the following gases, _____ will have the greatest rate of effusion at a given temperature.
A) CH_4 B) Ar C) HBr D) HCl E) NH_3

Answer: A

17) Which one of the following gases would deviate the least from ideal gas behavior?
A) CO_2 B) CH_3Cl C) Ne D) F_2 E) Kr

Answer: C

18) Which noble gas is expected to show the largest deviations from the ideal gas behavior?
A) krypton B) argon C) neon D) xenon E) helium

Answer: D

19) The strongest interparticle attractions exist between particles of a _____ and the weakest interparticle attractions exist between particles of a _____.
A) liquid, gas B) solid, gas C) liquid, solid D) gas, solid E) solid, liquid

Answer: B

20) Which one of the following exhibits dipole-dipole attraction between molecules?
A) CCl_4 B) Br_2 C) CO_2 D) $C_{10}H_{22}$ E) PH_3

Answer: E

21) Of the following, _____ has the highest boiling point.
A) Cl_2 B) O_2 C) Br_2 D) H_2 E) N_2

Answer: C

22) In which of the following molecules is hydrogen bonding likely to be the most significant component of the total intermolecular forces?
A) CO_2 B) CH_4 C) $C_5H_{11}OH$ D) $C_6H_{13}NH_2$ E) CH_3OH

Answer: E

23) What types of intermolecular forces exist between HI and H_2S?
A) dispersion forces, hydrogen bonding, dipole-dipole, and ion-dipole
B) dispersion forces, dipole-dipole, and ion-dipole
C) dispersion forces and dipole-dipole
D) dipole-dipole and ion-dipole
E) dispersion forces, dipole-dipole, and ion-dipole

Answer: C

24) Which statements about viscosity are true?
(i) Viscosity increases as temperature decreases.
(ii) Viscosity increases as molecular weight increases.
(iii) Viscosity increases as intermolecular forces increase.
A) (i) only B) (i) and (iii) C) (ii) and (iii) D) none E) all

Answer: E

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

Substance	ΔH_{vap} (kJ/mol)
Argon (Ar)	6.3
Benzene (C_6H_6)	31.0
Ethanol (C_2H_5OH)	39.3
Water (H_2O)	40.8
Methane (CH_4)	9.2

A) Ethanol B) Methane C) Water D) Benzene E) Argon

Answer: C

26) The slope of a plot of the natural log of the vapor pressure of a substance versus 1/T is _____.

A) $\frac{1}{\Delta H_{vap}}$ B) $-\Delta H_{vap}$ C) ΔH_{vap} D) $\frac{-1}{\Delta H_{vap}}$ E) $-\frac{\Delta H_{vap}}{R}$

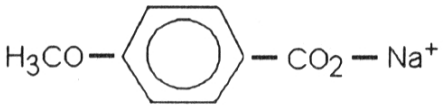
Answer: E

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

A) $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$

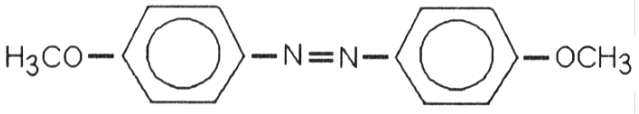
B) $CH_3CH_2CH_2CH_2CH_2^- \ Na^+$

C)



D) $CH_3CH_2\text{-}C(CH_3)_2\text{-}CH_2CH_3$

E)



Answer: E

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

A) regions of electron density on an atom will organize themselves so as to maximize *s*-character
B) atomic orbitals of the bonding atoms must overlap for a bond to form
C) electron domains in the valence shell of an atom will arrange themselves so as to minimize repulsions
D) regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap
E) hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry

Answer: C

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

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

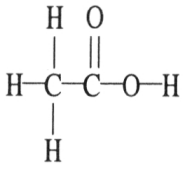
Answer: D

30) The electron domain and molecular geometry of BrO_2^- is _____.

A) trigonal pyramidal, seesaw
B) tetrahedral, trigonal planar
C) trigonal pyramidal, linear
D) trigonal planar, trigonal planar
E) tetrahedral, bent

Answer: E

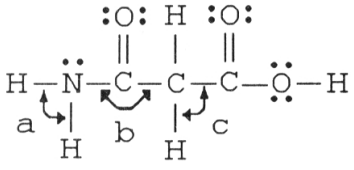
31) The molecular geometry of the right-most carbon in the molecule below is _____.



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

Answer: C

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



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

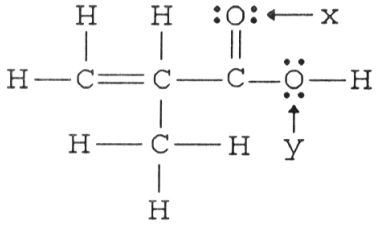
Answer: A

33) The molecular geometry of the SF_6 molecule is _____, and this molecule is _____.

A) octahedral, nonpolar
B) trigonal planar, polar
C) trigonal bipyramidal, polar
D) trigonal pyramidal, polar
E) trigonal planar, nonpolar

Answer: A

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



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

Answer: A

35) There are _____ σ bonds and _____ π bonds in $H_3C\text{-}CH_2\text{-}CH{=}CH\text{-}CH_2\text{-}C{\equiv}CH$.

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

Answer: A

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

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

Answer: D

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, 0, and 1/2
C) 1, 0, and 0
D) 1, 2, and 0
E) 1, 1/2, and 1/2

Answer: E

38) Based on molecular orbital theory, the bond order of the N—N bond in the N_2 molecule is _____.

A) 0 B) 1 C) 2 D) 3 E) 5

Answer: D

39) Based on molecular orbital theory, the bond order of the N—N bond in the N_2^{2+} ion is _____.

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

Answer: C

40) Of the following, _____ appear(s) to gain mass in a magnetic field.

B_2 N_2 O_2

A) B_2 and O_2 B) B_2 and N_2 C) O_2 only D) N_2 and O_2 E) N_2 only

Answer: A