

# 1101 Final Exam\_01/19/22\_(A)

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

- 1) The electron-domain geometry and the molecular geometry of a molecule of the general formula  $AB_n$  will always be the same if \_\_\_\_\_.
- A)  $n$  is less than four
  - B) the octet rule is obeyed
  - C) there is more than one central atom
  - D) there are no lone pairs on the central atom
  - E)  $n$  is greater than four

Answer: D

- 2) For molecules of the general formula  $AB_n$ ,  $n$  can be greater than four \_\_\_\_\_.
- A) only when A is boron or beryllium
  - B) only when A is carbon
  - C) only when A is an element from the third period or below the third period
  - D) for any element A
  - E) only when A is Xe

Answer: C

- 3) Three monosulfur fluorides are observed:  $SF_2$ ,  $SF_4$ , and  $SF_6$ . Of these, \_\_\_\_\_ is/are polar.
- A)  $SF_6$  only
  - B)  $SF_2$  only
  - C)  $SF_2$ ,  $SF_4$ , and  $SF_6$
  - D)  $SF_2$  and  $SF_4$  only
  - E)  $SF_4$  only

Answer: D

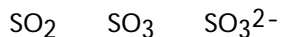
- 4) There are \_\_\_\_\_  $\sigma$  bonds and \_\_\_\_\_  $\pi$  bonds in  $H_3C-CH_2-CH=CH-CH_2-C\equiv CH$ .
- A) 12, 2                      B) 16, 3                      C) 14, 2                      D) 13, 2                      E) 10, 3

Answer: B

- 5) Of the following, the central atom is  $sp^3d^2$  hybridized only in \_\_\_\_\_.
- A)  $XeF_4$                       B)  $BeF_2$                       C)  $Br_3^-$                       D)  $PH_3$                       E)  $PCl_5$

Answer: A

- 6) Which of the following molecules or ions will exhibit delocalized bonding?



- A)  $SO_3^{2-}$  only
- B)  $SO_2$  and  $SO_3$
- C)  $SO_2$ ,  $SO_3$ , and  $SO_3^{2-}$
- D)  $SO_3$  and  $SO_3^{2-}$
- E) None of the above will exhibit delocalized bonding.

Answer: B

7) Of the following, \_\_\_\_\_ appear(s) to gain mass in a magnetic field.

B<sub>2</sub>    N<sub>2</sub>    O<sub>2</sub>

- A) N<sub>2</sub> and O<sub>2</sub>      B) B<sub>2</sub> and O<sub>2</sub>      C) N<sub>2</sub> only      D) B<sub>2</sub> and N<sub>2</sub>      E) O<sub>2</sub> only

Answer: B

8) The order of MO energies in B<sub>2</sub>, C<sub>2</sub>, and N<sub>2</sub> ( $\sigma_{2p} > \pi_{2p}$ ), is different from the order in O<sub>2</sub>, F<sub>2</sub>, and Ne<sub>2</sub> ( $\sigma_{2p} < \pi_{2p}$ ). This is due to \_\_\_\_\_.

- A) less effective overlap of p orbitals in B<sub>2</sub>, C<sub>2</sub>, and N<sub>2</sub>  
B) greater 2s-2p interaction in O<sub>2</sub>, F<sub>2</sub>, and Ne<sub>2</sub>  
C) greater 2s-2p interaction in B<sub>2</sub>, C<sub>2</sub>, and N<sub>2</sub>  
D) the more metallic character of boron, carbon and nitrogen as compared to oxygen, fluorine, and neon  
E) less effective overlap of p orbitals in O<sub>2</sub>, F<sub>2</sub>, and Ne<sub>2</sub>

Answer: C

9) A sample of gas (1.9 mol) is in a flask at 21 °C and 697 mm Hg. The flask is opened and more gas is added to the flask. The new pressure is 841 mm Hg and the temperature is now 26 °C. There are now \_\_\_\_\_ mol of gas in the flask.

- A) 2.9      B) 0.28      C) 2.3      D) 1.6      E) 3.5

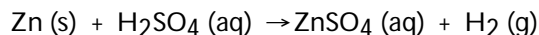
Answer: C

10) The density of HCN is \_\_\_\_\_ g/L at STP.

- A) 0.829      B) 2.21      C) 1.21      D) 329      E) 605

Answer: C

11) Zinc reacts with aqueous sulfuric acid to form hydrogen gas:



In an experiment, 201 mL of wet H<sub>2</sub> is collected over water at 27 °C and a barometric pressure of 765 torr. How many grams of Zn have been consumed? The vapor pressure of water at 27 °C is 26.74 torr.

- A)  $4.38 \times 10^6$       B) 394      C) 519      D)  $3.94 \times 10^5$       E) 0.519

Answer: E

12) Using the van der Waals equation, the pressure in a 22.4 L vessel containing 1.50 mol of chlorine gas at 0.00 °C is \_\_\_\_\_ atm. ( $a = 6.49 \text{ L}^2\text{-atm/mol}^2$ ,  $b = 0.0562 \text{ L/mol}$ )

- A) 1.91      B) 0.993      C) 0.676      D) 1.50      E) 1.48

Answer: E

13) A 255 mL round-bottom flask is weighed and found to have a mass of 114.85 g. A few milliliters of an easily vaporized liquid are added to the flask and the flask is immersed in a boiling water bath. All of the liquid vaporizes at the boiling temperature of water, filling the flask with vapor. When all of the liquid has vaporized, the flask is removed from the bath, cooled, dried, and reweighed. The new mass of the flask and the condensed vapor is 115.23 g. Which of the following compounds could the liquid be? (Assume the ambient pressure is 1 atm.)

- A) C<sub>3</sub>H<sub>7</sub>OH      B) C<sub>4</sub>H<sub>9</sub>OH      C) C<sub>4</sub>H<sub>10</sub>      D) C<sub>2</sub>H<sub>6</sub>      E) C<sub>2</sub>H<sub>5</sub>OH

Answer: E

14) How much faster does  $^{235}\text{UF}_6$  effuse than  $^{238}\text{UF}_6$ ?

- A) 1.013 times as fast
- B) 1.009 times as fast
- C) 1.004 times as fast
- D) 1.018 times as fast
- E) 1.006 times as fast

Answer: E

15) According to kinetic-molecular theory, in which of the following gases will the root-mean-square speed of the molecules be the highest at  $200\text{ }^\circ\text{C}$ ?

- A)  $\text{N}_2\text{O}$
- B)  $\text{O}_2$
- C)  $\text{UF}_6$
- D)  $\text{NH}_3$
- E) None. The molecules of all gases have the same root-mean-square speed at any given temperature.

Answer: D

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

- A)  $\text{SiO}_2$
- B)  $\text{Cl}_2$
- C)  $\text{CBr}_4$
- D)  $\text{AsH}_3$
- E)  $\text{BH}_3$

Answer: D

17) Of the following substances, \_\_\_\_\_ has the highest boiling point.

- A)  $\text{CH}_3\text{CH}_2\text{OH}$
- B)  $\text{Cl}_2$
- C)  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{OH}$
- D)  $\text{C}_4\text{H}_{10}$
- E)  $\text{N}_2$

Answer: C

18) The enthalpy change for converting 10.0 g of ice at  $-50.0\text{ }^\circ\text{C}$  to water at  $50.0\text{ }^\circ\text{C}$  is \_\_\_\_\_ kJ. The specific heats of ice, water, and steam are 2.09 J/g-K, 4.18 J/g-K, and 1.84 J/g-K, respectively. For  $\text{H}_2\text{O}$ ,  $\Delta H_{\text{fus}} = 6.01\text{ kJ/mol}$ , and  $\Delta H_{\text{vap}} = 40.67\text{ kJ/mol}$ .

- A) 4.38
- B) 3138
- C) 9.15
- D) 6.47
- E) 12.28

Answer: D

19) Of the following, \_\_\_\_\_ is the most volatile.

- A)  $\text{C}_2\text{H}_6$
- B)  $\text{C}_2\text{Cl}_6$
- C)  $\text{C}_2\text{Br}_6$
- D)  $\text{C}_2\text{I}_6$
- E)  $\text{C}_2\text{F}_6$

Answer: A

20) Which will have a larger band gap: GaN, GaP, GaAs, or GaSb?

- A) GaP
- B) GaAs
- C) GaN
- D) GaSb
- E) All choices have identical band gaps.

Answer: C

- 21) 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) 5.31                      D) 1.88                      E) 2.66

Answer: B

- 22) A solid has a very high melting point, great hardness, and poor electrical conduction. This is a(n) \_\_\_\_\_ solid.
- A) covalent network  
B) ionic  
C) metallic and covalent network  
D) molecular  
E) metallic

Answer: A

- 23) For a substitutional alloy to form, the two metals combined must have similar
- A) atomic radii and chemical bonding properties.  
B) band gap and reactivity.  
C) number of valence electrons and electronegativity.  
D) ionization potential and electron affinity.  
E) reduction potential and size.

Answer: A

- 24) Covalent bonding occurs in both molecular and covalent-network solids. Which of the following statements best explains why these two kinds of solids differ so greatly in their hardness and melting points?
- A) The molecules in molecular solids have stronger covalent bonding than covalent-network solids do.  
B) The molecules in molecular solids are held together by weak intermolecular interactions.  
C) The atoms in covalent-network solids are more polarizable than those in molecular solids.  
D) Molecular solids are denser than covalent-network solids.

Answer: B

E) All of the above are wrong.

- 25) Which type of liquid crystal is colored and changes color with temperature?
- A) smectic B                      B) nematic                      C) cholesteric                      D) smectic C                      E) smectic A

Answer: C