* Enter your answers on the bubble sheet. Turn in all sheets. *

This exam is composed of 25 questions on 3 pages (in addition to this cover page).

10 of the questions involve mathematics that might require a calculator. Go initially through the exam and answer the questions you can answer quickly. Then go back and try the ones that are more challenging to you and/or that require calculations.

As discussed in the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

I hereby state that all answers on this exam are my own and that I have neither gained unfairly from others nor have I assisted others in obtaining an unfair advantage on this exam.

\[
E = \frac{h \nu}{\lambda} \quad \text{or} \quad \frac{E_{n}^{H-\text{atom}}}{n^2} = -\frac{R_{H}h\nu}{n^2}
\]

1 mL = 1 cm³

Some common ions:

\[
\text{PO}_4^{3-}, \text{CN}^{-}, \text{CH}_3\text{CO}_2^{-}, \text{NO}_2^{-}, \text{NO}_3^{-}, \text{CO}_3^{2-}, \text{SO}_3^{2-}, \text{SO}_4^{2-}
\]

\[
h = 6.626 \times 10^{-34} \text{ J s}
\]

\[
c = 2.9998 \times 10^{8} \text{ m s}^{-1}
\]

\[
N = 6.022 \times 10^{23} \text{ mol}^{-1}
\]

\[
R_{H} = 1.097 \times 10^{7} \text{ m}^{-1}
\]

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Identify the choice that best completes the statement or answers the question.

1. How many protons, neutrons, and electrons are in a hydrogen-3 ($^3\text{H}$) atom?
   a. 1 proton, 1 neutron, 1 electron
   b. 1 proton, 2 neutrons, 1 electron
   c. 1 proton, 3 neutrons, 1 electron
   d. 2 protons, 1 neutron, 2 electrons
   e. 2 protons, 1 neutron, 1 electron

2. What is the atomic symbol for an element with 38 protons and 50 neutrons?
   a. $^{38}_{12}\text{Mg}$
   b. $^{38}_{50}\text{V}$
   c. $^{38}_{88}\text{Sr}$
   d. $^{50}_{88}\text{Sn}$
   e. $^{226}_{88}\text{Ra}$

3. Which atom is most likely to form a 1– ion?

4. Which atom is most likely to form a 2+ ion?
   a. Sc b. Sr c. Ga d. S e. F

5. Identify the ions in MgHPO$_4$.
   a. Mg$^{2+}$ and PO$_4^{3–}$
   b. Mg$^{2+}$ and HPO$_4^{2–}$
   c. Mg$^+$ and HPO$_4^{–}$
   d. Mg$^{3+}$ and HPO$_4^{3–}$
   e. Mg$^{2+}$, H$^+$, P$^{3–}$, and O$^{2–}$

6. What is the correct formula for potassium carbonate?
   a. KCO$_3$ b. K$_2$CO$_3$ c. KHCO$_3$ d. K$_2$HCO$_3$ e. KH$_2$CO$_3$

7. Predict which ionic compound has the highest melting point.
   a. KBr b. CaO c. Rbl d. MgBr$_2$ e. CsCl

8. What is the mass of 0.018 mol Mg?
   a. $4.0 \times 10^{-23}$ g c. 0.44 g e. $1.4 \times 10^{3}$ g
   b. $7.4 \times 10^{-4}$ g d. 2.3 g

9. The molar mass of platinum is 195.08 g/mol. What is the mass of $1.00 \times 10^{2}$ Pt atoms?
   a. $8.51 \times 10^{-25}$ g c. $1.67 \times 10^{-22}$ g e. $3.24 \times 10^{-20}$ g
   b. $3.24 \times 10^{-24}$ g d. $3.24 \times 10^{-22}$ g

10. What mass of Ba contains the same number of atoms as 3.0 g Li?
    a. 0.0031 g c. 3.0 g e. $2.9 \times 10^{3}$ g
    b. 0.15 g d. 59 g
11. What is the mass percent of each element in sulfuric acid, \( \text{H}_2\text{SO}_4 \)?
   a. 2.055% H, 32.69% S, 65.25% O
   b. 1.028% H, 32.69% S, 66.28% O
   c. 28.57% H, 14.29% S, 57.17% O
   d. 1.028% H, 33.72% S, 65.25% O
   e. 2.016% H, 32.07% S, 65.91% O

12. An ionic compound has the formula \( \text{MCl}_2 \). The mass of 0.3011 mol of the compound is 62.69 grams. What is the identity of the metal \( \text{M} \)?
   a. Ni  b. Cu  c. Sn  d. Hg  e. Ba

13. What is the charge of the most common ion formed from I?
   a. -2  b. -1  c. 0  d. +1  e. +2

14. The correct molecular formula for the molecule at right is
   a. \( \text{C}_2\text{O}_2\text{H}_4 \)  d. \( \text{C}_2\text{O}_2\text{H}_3 \)
   b. \( \text{CO}_2\text{H}_4 \)  e. \( \text{C}_2\text{O}_2\text{H}_3 \)
   c. \( \text{C}_2\text{OH}_4 \)

15. The equation at right yields a result in what units?
   \( \left( \frac{\text{kg} \cdot \text{m}^2 \cdot \text{s}^{-2}}{\text{g} \cdot \text{m} \cdot \text{s}^{-1}} \right) \)
   a. distance  b. velocity  c. mass  d. time  e. density

16. Magnesium reacts with chlorine gas to produce magnesium chloride. How many moles of Mg will react with 2.6 moles of \( \text{Cl}_2 \)?
   a. 1.3 mol  b. 2.6 mol  c. 3.9 mol  d. 5.2 mol  e. 7.8 mol

17. An argon ion laser emits light at 457.9 nm. What is the frequency of this radiation?
   a. \( 4.338 \times 10^{-19} \text{ s}^{-1} \)
   b. \( 1.527 \times 10^{-15} \text{ s}^{-1} \)
   c. \( 1.373 \times 10^{11} \text{ s}^{-1} \)
   d. \( 6.547 \times 10^{14} \text{ s}^{-1} \)
   e. \( 2.305 \times 10^{18} \text{ s}^{-1} \)

18. The _____ of a photon of light is _____ proportional to its frequency and _____ proportional to its wavelength.
   a. energy, directly, inversely  d. intensity, inversely, directly
   b. energy, inversely, directly  e. amplitude, directly, inversely
   c. velocity, directly, inversely
Chem 111 Evening Exam #1a

Name: _______________________________

19. What is the energy (in kJ) of 1.00 mole of photons of red light with a wavelength of 650 nm?
   a. 4.24 kJ   b. 60.7 kJ   c. 91.6 kJ   d. 184 kJ   e. 236 kJ

20. The energy required to break one mole of hydrogen-hydrogen bonds in H₂ is 436 kJ/mol. What is the longest wavelength of light capable of breaking a single hydrogen-hydrogen bond?
   a. 0.688 nm   b. 119 nm   c. 132 nm   d. 274 nm   e. 688 nm

21. For a hydrogen atom, calculate the energy of a photon in the Balmer series that results from the transition \( n = 3 \) to \( n = 2 \). The Rydberg constant is \( 1.0974 \times 10^7 \text{ m}^{-1} \). (\( h = 6.626 \times 10^{-34} \text{ J} \cdot \text{s} \) and \( c = 2.998 \times 10^8 \text{ m/s} \))
   a. \( 3.03 \times 10^{-19} \text{ J} \)   c. \( 4.36 \times 10^{-19} \text{ J} \)   e. \( 1.09 \times 10^{-17} \text{ J} \)
   b. \( 3.63 \times 10^{-19} \text{ J} \)   d. \( 2.18 \times 10^{-18} \text{ J} \)

22. All of the following sets of quantum numbers are allowed EXCEPT
   a. \( n = 1, \ell = 0, m_\ell = 0 \)   d. \( n = 5, \ell = 1, m_\ell = 0 \)
   b. \( n = 3, \ell = 2, m_\ell = +2 \)   e. \( n = 6, \ell = 2, m_\ell = +3 \)
   c. \( n = 4, \ell = 3, m_\ell = -1 \)

23. What type of orbital is designated \( n = 4, \ell = 0, m_\ell = 0 \)?
   a. 4s   b. 4p   c. 4d   d. 4f   e. none

24. When propane undergoes complete combustion, the products are carbon dioxide and water.
   \[ \text{C}_3\text{H}_8 (\ell) + \text{O}_2 (g) \rightarrow \text{CO}_2 (g) + \text{H}_2\text{O}(g) \]
   What are the respective coefficients when the equation is balanced with the smallest whole numbers?
   a. 1, 1, 1, 1   d. 1, 3, 2, 3
   b. 1, 5, 3, 4   e. 2, 7, 4, 6
   c. 2, 3, 4, 6

25. Which is the name and number of this course?
   b. Chem 0   d. Basket Weaving 101
Chem 111 Evening Exam #1  
Answer Key

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