

* 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.

Signature

$E = h\nu = \frac{hc}{\lambda}$ $E_n^{H-atom} = -\frac{R_H hc}{n^2}$ $1 \text{ mL} = 1 \text{ cm}^3$	Some common ions: PO_4^{3-} CN^- CH_3CO_2^- NO_2^- NO_3^- CO_3^{2-} SO_3^{2-} 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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a

PERIODIC TABLE OF THE ELEMENTS

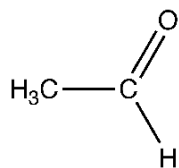
1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.939	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

a

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

- How many protons, neutrons, and electrons are in a hydrogen-3 (^3H) atom?
 - 1 proton, 1 neutron, 1 electron
 - 1 proton, 2 neutrons, 1 electron
 - 1 proton, 3 neutrons, 1 electron
 - 2 protons, 1 neutron, 2 electrons
 - 2 protons, 1 neutron, 1 electron
- What is the atomic symbol for an element with 38 protons and 50 neutrons?
 - $^{88}_{12}\text{Mg}$
 - $^{50}_{38}\text{V}$
 - $^{88}_{38}\text{Sr}$
 - $^{88}_{50}\text{Sn}$
 - $^{226}_{88}\text{Ra}$
- Which atom is most likely to form a 1- ion?
 - K
 - Mg
 - P
 - Br
 - Ar
- Which atom is most likely to form a 2+ ion?
 - Sc
 - Sr
 - Ga
 - S
 - F
- Identify the ions in MgHPO_4 .
 - Mg^{2+} and PO_4^{3-}
 - Mg^{2+} and HPO_4^{2-}
 - Mg^+ and HPO_4^-
 - Mg^{3+} and HPO_4^{3-}
 - Mg^{2+} , H^+ , P^{3-} , and O^{2-}
- What is the correct formula for potassium carbonate?
 - KCO_3
 - K_2CO_3
 - KHCO_3
 - K_2HCO_3
 - KH_2CO_3
- Predict which ionic compound has the highest melting point.
 - KBr
 - CaO
 - RbI
 - MgBr_2
 - CsCl
- What is the mass of 0.018 mol Mg?
 - 4.0×10^{-23} g
 - 7.4×10^{-4} g
 - 0.44 g
 - 2.3 g
 - 1.4×10^3 g
- The molar mass of platinum is 195.08 g/mol. What is the mass of 1.00×10^2 Pt atoms?
 - 8.51×10^{-25} g
 - 3.24×10^{-24} g
 - 1.67×10^{-22} g
 - 3.24×10^{-22} g
 - 3.24×10^{-20} g
- What mass of Ba contains the same number of atoms as 3.0 g Li?
 - 0.0031 g
 - 0.15 g
 - 3.0 g
 - 59 g
 - 2.9×10^3 g

11. What is the mass percent of each element in sulfuric acid, H_2SO_4 ?
- 2.055% H, 32.69% S, 65.25% O
 - 1.028% H, 32.69% S, 66.28% O
 - 28.57% H, 14.29% S, 57.17% O
 - 1.028% H, 33.72% S, 65.25% O
 - 2.016% H, 32.07% S, 65.91% O
12. An ionic compound has the formula MCl_2 . The mass of 0.3011 mol of the compound is 62.69 grams. What is the identity of the metal **M**?
- Ni
 - Cu
 - Sn
 - Hg
 - Ba
13. What is the charge of the most common ion formed from I?
- 2
 - 1
 - 0
 - +1
 - +2



14. The correct molecular formula for the molecule at right is
- $\text{C}_2\text{O}_2\text{H}_4$
 - CO_2H_4
 - C_2OH_4
 - $\text{C}_2\text{O}_2\text{H}_3$
 - $\text{C}_2\text{O}_2\text{H}_3$
15. The equation at right yields a result in what units?
- $$\frac{(kg \cdot m^2 \cdot s^{-2})}{g \cdot m \cdot s^{-1}}$$
- distance
 - velocity
 - mass
 - time
 - density
16. Magnesium reacts with chlorine gas to produce magnesium chloride. How many moles of Mg will react with 2.6 moles of Cl_2 ?
- 1.3 mol
 - 2.6 mol
 - 3.9 mol
 - 5.2 mol
 - 7.8 mol
17. An argon ion laser emits light at 457.9 nm. What is the frequency of this radiation?
- $4.338 \times 10^{-19} \text{ s}^{-1}$
 - $1.527 \times 10^{-15} \text{ s}^{-1}$
 - $1.373 \times 10^{11} \text{ s}^{-1}$
 - $6.547 \times 10^{14} \text{ s}^{-1}$
 - $2.305 \times 10^{18} \text{ s}^{-1}$
18. The ____ of a photon of light is ____ proportional to its frequency and ____ proportional to its wavelength.
- energy, directly, inversely
 - energy, inversely, directly
 - velocity, directly, inversely
 - intensity, inversely, directly
 - amplitude, directly, inversely

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.
 $__ \text{C}_3\text{H}_8(\ell) + __ \text{O}_2(\text{g}) \rightarrow __ \text{CO}_2(\text{g}) + __ \text{H}_2\text{O}(\text{g})$
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?
a. Chem 111 c. Chem 365 e. Bio 101
b. Chem 0 d. Basket Weaving 101

Answer Key

1.	B	2.2 Atomic Number and Atomic Mass
2.	C	2.2 Atomic Number and Atomic Mass
3.	D	2.7 Ionic Compounds: Formulas, Names, and Properties
4.	B	2.7 Ionic Compounds: Formulas, Names, and Properties
5.	B	2.7 Ionic Compounds: Formulas, Names, and Properties
6.	B	2.7 Ionic Compounds: Formulas, Names, and Properties
7.	B	2.7 Ionic Compounds: Formulas, Names, and Properties
8.	C	2.9 Atoms, Molecules, and the Mole
9.	E	2.9 Atoms, Molecules, and the Mole
10.	D	2.9 Atoms, Molecules, and the Mole
11.	A	2.10 Describing Compound Formulas
12.	E	2.10 Describing Compound Formulas
13.	B	2.7 Ionic Compounds: Formulas, Names, and Properties
14.	C	
15.	B	
16.	B	4.1 Mass Relationships in Chemical Reactions: Stoichiometry
17.	D	6.1 Electromagnetic Radiation
18.	A	6.2 Planck, Einstein, Energy, and Photons
19.	D	6.2 Planck, Einstein, Energy, and Photons
20.	D	6.2 Planck, Einstein, Energy, and Photons
21.	A	6.3 Atomic Line Spectra and Niels Bohr
22.	E	6.5 The Modern View of Electronic Structure: Wave or Quantum Mechanics
23.	A	6.6 The Shapes of Atomic Orbitals
24.	B	3.2 Balancing Chemical Equations
25.	A	