

JBA 2024 – Chemistry Exam 1

Name: _____ Score: _____/100 = _____/80

1. Which of the following is a member of the group of elements called the *halogens*? (3 points)

- a. potassium
- b. calcium
- c. bromine
- d. argon

Answer c

2. When beryllium forms an ion, what charge will the ion have? (3 points)

- a. +1
- b. -1
- c. +2
- d. -2

Answer c

3. The electron configuration for manganese is: (3 points)

- a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$
- c. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$
- d. $1s^2 2s^2 2p^6 3s^2$

Answer b

4. Which item below IS NOT part of Dalton's atomic theory? (3 points)

- a. All atoms of a particular element are identical
- b. Atoms combine in whole number ratios to form compounds.
- c. Atoms can be split into protons, neutrons and electrons
- d. Reactions involve the rearrangement of atoms.

Answer c

5. Below are four statements about protons, only one of which is true. Identify the true statement. (3 points)

- a. Protons have about the same mass as electrons.
- b. Protons have about the same mass as neutrons.
- c. Some atoms don't have any protons.
- d. Protons have the same magnitude of charge as neutrons, but opposite sign

Answer b

6. Which of these bonds do you expect to be the **most** polar? (3 points)

- a. F-F
- b. O-F
- c. N-F
- d. C-F

Answer d

7. Which of the following elements occurs naturally as a diatomic molecule? (3 points)

- a. sulfur
- b. helium
- c. carbon
- d. oxygen

Answer d

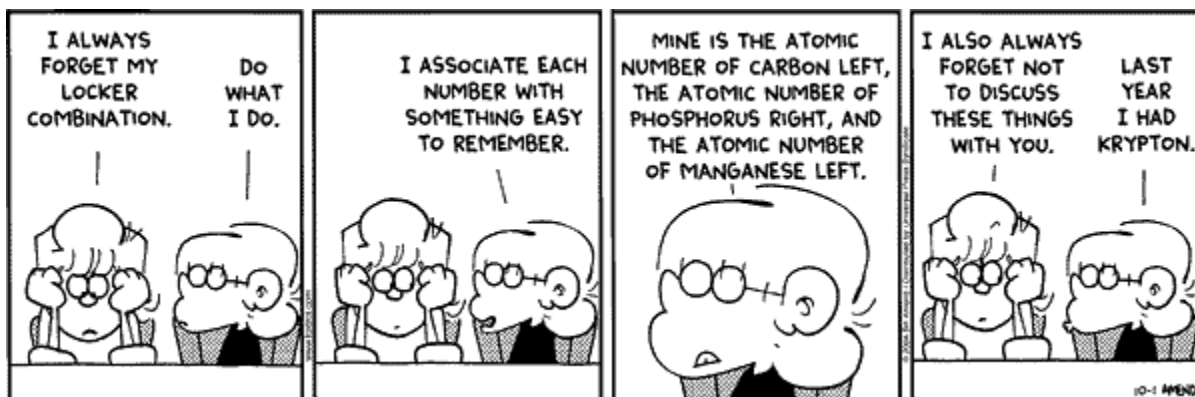
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 Use appropriate units and significant figures for results of calculations!

8. Match the term with its definition. (8 points)

<u>B</u> electron	A. a dumb bell shape in space where an electron or a pair of electrons can be found
<u>I</u> mass number	B. a subatomic particle with a mass of 1/1824 and a charge of -1
<u>F</u> electronegativity	C. negatively charged species that forms when an atom gains one or more electrons
<u>E</u> compound	D. a generalization that in most stable molecules, many atoms will share in eight outer electrons to fill their valence shell.
<u>H</u> covalent bond	E. a pure substance made up of two or more elements in a fixed characteristic chemical combination and composition
<u>D</u> octet rule	F. the tendency for an atom to attract electrons toward itself in a bond.
<u>C</u> anion	G. atoms of the same element, but with different number of neutrons
<u>G</u> isotopes	H. a chemical bond created when two atoms share electrons.
	I. the number of protons and neutrons that atom contains.
	J. positively charged species that forms when an atom loses one or more electrons

9. Complete the table for the elements below: (8 points)

Element	Electron Configuration	Number of Valence Electrons
Silicon	$1s^2 2s^2 2p^6 3s^2 3p^2$	4
Chlorine	$1s^2 2s^2 2p^6 3s^2 3p^5$	7



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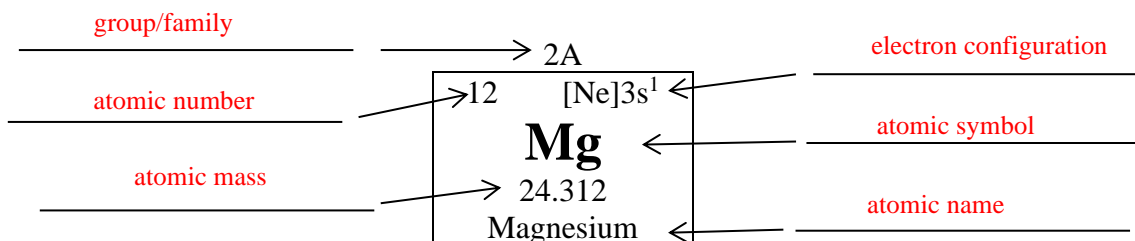
10. Complete the following table. (10 points)

Symbol	$^{12}_6\text{C}$	$^{55}_{26}\text{Fe}$	$^{40}_{20}\text{Ca}^{2+}$
# of protons	6	26	20
# of neutrons	6	29	20
# of electrons	6	26	18
Charge	0	0	+2
Mass #	12	55	40
Atomic #	6	26	20

11. Complete the table below: (10 points)

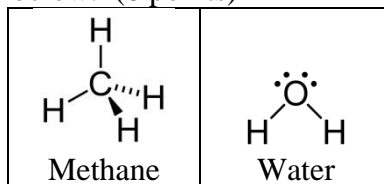
Formula	Name
ZnS	zinc (II) sulfide
N ₂ O ₅	dinitrogen pentoxide
PF ₆	phosphorous hexafluoride
Na ₂ O	sodium oxide
Mg ₃ N ₂	magnesium nitride

12. Fill-in the proper term for each item indicated on the diagram below. The terms are group/family, electronic configuration, atomic number, atomic mass, atomic symbol, atomic name. (6 points)



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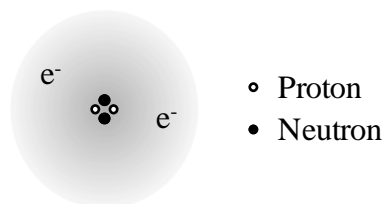
13. Use your understanding of molecular structure and intermolecular forces to explain why methane (CH_4) is a gas at room temperature and water (H_2O) is a liquid. The structures for methane and water are shown below. (6 points)



You should talk about the fact that methane is a nonpolar molecule, but water is polar, due to the electronegativity differences of atoms in the bonds and the orientation of the bonds in the molecule. As a result, water can undergo stronger intermolecular forces (like dipole-dipole interactions), that methane cannot. These stronger intermolecular forces require more energy to disrupt, making it more difficult to cause water to go from the liquid phase to the gas phase (that is, to boil).

14. Describe what an individual helium atom (${}^4_2\text{He}$) looks like. Be as detailed as you can. You may wish to include a sketch. (6 points)

Helium atoms are comprised of a nucleus that contains two protons and two neutrons and comprises most of the mass of the atom. The remainder of the atom consists of electrons in orbitals around the nucleus. The orbitals contain electrons and mostly empty space. A sketch might look something like this:



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15. Draw Lewis structures for the following compounds and determine their shape and polarity.
 (12 pts)

Species	Draw the Lewis Structure	<u>Molecular Shape</u> Circle the correct shape. (You may build a model)	Polar Molecule? Circle yes or no.
NH ₃	$\begin{array}{c} \text{H}-\ddot{\text{N}}-\text{H} \\ \\ \text{H} \end{array}$	Linear Bent Trigonal Planar Trigonal Pyramidal Tetrahedral	Yes No
CH ₂ O	$\begin{array}{c} \text{:O:} \\ \\ \text{H}-\text{C}-\text{H} \end{array}$	Linear Bent Trigonal Planar Trigonal Pyramidal Tetrahedral	Yes No
CS ₂	$\ddot{\text{S}}=\text{C}=\ddot{\text{S}}$	Linear Bent Trigonal Planar Trigonal Pyramidal Tetrahedral	Yes No

16. Balance the following reactions: (12 points)

