Name _____ Practice Part II "In Terms Of" Mr. Beaudoin

1. Explain, in terms of molecular structure or distribution of charge, why a molecule of CF_4 is nonpolar.

2. Explain in terms of atomic structure, why the atomic radius of iodine is greater than the atomic radius of fluorine.

3. Base your answer to the following question on the information below.

Some Properties of Three Compounds at Standard Pressure

Compound	Boiling Point (°C)	Solubility in 100. Grams of H_2O at 20.°C (g)
ammonia	–33.2	56
methane	–161.5	0.002
hydrogen chloride	–84.9	72

Explain, in terms of intermolecular forces, why ammonia has a higher boiling point than the other compounds in the table.

4. Base your answer to the following question on the balanced equation below.

$$2Na(s) + Cl_2 \rightarrow 2NaCl(s)$$

Explain, in terms of electrons, why the bonding in NaCl is ionic.

5. Explain, in terms of atomic structure, why the noble gas neon is an unreactive element.

6. Base your answer to the following question on the information below.

In the gold foil experiment, a thin sheet of gold was bombarded with alpha particles. Almost all the alpha particles passed straight through the foil. Only a few alpha particles were deflected from their original paths.

Explain, in terms of charged particles, why some of the alpha particles were deflected.

7. Base your answer to the following question on the elements in Group 2 on the Periodic Table.

Explain, in terms of atomic structure, why the elements in Group 2 have similar chemical properties.

8. Base your answer to the following question on the information below.

A metal, *M*, was obtained from a compound in a rock sample. Experiments have determined that the element is a member of Group 2 on the Periodic Table of the Elements.

Explain, in terms of electrons, why element *M* is a good conductor of electricity.

9. Base your answer to the following question on the information below.

In a laboratory, a student makes a solution by completely dissolving 80.0 grams of $KNO_3(s)$ in 100.0 grams of hot water. The resulting solution has a temperature of 60.°C. The room temperature in the laboratory is 22°C.

Classify, in terms of saturation, the type of solution made by the student.

10. Base your answer to the following question on the information below.

The atomic and ionic radii for sodium and chlorine are shown in the table below.

Atomic and Ionic Radii

Particle	Radius (pm)
Na atom	190.
Na^+ ion	102
Cl atom	97
Cl^- ion	181

Explain, in terms of atomic structure, why the radius of an Na atom is larger than the radius of an Na^+ ion.

11. Base your answer to the following question on the information below.

Biodiesel is an alternative fuel for vehicles that use petroleum diesel. Biodiesel is produced by reacting vegetable oil with CH_3OH. Methyl palmitate, $C_{15}H_{31}COOCH_3$, a compound found in biodiesel, is made from soybean oil. One reaction of methyl palmitate with oxygen is represented by the balanced equation below.

$$2C_{15}H_{31}COOCH_3 + 49O_2 \rightarrow 34CO_2 + 34H_2O + \text{energy}$$

Explain, in terms of *both* atoms and molecular structure, why there is no isomer of CH_3OH.

12. Explain, in terms of activity, why HCl(aq) reacts with Zn(s), but HCl(aq) does *not* react with Cu(s).

13. Base your answer to the following question on the table below.

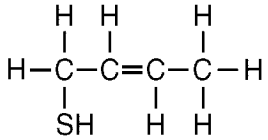
Naturally Occurring Isotopes of Copper

Isotope Notation	**Percent Natural Abundance** (%)	**Atomic Mass** (atomic mass units, u)
Cu-63	69.17	62.930
Cu-65	30.83	64.928

State, in terms of subatomic particles, how an atom of Cu-63 differs from an atom of Cu-65.

14. Base your answer to the following question on the information below.

A thiol is very similar to an alcohol, but a thiol has a sulfur atom instead of an oxygen atom in the functional group. One of the compounds in a skunk's spray is 2-butene-1-thiol. The formula of this compound is shown below.



Explain, in terms of composition, why this compound is a thiol.

15. Base your answer to the following question on the information below.

A fluorescent light tube contains a noble gas and a drop of mercury. When the fluorescent light operates, the Hg is a vapor and there are free-flowing Hg ions and electrons in the tube. The electrons collide with Hg atoms that then emit ultraviolet (UV) radiation.

The inside of the tube is coated with a mixture of several compounds that absorbs UV radiation. Ions in the coating emit a blend of red, green, and blue light that together appears as white light. The compound that produces red light is Y_2O_3. The compound that produces green light is $CeMgAl_{11}O_{19}$. The compound that produces blue light is $BaMgAl_{10}O_{17}$.

Explain, in terms of *both* electrons and energy, how ions in the coating emit light.

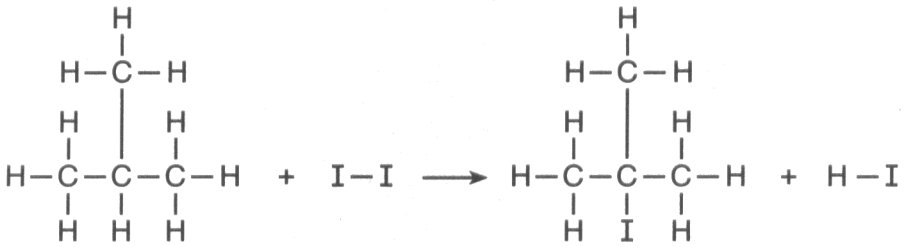
16. Base your answer to the following question on the information below.

A battery-operated smoke detector produces an alarming sound when its electrical sensor detects smoke particles. Some ionizing smoke detectors contain the radioisotope americium-241, which undergoes alpha decay and has a half-life of 433 years. The emitted alpha particles ionize gas molecules in the air. As a result, an electric current flows through the detector. When smoke particles enter the detector, the flow of ions is interrupted, causing the alarm to sound.

Explain, in terms of particle behavior why smoke particles cause the detector alarm to sound.

17. Base your answer to the following question on the information below

The hydrocarbon 2-methylpropane reacts with iodine as represented by the balanced equation below. At standard pressure, the boiling point of 2-methylpropane is lower than the boiling point of 2-iodo-2-methylpropane.



2-methylpropane 2-iodo-2-methylpropane

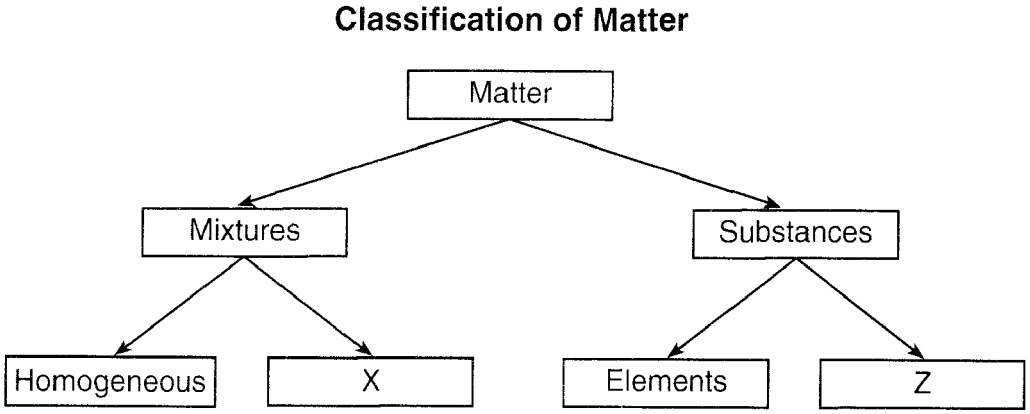
Explain, in terms of bonding, why the hydrocarbon 2-methylpropane is saturated.

18. Explain, in terms of collision theory, why an increase in temperature increases the rate of a chemical reaction.

19. Base your answer to the following question on the properties of propanone.

Explain, in terms of molecular energy, why the vapor pressure of propanone increases when its temperature increases.

20. Base your answer to the following question on the diagram below concerning the classification of matter.



Explain, in terms of particle arrangement, why NaCl(aq) is a homogeneous mixture.

21. Because tap water is slightly acidic, water pipes made of iron corrode over time, as shown by the balanced ionic equation below:

$$2Fe + 6H^{+} \rightarrow 2Fe^{3+} + 3H_2$$

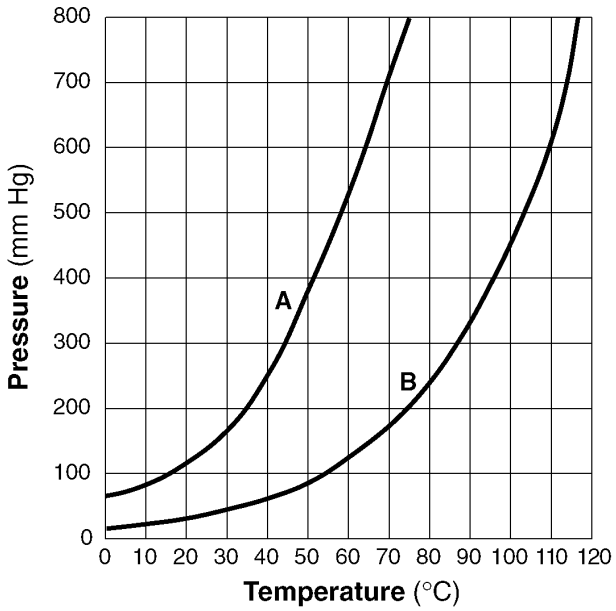
Explain, in terms of chemical reactivity, why copper pipes are *less* likely to corrode than iron pipes.

22. Base your answer to the following question on the information below

An atom in an excited state has an electron configuration of 2-7-2.

Explain, in terms of subatomic particles, why this excited atom is electrically neutral.

23. Base your answer to the following question on the graph below, which shows the vapor pressure curves for liquids *A* and *B*.



Which liquid will evaporate more rapidly? Explain your answer in terms of intermolecular forces.

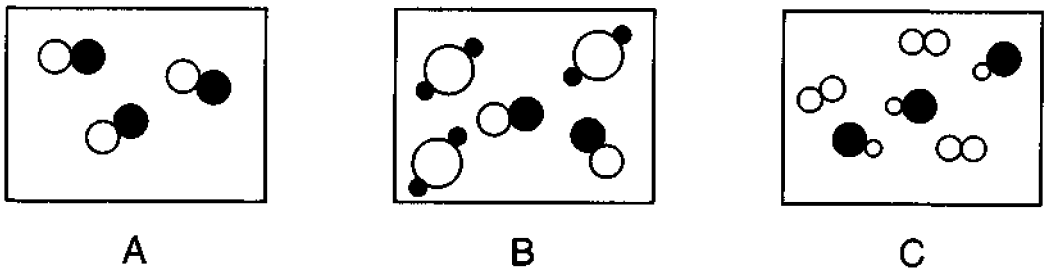
24. Base your answer to the following question on the table below.

First Ionization Energy of Selected Elements

Element	Atomic Number	First Ionization Energy (kJ/mol)
lithium	3	520
sodium	11	496
potassium	19	419
rubidium	37	403
cesium	55	376

Explain, in terms of atomic structure, why cesium has a *lower* first ionization energy than rubidium.

25. Base your answer to the following question on the pictures below:



Explain, in terms of the *composition*, why sample *A* represents a pure substance.

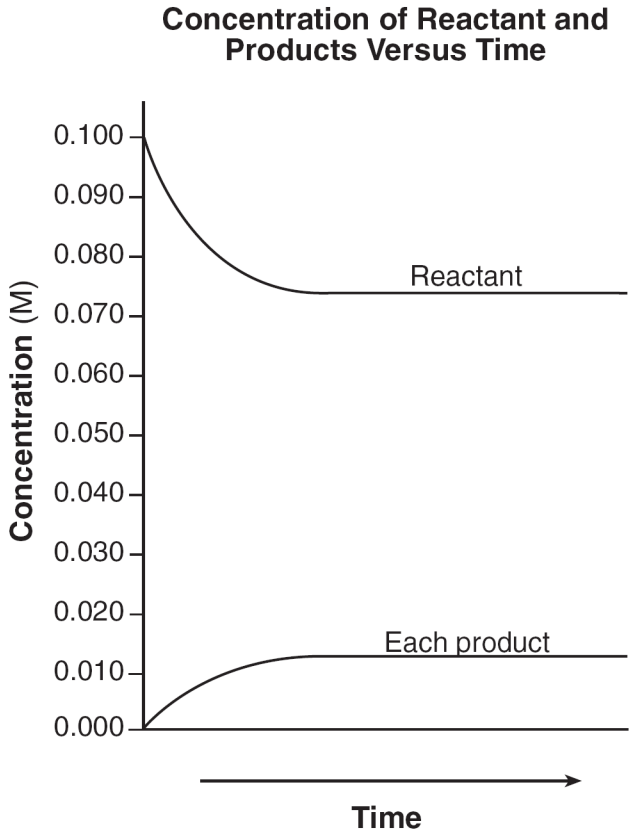
26. Base your answer to the following question on the information below.

Aluminum is one of the most abundant metals in Earth's crust. The aluminum compound found in bauxite ore is Al_2O_3. Over one hundred years ago, it was difficult and expensive to isolate aluminum from bauxite ore. In 1886, a brother and sister team, Charles and Julia Hall, found that molten (melted) cryolite, Na_3AlF_6, would dissolve bauxite ore. Electrolysis pf the resulting mixture caused the aluminum ions in the Al_2O_3 to be reduced to molten aluminum metal. This less expensive process is known as the Hall process.

Explain, in terms of ions, why molten cryolite conducts electricity.

27. Base your answer to the following question on the information below.

In a laboratory, 0.100 mole of colorless hydrogen iodide gas at room temperature is placed in a 1.00-liter flask. The flask is sealed and warmed, causing the HI(g) to start decomposing to $H_2(g)$ and $I_2(g)$. Then the temperature of the contents of the flask is kept constant.
During this reaction, the contents of the flask change to a pale purple-colored mixture of HI(g), $H_2(g)$, and $I_2(g)$. When the color of the mixture in the flask stops changing, the concentration of $I_2(g)$ is determined to be 0.013 mole per liter. The relationship between concentration and time for the reactant and products is shown in the graph below.



State, in terms of concentration, evidence that indicates the system in the flask has reached equilibrium.

28. Explain, in terms of electronegativity difference, why the bond in a molecule of HF is more polar than the bond in a molecule of HI.

Base your answers to questions **29** and **30** on the information below.

In the early 1800s, John Dalton proposed an atomic theory that was based on experimental observations made by several scientists. Three concepts of Dalton's atomic theory are stated below.

Statement *A*: Atoms are indivisible and cannot be destroyed or broken down into smaller parts.
Statement *B*: Atoms of one element cannot be changed into atoms of another element.
Statement *C*: All atoms of one element have the same mass.

29. Explain, in terms of particles, why statement *A* is no longer accepted.

30. Explain, in terms of particles in the atoms of an element, why statement *C* is *false*.

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31. Base your answer to the following question on the information below.

The diagram below shows a system in which water is being decomposed into oxygen gas and hydrogen gas. Litmus is used as an indicator in the water. The litmus turns red in test tube 1 and blue in test tube 2.

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The oxidation and reduction occurring in the test tubes are represented by the balanced equations below.

Test tube 1: $2H_2O(\ell) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

Test tube 2: $4H_2O(\ell) + 4e^- \rightarrow 2H_2(g) + 4OH^-(aq)$

Explain, in terms of the products formed in test tube 2, why litmus turns blue in test tube 2.

32. Base your answer to the following question on the information below.

A glass tube is filled with hydrogen gas at low pressure. An electric current is passed through the gas, causing it to emit light. This light is passed through a prism to separate the light into the bright, colored lines of hydrogen's visible spectrum. Each colored line corresponds to a particular wavelength of light. One of hydrogen's spectral lines is red light with a wavelength of 656 nanometers.

Tubes filled with other gases produce different bright-line spectra that are characteristic of each kind of gas. These spectra have been observed and recorded.

Explain, in terms of electron energy states and energy changes, how hydrogen's bright-line spectrum is produced.

33. Base your answer to the following question on the information below.

At a pressure of 101.3 kilopascals and a temperature of 373 K, heat is removed from a sample of water vapor, causing the sample to change from time gaseous phase to time liquid phase. This phase change is represented by the equation below.

$$H_2O(g) \rightarrow H_2O(\ell) + \text{heat}$$

Explain, in terms of particle arrangement, why entropy *decreases* during this phase change.

34. Base your answer to the following question on the passage below.

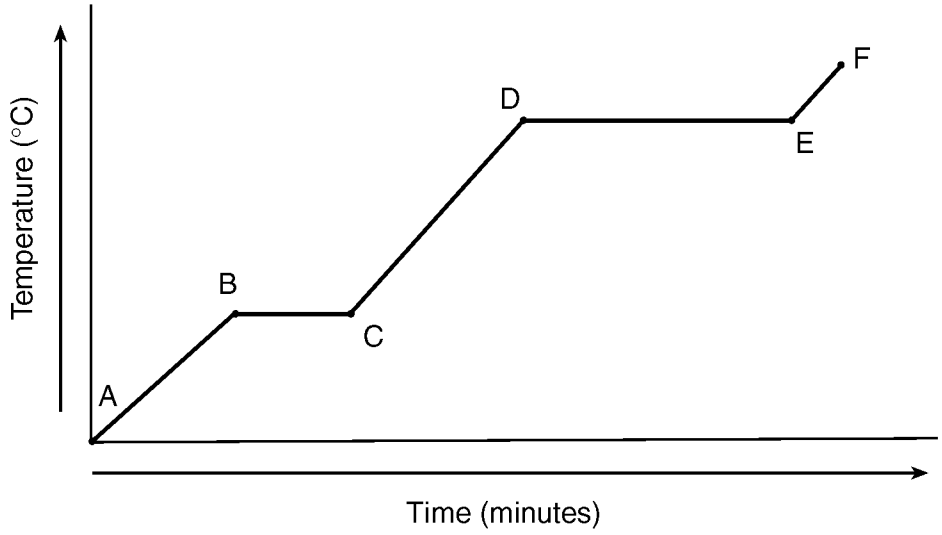
Acid rain lowers the pH in ponds and lakes and over time can cause the death of some aquatic life. Acid rain is caused in large part by the burning of fossil fuels in power plants and by gasoline-powered vehicles. The acids commonly associated with acid rain are sulfurous acid, sulfuric acid, and nitric acid.

In general, fish can tolerate a pH range between 5 and 9. However, even small changes in pH can significantly affect the solubility and toxicity of common pollutants. Increased concentrations of these pollutants can adversely affect the behavior and normal life processes of fish and cause deformity, lower egg production, and less egg hatching.

Acid rain caused the pH of a body of water to decrease. Explain this pH decrease in terms of the change in concentration of hydronium ions.

35. Base your answer to the following question on the information below.

Given the heating curve where substance *X* starts as a solid below its melting point and is heated uniformly:



Describe, in terms of *particle behavior* or *energy,* what is happening to substance *X* during line segment $\overline{BC}$.

Answer Key
review in terms of

1.
2. An iodine atom has more electron shells than a fluorine atom. A fluorine atom has fewer electron shells.
3. –Ammonia has stronger intermolecular forces than either methane or hydrogen chloride. –Ammonia has hydrogen bonding
4. The sodium atom transfers its one valence electron to the chlorine atom.
5. *Examples:* – Neon has atoms with a complete outer shell of electrons. – Neon has a complete octet. – Neon has eight valence electrons.
6. –Alpha particles are positive and are repelled by the nucleus that is also positive. –Both protons and alpha particles are positively charged so they repel each other. –Protons and alpha particles have the same charge.
7. –In the ground state, an atom of each element has two valence electrons. –The number of electrons in the outermost shell of each atom is the same.
8. Examples: – Metals have freely moving valence electrons. – mobile valence electrons – sea of mobile electrons – Electrons are delocalized.
9. The solution made by the student is unsaturated.
10. • A sodium atom loses the electron in its outer shell, causing the radius of the ion to be smaller than the radius of the atom. • An Na atom has three electron shells, but an Na^+ ion has only two electron shells.
11. Examples: With only one carbon atom bonded to one oxygen atom, there can be no rings or chains with branches in the molecular structure.; There are too few atoms to create a different molecular structure.
12. Acceptable responses include, but are not limited to: • Zinc is more active than hydrogen, but copper is less active than hydrogen. • On Table *J*, Zn is above H_2, and Cu is below H_2.
13. *Examples*: – An atom of copper-63 has two fewer neutrons than an atom of copper-65. – An atom of Cu-63 has 34 neutrons and an atom of Cu-65 has 36 neutrons.
14. *Examples*: – This compound contains an –SH functional group – There is a sulfur atom instead of an oxygen atom in the functional group
15. *Examples*: – Electrons move from the ground state to an excited state as the compounds gain energy. Light energy is released when the electrons return to lower states. – Electrons lose energy as they move to lower shells. – Light is emitted as electrons return from higher to lower energy states.
16. *Examples:* – Smoke particles interrupt the flow of ions required to maintain an electric current.– fewer freely moving charged particles in the detector
17. *Examples:* – A 2-methylpropane molecule has only single carbon-carbon bonds. – There are only single bonds in methylpropane. – no multiple bonds between carbon atoms
18. —As molecules acquire more kinetic energy, the number of effective collisions increases. higher temperature, greater frequency of collisions
19. Acceptable responses include, but are not limited to: As the temperature increases, more molecules have enough energy to escape the liquid phase.
20. Examples: – The water molecules, sodium ions, and chloride ions are uniformly mixed together. – All particles distribute evenly.

Answer Key
review in terms of

21. Examples: – Copper is less reactive than iron – Cu below H_2 on Table *J*

22. The number of protons equals the number of electrons. *or* The atom has 11 protons and 11 electrons.

23. liquid *A*
Example:
The higher vapor pressure of liquid *A* indicates that the intermolecular forces between its molecules are weaker, allowing the molecules to escape more readily to the vapor phase.

24. Acceptable responses include, but are not limited to:
As atomic radius increases, valence electrons are more easily removed.
The force of attraction between the nucleus and the valence electrons decreases down the group.
cesium has more shells, easier to remove electrons

25. Sample *A* has only one type of molecule *or* All particles are the same *or* not a mixture

26. *Examples*: – There are freely moving ions in the molten cryolite – Ions are no longer held together in a crystal lattice

27. *Examples:* – The concentration of each product and the concentration of the reactant remain the same. – The concentrations have reached constant levels. – The horizontal lines on the graph show that the concentrations are constant.

28. Acceptable responses include, but are not limited to: • The electronegativity difference between H and F is greater than the electronegativity difference between H and I. •The difference for HF is 1.9, and the difference for HI is 0.6.

29. Acceptable responses include, but are not limited to: • Smaller parts of atoms exist, such as protons, neutrons, and electrons. • During some nuclear reactions, unstable atoms can spontaneously decay into smaller particles. • Atoms can lose electrons.

30. Acceptable responses include, but are not limited to: • Atoms of different isotopes of an element have different masses because they have different numbers of neutrons. • Atoms of an element can differ in the number of neutrons and, therefore, masses.

31. • Litmus turns blue when a sufficient amount of hydroxide ions are produced. • The reaction in test tube 2 produces OH^- ions that make this solution basic. Litmus is blue in a basic solution.

32. *Examples*: – The electron of hydrogen absorbs energy and jumps to a higher energy state. The excited electron returns to a lower energy state, releasing light energy – The e^- absorbs energy and jumps to a higher level. The e^- falls back to a lower level and releases energy related to a particular color.

33. The arrangement of the H_2O molecules becomes more ordered as liquid water forms; As a liquid, the movement of the particles is less random.

34. Examples: – the pH goes down because there are more hydronium ions in solution. – $[H_3O^+]\uparrow$

35. Examples: –The potential energy of the particles increases. –PE increases.
–KE remains the same. –particles more disordered
–Particles are spreading farther apart.
–Intermolecular forces of attraction decrease.