

Chemistry I – Semester Exam Review – Mrs. Bauck
Optional 40-point assignment and help card due _____

The exam will consist of 165 multiple-choice questions covering the material from first semester. The exam is divided into sections by topics. You will need #2 pencils and erasers, a calculator, as well as something to do (book, magazine, other classes' work, etc.) if you finish early. No electronic devices are allowed as long as exams are being taken in the room.

The semester exam is weighted 25% of the semester grade. Study for it. Reread the book and notes, redo practice problems, watch tutorial videos—whatever helps you, do it. This exam review was written directly from the exam. The exam review will count as a 40/40 optional assignment grade if it is completed correctly and turned in by due date. NO LATE ASSIGNMENTS WILL BE ACCEPTED.

“Help card”: You may use ONE 3” x 5” or 4” x 6” index card with information written or typed on both sides. The actual card must be submitted for approval the day the exam review is due. It will be checked for size and content. No electronic copies of cards will be accepted. No sharing of cards during the exam is permitted. You may write any information you want on the card EXCEPT THE POLYATOMIC IONS. You will have a laminated periodic table, but I will not furnish any equations or constants for you, so doing a help card is important. NO LATE HELP CARDS WILL BE ACCEPTED.

Here is the minimum information recommended to be on the card: density equation, Kelvin equation, wave equations, Planck's constant, speed of light constant, VSEPR table of shapes.

Breakdown of questions by topic:

Introduction to chemistry; general topics = 20
Scientific measurement, sig. figs., metrics, and dimensional analysis = 25
Atomic structure = 15
Compounds; writing and naming chemical formulas = 33
Electrons and electron configurations - 19
Periodic table; periodicity = 17
Ionic bonds = 23
Covalent bonds = 13

INTRO TO CHEM: GENERAL TOPICS

- 1) **Biochemistry**: What is it?
- 2) **Chemical change**: What is it? Identify characteristics and examples.
- 3) **Chemical property**: What is it? Identify characteristics and examples.
- 4) **Chemical reaction**: What is it; How do you tell one has taken place?
- 5) **Compound**: What is it? Contrast with **element**.
- 6) **Control / control group**: What is it? How does it fit into an experiment? How does it related to variables?
- 7) **Element**: What is it? Contrast with **compound**.
- 8) **Energy**: What is it? Identify types: kinetic, radiant
- 9) **Experiment**: What is it? How it is designed?
- 10) **Heterogeneous mixture**: What is it? Identify examples. Contrast with **homogeneous mixture**.
- 11) **Homogeneous mixture (solution)**: What is it? Identify examples. Contrast with **heterogeneous mixture**.
- 12) **Hypothesis**: What is it? Give an example.
- 13) **Organic chemistry**: What is it?
- 14) **Physical change**: What is it? Identify characteristics and examples.
- 15) **Physical property**: What is it? Identify characteristics and examples.
- 16) **Reaction**: What is it? Identify **reactants** and **products** in a sample reaction.
- 17) **Scientific law**: What is it? Identify characteristics; contrast with **theory**.
- 18) **Theory**: What is it? Identify characteristics; contrast with **scientific law**.
- 19) **Variable**: What is it? Contrast **independent variables** and **dependent variables**. Identify **independent variables** and **dependent variables** in an example.

SCIENTIFIC MEASUREMENT, SIG. FIGS., METRICS, AND DIMENSIONAL ANALYSIS

Note: There are at least 10 math problems in this section: density, temperature conversion, sig. figs, scientific notation, dimensional analysis.

- 20) What is the symbol **μ** ? What does it mean, numerically?
- 21) **Absolute zero**: What is it?
- 22) **Accuracy**: What is it? Contrast with **precision**.
- 23) **Density**: What does this measure? Identify proper units. Solve problems for D, M, or V, using the equation **$D = M / V$**
- 24) **Dimensional analysis**: How does it work? What is the function of **conversion factors**? Be able to do simple math dimensional analysis problems.
- 25) **Kelvin**: What does this measure? Convert from **Kelvin** to **Celsius**, and **Celsius** to **Kelvin** using the equation **$K = C + 273$**
- 26) **Mass**: What does this measure? Identify proper mass units, and list three of them here.
- 27) **Metric system**: know the **prefixes** in order, from kilo down to milli. What do they mean numerically?
- 28) **Precision**: What is it? Contrast with **accuracy**.
- 29) **SI**: What is this? Identify the common **base units** of mass, temperature, length.
- 30) **Scientific notation**: Know how to put a number from standard notation into scientific notation and vice versa.
- 31) **Significant figures** (“**sig. figs**”): What are they? How are they used? Know *how* to apply the sig. fig rules. (“How many sig. figs are in the number ---?”) Know how to round numbers from addition/subtraction or multiplication/division to the correct number of sig. figs.
- 32) **Volume**: What is it? Identify possible units of volume.

ATOMIC STRUCTURE

- 33) **Atomic mass**: What is it? Where is it found? Contrast with **atomic number** and **mass number**.
- 34) **Atomic number**: What is it? Where is it found? What types of information does the atomic number give?
- 35) **Electron**: What is it? Where is it located? What is its symbol? What is its relative mass? What is its charge?
- 36) **Isotopes**: What are they? How are isotopes of an element the same? How are they different?
- 37) **Mass number**: What is it? Why is it NOT the number on the periodic table?
- 38) **Nucleus**: What is it? Is it the heaviest part of the atom?
- 39) **Neutron**: What is it? Where is it located? What is its symbol? What is its relative mass? What is its charge?
- 40) **Proton**: What is it? Where is it located? What is its symbol? What is its relative mass? What is its charge?
- 41) **Rutherford’s gold foil experiment**: How was it set up? What did the results show?
- 42) **Subatomic particles**: What are the three main ones? How many do scientists think there are in total? Be able to find the numbers of protons, neutrons, and electrons of an atom (a mass number will be given when needed).

COMPOUNDS; WRITING AND NAMING CHEMICAL FORMULAS

Note: There are at least 20 questions in this section about naming compounds, classifying compounds, and writing formulas.

- 43) **Acids**: What are they? Be able to identify formulas of common acids.
- 44) **Anion**: What is it? What is a **monatomic anion**? How does it form? Understand how the charges work.
- 45) **BI**: What does this stand for?
- 46) **BM**: What does this stand for?
- 47) **Cation**: What is it? What is a **monatomic cation**? How does it form? Understand how the charges work.
- 48) “Charge Chant”: know the common **ionic charges (oxidation numbers)** of the representative elements
- 49) **Compound**: What is it? Be able to identify **BI**, **BM**, and **TI** compounds.

- 50) Formulas of compounds: Be able to write the formula of a compound, given its name. (Crisscross of BI and TI; using prefixes for BM).
- 51) **Groups**: Where are they in the periodic table? Why is the group arrangement important?
- 52) **Metals**: Where are they in the periodic table? Identify characteristics.
- 53) **“Middle metals”**: How do these work when they form cations? Explain how Roman numerals are used in naming them.
- 54) **Metalloids**: What are two other names for the metalloids? Where are they in the periodic table? Identify the seven metalloids.
- 55) **Molecular compound**: What types of elements make up a “BM” compound? Identify characteristics of molecular compounds.
- 56) **Naming compounds**: given a chemical formula, be able to name the compound correctly.
- 57) **Nonmetals**: Where are they in the periodic table? Identify examples. Identify characteristics.
- 58) **Periods**: Where are they in the periodic table?
- 59) **Polyatomic ion**: What is it made of? Know the common polyatomic ions. List them here.
- 60) **Prefixes**: Know the prefixes used for naming BM compounds. List them here.
- 61) **Subscripts and superscripts**: How can you identify them in a formula? Describe their functions.
- 62) **TI**: What does this stand for?

ELECTRONS AND ELECTRON CONFIGURATIONS

- 63) What is the symbol λ ?
- 64) Aufbau diagram: Know what the **“boxes”** and **“arrows”** mean. Why do the “arrows” point in opposite directions?
- 65) **Electron configuration**: What is it? How is it done? Know how to write complete electron configurations as well as condensed and valence configurations. Be able to identify an element based on its electron configuration. Be able to identify how an ion changes its electron configuration.
- 66) **em**: What does this stand for? Know the correct sequence of **em radiation** from low to high energy.
- 67) **Energy**: What is it? List the common unit for energy in wave equations.
- 68) **Frequency**: What is it? List the common unit for energy in wave equations.
- 69) **Ground state** and **excited state**: What are these? How are they related?
- 70) **Orbital**: What is it? Give examples. What are **s, p, d, f**? What are their shapes?
- 71) **Principal quantum number (n)**: What is a common name for this? How many are there, according to the periodic table?
- 72) **Quantum**: What is it?
- 73) **Valence**: What is it? Be able to recognize valence electron configurations.
- 74) **Visible light**: Know the correct sequence of colors from low to high energy.
- 75) **Wave anatomy**: know **crest, trough, wavelength, frequency, amplitude**.
- 76) **Wave-particle duality of nature**: What is it?
- 77) Solve the **wave equation $c = \lambda\nu$** for frequency. Show an example problem here.
- 78) Solve the **wave equation $c = \lambda\nu$** for wavelength. Show an example problem here.
- 79) Solve the **wave equation $E = h\nu$** for energy. Show an example problem here.
- 80) Solve the **wave equation $E = h\nu$** for frequency. Show an example problem here.

PERIODIC TABLE; PERIODICITY

- 81) **Atomic size (atomic radius)**: What is the periodic trend for atomic radius from top to bottom down a group; from left to right across a period? Compare atomic size (of the neutral atom) to the **ionic size of cations and anions**.
- 82) **Electronegativity**: What is it? What is the periodic trend for electronegativity from top to bottom down a group; from left to right across a period? Which element is the “greediest”? Why?
- 83) **Group IA (1)**: Where are they located? What is this group called? Identify elements from this group. What charge do these ions form? How is their valence configuration related to each other?
- 84) **Group IIA (2)**: Where are they located? What is this group called? Identify elements from this group. What charge do these ions form? How is their valence configuration related to each other?

- 85) **Group VIIA (17):** Where are they located? What is this group called? Identify elements from this group. What charge do these ions form? How is their valence configuration related to each other?
- 86) **Group VIIIA (18):** Where are they located? What is this group called? Identify elements from this group. How is their valence configuration related to each other? Why are they **inert**?
- 87) **Inner transition metals:** What are two other names for this collection of elements? Where are they located? Which orbitals do they fill?
- 88) **Ionization energy:** What is it? What is the periodic trend for ionization energy from top to bottom down a group; from left to right across a period?
- 89) **Representative elements:** Where are they located in the periodic table? Which orbitals do they fill?
- 90) **Transition metals:** Where are they located in the periodic table? Which orbitals do they fill?
- 91) **Valence:** Why are only **s & p** orbitals included in normal valence configurations?

IONIC BONDS

- 92) Crystal types: **SC, BCC, FCC, HCP.**
- 93) **Electron dot diagrams (Lewis structures):** Be able to predict the number of electron dots for elements and ions.
- 94) **Formula unit:** What is this? Where is it found? Contrast with **molecule.**
- 95) **Delocalized electrons:** What are these? Where are they found? Relate to **metallic bonding.**
- 96) **Ionic bond, ionic compound:** Identify characteristics. Relate the term **salt** to ionic compounds.
- 97) **Malleable:** What is this?
- 98) **Metals:** What are they? Identify characteristics. Identify metallic elements.
- 99) **Noble Gas configuration:** What is this? How does this support the **octet rule**? What are the two element exceptions to the octet rule?
- 100) **Octet rule:** What is this? How does this relate to dot diagrams for atoms? How does this relate to ion formation?
- 101) **Pseudo-Noble Gas configuration:** What is this? When does it happen? Why is this an exception to the octet rule?
- 102) **Valence:** Understand electron changes ion cations and anions. Be able to identify how an ion changed its electron configuration.

COVALENT BONDS

- 103) What is the symbol δ ? How does it relate to **polarity**?
- 104) **Bond strength:** Arrange the following from strongest to weakest: **polar covalent bond, nonpolar covalent bond, ionic bond.**
- 105) **Covalent bond:** What is it? Contrast to an **ionic bond.** Compare and contrast **polar** vs. **nonpolar covalent bonds.** When do these form?
- 106) **Electron dot diagrams (Lewis structures):** Be able to predict the number of **unshared pairs** in an element, and the **number of bonds** that can form as a result.
- 107) **Intermolecular forces:** What does this mean? Give examples and be able to describe them: **hydrogen bonding, London/dispersion** forces, **dipole-dipole** forces.
- 108) **Hydrogen bonding:** What is it? How does it occur? Recognize molecules that can undergo hydrogen bonding.
- 109) **Polarity:** What is this? How does it work? Define **polar** and **non-polar.**
- 110) **VSEPR:** What does this stand for? How does it work? Relate to **molecular geometry.** Given a chemical formula, predict the shape of the molecule.