Chemistry 151
Final Exam

Name:

SSN:

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**Exam Rules & Guidelines**

- **Show your work.** No credit will be given for an answer unless your work is shown. Indicate your answer with a box or a circle.

- All paperwork must be turned in (including “Additional Information: and scratch paper.)

- Enter the correct letter of the answer to each question on the scantron sheet provided. There is only one correct answer to each question.

- **TURN OFF** your cell phone. If it rings, your exam will be collected and graded as is.
1. A sample of He gas (2.35 moles) occupies 57.9 L at 300.0 K and 1.00 atm. The volume of the sample is _______ L at 423 K and 1.00 atm.

   A) 0.709  
   B) 41.1  
   C) 81.6  
   D) 1.41  
   E) 57.9

2. What is the predominant intermolecular force in CBr₄?

   A) London-dispersion forces  
   B) Ion-dipole attraction  
   C) Ionic bonding  
   D) Dipole-dipole attraction  
   E) Hydrogen bonding

3. On a phase diagram, the critical pressure is _______.

   A) The pressure required to melt a solid  
   B) The pressure below which a substance is a solid at all temperatures  
   C) The pressure above which a substance is a liquid at all temperatures  
   D) The pressure at which a liquid changes to a gas  
   E) The pressure required to liquefy a gas at its critical temperature

4. The electron configuration of a ground-state zinc (Zn) atom is _______.

   A) [Kr] 4s²3d¹⁰  
   B) [Ar] 4s²3d¹⁰  
   C) [Ar] 4s¹3d¹⁰  
   D) [Ar] 3s²3d¹⁰  
   E) [Kr] 3s²3d¹⁰

5. Which of the following atoms has the largest radius?

   A) I  
   B) Co  
   C) Ba  
   D) Sr  
   E) Ca
6. The Lewis structure of AsH$_3$ shows _______ nonbonding electron pair(s) on As.
   A) 0
   B) 1
   C) 2
   D) 3
   E) Cannot be determined from the data given.

7. Which one of the following is a correct Lewis structure for the nitrate ion?

   ![Lewis structures of nitrate ions]
   a. [Structure A]
   b. [Structure B]
   c. [Structure C]
   d. [Structure D]

8. For the correct structure of the nitrate ion, what is the bond angle from O-N-O?
   A) 90
   B) 109.5
   C) 120
   D) 180
   E) 60

9. A gas will behave **LEAST** like an ideal gas under conditions of _______.
   A) High temperature and high pressure
   B) High temperature and low pressure
   C) Low temperature and high pressure
   D) Low temperature and low pressure
   E) Standard temperature and pressure

10. What volume (mL) of a concentrated solution of NaOH (6.00 M) must be diluted to 200 mL to make a 0.88 M NaOH solution?
    A) 2.64
    B) 176
    C) 26.4
    D) 29.3
11. According to VSEPR theory, the shape of a water molecule is _______.
   A) Linear
   B) Bent
   C) Trigonal pyramidal
   D) Tetrahedral
   E) Square planar

12. The only noble gas without 8 valence electrons is _______.
   A) He
   B) Ne
   C) Ar
   D) Kr
   E) Xe

13. What is the maximum number of electrons in the 4d subshell?
   A) 2
   B) 4
   C) 6
   D) 8
   E) 10

14. ________ is an octet violator.
   A) NF₃
   B) BeH₂
   C) SO₂
   D) CF₄
   E) SO₃²⁻

15. The volume of 1 mole of an ideal gas at STP is _______ L.
   A) 0.08206
   B) 62.36
   C) 1.00
   D) 22.4
   E) 14.7
16. There is/are ________ π-bond(s) in the molecule below.

\[
\begin{align*}
\text{H} & \quad \text{N} \equiv \text{N} \quad \text{C} \quad \text{H} \\
\text{H} & \quad \text{H}
\end{align*}
\]

A) 7  
B) 6  
C) 2  
D) 1  
E) 0

17. Ca(OH)\(_2\) is a ________.

A) strong base  
B) weak base  
C) strong acid  
D) weak acid  
E) binary compound

18. A ________ ΔH corresponds to an ________ process.

A) negative, endothermic  
B) negative, exothermic  
C) positive, exothermic  
D) zero, exothermic  
E) zero, endothermic

19. If 3.06 moles O\(_2\) and 3.60 moles CO react to form CO\(_2\) according to the equation

\[
\text{O}_2(\text{g}) \quad + \quad 2 \text{CO}(\text{g}) \quad \rightarrow \quad 2 \text{CO}_2(\text{g})
\]

How many grams of CO\(_2\) will be produced?

A) 3.60 grams  
B) 79.2 grams  
C) 158 grams  
D) 317 grams
20. There are _______ electrons, _______ protons, and _______ neutrons in an atom of $^{132}$Xe.

A) 132, 132, 54  
B) 54, 54, 132  
C) 78, 78, 54  
D) 54, 54, 78  
E) 78, 78, 132

21. When the following equation is balanced, the coefficient of H$_2$S is ______.

$$\text{H}_2\text{S} \quad + \quad \text{Fe(OH)}_3 \quad \rightarrow \quad \text{Fe}_2\text{S}_3 \quad + \quad \text{H}_2\text{O}$$

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

22. What is the mass % of carbon in dimethylsulfoxide, C$_2$H$_6$SO?

A) 60.0  
B) 20.6  
C) 30.7  
D) 7.74  
E) 79.8

23. What is the molarity of an aqueous solution containing 75.3 g of glucose (C$_6$H$_{12}$O$_6$, mol wt = 180 g/mole) in 35.5 mL of solution?

A) 1.85  
B) 2.12  
C) 0.197  
D) 3.52  
E) 11.8
24. Using Table of Thermodynamic Constants, what is $\Delta H$ for this reaction?

$$2 \text{ CO(g)} + \text{O}_2(g) \rightarrow 2 \text{CO}_2(g)$$

A) -566.4  
B) -283.3  
C) 283.3  
D) -677.0  
E) 566.4

25. The quantity ________ meters is the same as 3 kilometers.

A) 3000  
B) 300  
C) 0.003  
D) 0.03  
E) 30

26. Which of the following will NOT be soluble in water?

A) CaCO$_3$  
B) KOH  
C) NaCl  
D) (NH$_4$)$_2$S

27. What pair of elements would you expect to exhibit the greatest similarity in physical and chemical properties?

A) O, S  
B) C, N  
C) K, Ca  
D) H, He  
E) SI, P

28. Lithium and nitrogen react to form lithium nitride, Li$_3$N.

$$6 \text{Li(s)} + \text{N}_2(g) \rightarrow 2 \text{Li}_3\text{N(s)}$$

How many grams of Li are needed to react with 14.0 grams of nitrogen?

A) 3.45  
B) 0.5  
C) .575  
D) 20.7
29. The density of silver is 10.5 g/mL. What is the mass (in grams) of a piece of silver with a volume of 23.6 mL?

   A) 248  
   B) 0.445  
   C) 2.25  
   D) 112  
   E) 23.6

30. How many molecules of NH$_3$ are in 27.0 g of NH$_3$?

   A) 459 molecules  
   B) 1.59 molecules  
   C) 9.56 x 10$^{23}$  
   D) 2.76 x 10$^{26}$

31. How many grams sodium chloride (mol wt = 58.4 g/mole) are needed to make 550 mL of a 1.90 M aqueous solution of sodium chloride?

   A) 61.1  
   B) 1.05  
   C) 30.5  
   D) 6.11 x 10$^4$  
   E) 122

32. What is the enthalpy change for the formation of 22.0 g HCl(g) made by the following reaction?

   \[ \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{HCl(}g) \quad \Delta H^o = -186 \text{ kJ/mole} \]

   A) 308 kJ  
   B) -224 kJ  
   C) -112.2 kJ  
   D) 56.1 kJ

33. Predict the charge of the most stable ion of potassium (K).

   A) +3  
   B) -1  
   C) +2  
   D) -2  
   E) +1
34. Which group of elements is most likely to form ions with a –3 charge?
   A) A  B) E  C) F  D) G

35. When elements in column B react with elements in column G, the general formula for the compounds formed is
   A) BG  B) B₂G  C) BG₂  D) B₂G₃

36. When elements from column A combine with the phosphate ion, the general formula for the compound formed is
   A) APO₄  B) A₃PO₄  C) A₃(PO₄)₂  D) A(PO₄)₃