

Chemistry 101 Practice Midterm 1

Name _____ SID _____

Name of lab. instructor _____

This exam is closed book/notes. You may have available writing instruments and a calculator.

Check your copy: you should have 7 total pages; 5 questions.

Show how you obtain your answers, so that the grader can give appropriate credit.

Maximum possible is 150 points. Each question is worth 30 points.

Information that may be useful:

$N_A = 6.022 \times 10^{23} / \text{mol}$; V of a sphere of radius $r = \frac{4\pi r^3}{3}$; V of a rectangular prism of width w , height h and length $l = whl$; uranium has a density of 19.1 g/cm^3 , and iron 7.86 g/cm^3 .

Significant figures figure significantly in your grade.

1.1 Which has the greater mass: a sphere of uranium of radius 3.00 cm or an iron bar of square cross section, 2.0 cm on each side and 60.0 cm long? Give the mass of each object in kg to the correct number of significant figures.

1.2 How many atoms of U are present in the sphere in 1.1?

2.1 Determine the numbers of protons and neutrons in the nucleus of each of the following isotopes:

a) Sr-90

b) B-11

c) Pt-195

2.2 Describe, in standard English prose, ONE of the following experiments:

Millikan's experiment to determine the charge on the electron OR

Rutherford's experiment that demonstrated the structure of the atom

Include a sketch of the equipment, a brief discussion of the principles, and the results and conclusions.

3.1 Calculate the % composition by mass for each element in sodium sulfate decahydrate, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$

3.2 Analysis of an ionic compound of magnesium, boron, and oxygen showed that it contains 38.3% Mg, 11.3% B, and 50.4% O. Determine the formula of this compound. Explain whether your answer is an empirical or a molecular formula.

3.3 Magnesium is the positive ion in the compound in 3. 2; how many electrons are present in the most likely positive magnesium ion in this compound?

4. Multiple choice. Circle the letter(s) of the best answer(s) to each part.

4.1 Which of the following is the most correct in regards to the mass spectrometer experiment?

- a. A mass spectrometer provides evidence of the existence of the proton.
- b. A mass spectrometer provides evidence of the existence of the electron.
- c. A mass spectrometer provides evidence for the existence of different isotopes.
- d. A mass spectrometer provides evidence that different atoms of the same element have different atomic numbers.
- e. Both c and d are correct.

4.2 Assume that only two isotopes of argon, Ar-38 and Ar-40, exist in nature. If this were true, the atomic weight of argon would fall most closely within which range?

- a. 38-40 amu
- b. 56-58 amu
- c. 18-38.5 amu
- d. 18-40 amu
- e. 18-58 amu

4.3 How many grams of magnesium (Mg) contain the same number of atoms as 20 g of neon (Ne)?

- a. 20 g
- b. 24 g
- c. 48 g
- d. 12 g
- e. 16 g

4.4 Which element can be classified as a transition metal?

- a. C
- b. Xe
- c. Cs
- d. O
- e. Ni

4.5 The chemical compound $(\text{CH}_3\text{O})_2\text{CH}_2$ can also be represented as:

- a. $\text{C}_3\text{H}_5\text{O}$.
- b. $\text{C}_3\text{H}_8\text{O}$.
- c. $\text{C}_3\text{H}_8\text{O}_2$.
- d. $\text{C}_2\text{H}_8\text{O}_2$.
- e. $\text{C}_2\text{H}_5\text{O}_2$.

5. Multiple choice. Circle the letter(s) of the best answer(s) to each part.

5.1 Which of the following are constitutional isomers?

- a. CH_2O and $\text{C}_6\text{H}_{12}\text{O}_6$
- b. C_3H_8 and $\text{CH}_3\text{CH}_2\text{CH}_3$
- c. $\text{C}_2\text{H}_5\text{OH}$ and CH_3OCH_3
- d. C_2H_4 and C_2H_6
- e. $\text{C}_6\text{H}_5\text{OH}$ and $\text{C}_6\text{H}_4(\text{OH})_2$

5.2 Which of the following is least likely to be an ionic compound?

- a. MgCl_2
- b. NaOH
- c. NaF
- d. FCl_3
- e. CaO

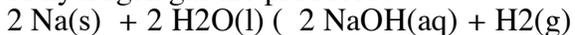
5.3 Give the formula for the ionic compound that forms between magnesium and nitrogen.

- a. MgN
- b. MgN_2
- c. Mg_2N
- d. Mg_3N_2
- e. Mg_3N

5.4 Caffeine has the empirical formula $\text{C}_4\text{H}_5\text{N}_2\text{O}$ and an approximate molecular weight of 97.1 g/mol. What is its molecular formula?

- a. $\text{C}_4\text{H}_5\text{N}_2\text{O}$
- b. $\text{C}_2\text{H}_2\text{NO}$
- c. $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$
- d. $\text{C}_4\text{H}_4\text{N}_4\text{O}_4$
- e. $\text{C}_2\text{H}_2\text{N}_2\text{O}_2$

5.5 In the reaction given below, how many grams of sodium metal are consumed if 2.02 g of hydrogen gas are produced?



- a. 92.0 g
- b. 5.75 g
- c. 11.5 g
- d. 23.0 g
- e. 46.0 g