Student Review

Chemistry Semester A

Test Description

Length: 2 hours
Points: 65 SR (85%), 2 BCRs (15%)

Unit	Approximate Number of Selected Response Items	
	On Level	*Honors*
Chemistry Skills and Processes	12	11
Classification of Matter	6	7
Formula Writing	10	10
Reactions	13	13
Stoichiometry	8	9
Atomic Structure	12	11
Periodicity	4	4
Totals	**65**	**65**

The vocabulary terms and objectives are grouped into units for your convenience. Some items may occur in multiple units during the semester. The vocabulary includes terms that students may encounter when reading examination items. (H) indicates items found on the Honors Chemistry examination but not on the Chemistry examination.

Some Vocabulary For the Exam

Classification of Matter

alloy
chemical change
classification
colloid
combustion
composition
compound
conductivity
conservation of mass
density
dissolving
distillation
element
filtration
flammability
heterogeneous
homogenous
insoluble
laser
malleable
mixture
physical change
pressure
property
pure substance
soluble
solution
suspension
Tyndall Effect
uniform
volume

Formulas

acids
alkane
binary ionic compound
bond
chemical formula
chemical name
diatomic
covalent compound
compound
formula unit
formula mass
hydrocarbon
inorganic
ionic bond
ionic covalent bond (molecular compound)
ion/ionic
molecular/molecule
monatomic ion
polyatomic ion
solute
solvent
organic
tertiary
subscript

Reactions

activity series
bond
catalyst

Reactions (continued)
chemical reaction
chemical equation
coefficient
combustion
decomposition
single displacement
double displacement
dissociation
electrolysis
hydrocarbon
insoluble
ionization
net ionic equation (H)
percent yield (H)
precipitate
product
reactant
soluble
subscript
synthesis

Stoichiometry
Avogadro's number
excess
limiting reactant
molar mass
mole
mole ratio
percent composition

Atomic Structure
alpha particles
anion
atom
average atomic mass
atomic number
Bohr
cation
charge
electron
electron configuration
energy level
excited state
ground state
ion
isotope
neutron
nucleus
orbital
percent abundance (H)
proton
valence electrons

Periodicity
actinide series
atomic radius
alkali metal
alkaline earth metal
electronegativity
family
group
halogen
ionization energy
lanthanide series
melting point
metallic character
noble gas
oxidation number
period
periodic law
precipitate
thermal conductivity
transition metal
trend
valence electrons

Upon successful completion of the first semester the student should be able to:

Chemistry Skills and Processes

- interpret graphs and diagrams.
- identify trends revealed by data.
- analyze data to form conclusions.
- defend the need for verifiable data.
- identify the control in an experiment.
- read and interpret a technical passage.
- identify the hypothesis of an experiment.
- identify meaningful, answerable, scientific questions.
- identify appropriate methods for conducting an investigation.
- use ratio and proportion in appropriate situations to solve problems.
- distinguish between a dependent variable and an independent variable.
- describe similarities and differences when explaining concepts and/or principles.
- identify the appropriate instruments and materials needed to conduct an experiment.
- recognize safe laboratory procedures.
- organize data using appropriate techniques.
- compare measurements in scientific notation.

Student Review

Classification of Matter

- classify elements as metals, nonmetals and metalloids based on common physical and chemical properties and position on periodic table.
- compare solutions to suspensions and colloids.
- differentiate among elements, compounds, mixtures and solutions.
- distinguish between physical and chemical changes.

Formula Writing

- determine the number and types of atoms represented by a given formula.
- write names and formulas for ionic and molecular compounds including binary compounds, polyatomic ions and common acids and bases, when given the name, periodic table and ion chart.
- identify traditional nomenclature (-ic and -ous suffixes). (H)
- name straight chain organic compounds (alkanes through decane).
- write symbols to represent elements, including diatomic elements, given a periodic table.

Reactions

- transpose word equations into symbolic chemical equations and vice versa.
- use the activity series to determine if single displacement reactions will occur.
- use solubility rules to predict if a precipitate will form in a double displacement reaction.
- use coefficients to balance simple chemical equations.
- apply the Law of Conservation of Mass to account for the same number of atoms of each type appearing in both the reactants and products.
- identify or describe synthesis, decomposition single displacement, double displacement and combustion reactions given balanced formula equation or written description.
- explain the meaning of coefficients in chemical equations.
- write net ionic equations. (H)

Stoichiometry

- define the mole in terms of Avogadro's number.
- explain the relationship between moles, mass and particles.
- utilize dimensional analysis to convert between moles and mass and mass and particles.
- calculate the formula mass of a compound using the periodic table.
- calculate the mass percent composition of a compound given the formula, formula mass and periodic table.
- demonstrate that adjusting quantities of reactants may affect the amounts of products formed.
- use the coefficients of a balanced equation to predict amounts of reactants and products at the molecular and mole level.
- use the coefficients of a balanced equation to predict the mass of products formed by a specified mass of a reactant. (H)
- manipulate the limiting reagent concept qualitatively.

Student Review

Atomic Structure

- describe the characteristics of protons, neutrons and electrons in terms of location, charge and mass.
- illustrate the structure of the atom by using the Bohr model, including the charge, relative mass and location of the sub-atomic particles.
- use atomic mass, atomic number, and charge to identify neutral atoms, ions, and isotopes.
- analyze the structure of the atom and describe the characteristics of the particles found there.
- describe electron configurations for the first twenty elements.
- describe electron configurations for all elements and justify exceptions. (H)
- distinguish between the nucleus and electron cloud.
- identify the atomic number and average atomic mass given the periodic table.
- identify isotopes of an element based on number of neutrons and/or atomic mass.
- calculate numbers of protons, neutrons and electrons for atoms given mass and the periodic table.
- write nuclide symbols and names that identify specific isotopes.
- calculate atomic mass and express it in atomic mass units.
- describe the characteristics of a neutral atom.
- compare the characteristics of the neutral atom to its ion.
- calculate an element's average atomic mass. (H)

Periodicity

- demonstrate that the arrangement and number of electrons and the properties of elements repeat in a periodic manner illustrated by their arrangement in the periodic table.
- use families, periods, and common family names in discussions of periodic trends.
- predict chemical and physical properties based on an element's location on the periodic table.
- classify elements as metals, nonmetals and metalloids based on common physical and chemical properties and position on periodic table.
- determine the number of valence electrons for a specific element, given a periodic table.
- describe how the trends of valence electrons, atomic radius, ionization energy, relative chemical reactivity, and metallic/nonmetallic properties behave in groups 1,2 and 13-18.
- locate groups/families on the periodic table, including groups 1-18, and the Alkali Metals, Alkaline Earth Metals, Transition Metals, Halogens, Noble Gases, Lanthanide Series and Actinide Series.
- describe the properties of the groups/families on the periodic table.
- locate periods 1-7 on the periodic table.

BCRs were put on the exam review sheets to encourage appropriate student collaboration and review of concepts in preparation for the entire exam (not just the BCRs). Teachers should not address these BCRs during the course of their instruction and review with students other than highlighting their availability to support STUDENT review and to teach, model and encourage collaboration around the concepts.

Students should be prepared to answer any of the following BCRs. Teachers will select two from the list below:

BCR: Separating a Precipitate

A chemistry student must separate solid barium sulfate, a precipitate, from an aqueous solution. Equipment and glassware normally found in the chemistry classroom are available to the student.

Describe how the student could separate the solid barium sulfate from the aqueous solution. Be sure to

- list the lab equipment needed to do the procedure
- explain how each item is used in the procedure
- list any safety equipment needed and how it is used in the procedure
- describe how this procedure might be used in a situation outside the chemistry classroom

BCR: Comparing Substances

Two solids, A and B, are located in the same family on the periodic table. A sample of each is placed in a beaker of HCl. Substance A produces a few bubbles that rise to the top of the liquid. Substance B bubbles vigorously.

Based on this information, compare substances A and B. Be sure to describe the following:

- what the bubbles indicate
- where the substances are located in relation to one another on the periodic table and the activity series
- the name of a family the substances could belong to
- which substance will have a larger atomic radius
- which substance will have a larger first ionization energy

BCR: Types of Reactions

Students' observations of three chemical reactions are shown in the table below. Use their data and the solubility table to classify each of the types of reactions.

Be sure to include

- the name of each type of reaction
- evidence that supports how each type is classified
- the reactants and products for each reaction

Reaction	Initial Observations / Notes	Final Observations / Notes
1	Clear, colorless KI solution is added to clear, colorless $Pb(NO_3)_2$ solution in a beaker.	A yellow solid appears in a clear liquid. The yellow solid is lead (II) iodide.
2	Magnesium (Mg), a solid silver-colored ribbon, is ignited in the flame of a Bunsen burner. The Mg burns with a bright white light.	White ashes remain after the Mg burns. Magnesium oxide is produced.
3	Mercury (II) oxide, a red, powdery solid, is heated in a test tube.	Mercury metal condenses on the walls of the test tube. A glowing splint inserted into the mouth of the test tube burns brightly.

BCR: Stoichiometry

Propane is used as a fuel in most gas grills to cook food on during the warm summer months. When the propane is burned, the following reaction takes place:

$$\mathbf{C_3H_8(l) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)}$$

A standard propane tank contains 6804 g of propane. Determine how many molecules of carbon dioxide gas are released into the atmosphere when an entire tank of propane is burned.

In your answer be sure to:

- Describe the type of chemical reaction the propane undergoes
- Calculate the number of moles of propane used in the reaction
- Explain the mole ratio between propane and carbon dioxide in this reaction
- Calculate the number of moles of carbon dioxide produced
- Calculate the number of molecules of carbon dioxide produced

BCR: The Flame Test

A student burns a small amount of six solutions in the flame of a Bunsen burner and records the color for each. Her data are shown in the table below.

Solution	Color
Lithium chloride	Red
Sodium chloride	Yellow
Potassium chloride	Violet
Calcium chloride	Red-orange
Strontium chloride	Red-orange
Barium chloride	Green

Analyze the results of the flame test colors. Be sure to include

- An explanation of the flame test results in terms of energy and electron movement
- An explanation of how the flame test can be used to identify ions
- The limitations of the flame test in identifying ions

BCR: Unknown Compound

Bob's chemistry teacher gives him a solid compound to use in a chemical reaction. The teacher tells him the compound is either sodium carbonate, Na_2CO_3, or sodium bicarbonate, $NaHCO_3$. Bob must determine the identity of the compound. He reacts the compound with excess HCl and measures the mass of the product. His data are shown in the table below.

MASS OF PRODUCT IN REACTION

Substance	Mass (g)
Mass of beaker	50.52
Mass of beaker + solid compound	52.43
Mass of beaker + dried product (NaCl)	52.63

The balanced chemical equations below show each possible reaction.

#1 $Na_2CO_3(s) + 2HCl(aq) \rightarrow H_2O(l) + CO_2(g) + 2NaCl(s)$

#2 $NaHCO_3(s) + HCl(aq) \rightarrow H_2O(l) + CO_2(g) + NaCl(s)$

Describe how you would use the information from the data table to determine the identity of the compound.

In your response, be sure to

- identify the compound
- support your choice by
  - explaining how you would use data from the table
  - showing calculations, including moles of reactants and moles of products
  - describing reasons for not choosing the other compound
- describe how using stoichiometry is necessary to select the correct compound