Polytechnic Tutoring Center

Midterm I REVIEW – CM 1013, Fall 2021

Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.

Multiple-Choice Problems:

1. A flask has a mass of 62.90 g when empty and 578.30 g when filled with water. When the same flask is filled with concentrated sulfuric acid, H_2SO_4, its mass is 1011.24 g. What is the density of concentrated sulfuric acid? (Assume water has a density of 1.000 g/cm^3)
A) 1.479 g/mL
B) 1.840 g/mL
C) 1.749 g/mL
D) 1.962 g/mL

2. How many grams of oxygen (O_2) are required to react with calcium (Ca) to produce 102.0 g of calcium oxide?
A) 357.5 g
B) 204.0 g
C) 29.1 g
D) 58.2 g

3. What is the percent mass of iron in $Fe_4[Fe(CN)_6]_3$?
A) 45% Fe
B) 26% Fe
C) 33% Fe
D) 58% Fe

4. An average atom of uranium (U) is approximately how many times heavier than an atom of potassium (K)?
A) 2.4 times
B) 6.1 times
C) 7.7 times
D) 12.5 times

5. Which set of elements below contains, respectively, an alkali metal, a halogen, and a transition metal?
A) Rb, Br, Ag
B) H, F, V
C) Li, S, Fe
D) Ca, Kr, Mn

6. Which of these pairs of elements would most likely form an ionic compound?
A) Cu and K
B) Al and Rb
C) At and K
D) P and Br

7. How many protons, neutrons, and electrons are there in an atom of potassium-40?
A) 19 protons, 21, neutrons, and 19 electrons
B) 40 protons, 19 neutrons, and 40 electrons
C) 21 protons, 19 neutrons, and 19 electrons
D) 19 protons, 21 neutrons, and 40 electrons

8. One mole of H_2
A) contains 6.022×10^{23} H atoms because the atomic weight is 1g/ mole H
B) contains 6.022×10^{23} H_2 molecules
C) contains 1 g of H_2 by definition
D) is equivalent to 6.022×10^{23} amu per reaction

9. What are the correct coefficients for the reaction below?
$\_PCl_3 + \_H_2O \rightarrow \_H_3PO_3 + \_HCl$
A) 1, 3, 1, 1
B) 1, 3, 1, 3
C) 1, 1, 1, 3
D) 2, 3, 2, 3

10. What is the correct chemical name of $CoCl_3$?
A) cobaltous chloride
B) cobalt trichloride
C) cobalt(III) chloride
D) cobalt(III) trichloride

11. What is the correct chemical formula of chromium(III) nitrite?
A) $Cr(NO_2)_3$
B) $CrNO_3$
C) $Cr_3(NO_2)_2$
D) $Cr(NO_3)_3$

12. Assume that magnesium consists of three isotopes having the abundances and masses given below. According to the data, what is the average atomic mass of magnesium?

Isotope	**Abundance**	**Mass**
^{24}Mg	78.70%	23.985 amu
^{25}Mg	10.13%	24.986 amu
^{26}Mg	11.17%	25.983 amu

A) 25.00 amu
B) 24.62 amu
C) 24.74 amu
D) 24.31 amu

13. When comparing a 10.00 g sample of iron with a 10.00 g sample of lead:
A) there are more lead atoms than iron atoms because lead is heavier
B) it is not possible to tell which sample contains more atoms without knowing density
C) each sample has the same number of atoms because the atomic radii and similar
D) there are more iron atoms than lead atoms

14. Which of the following is an example of a physical property?
A) Polymerization of DNA creates a double helix shape
B) Proteins are synthesized by ribosomes in plants and transport macromolecules.
C) Water corrodes an iron tank and changes color to orange
D) Lithium battery explodes when punctured
E) Heated water turns into steam at 100C, but condenses again at high pressure

15. Which of the following is an extensive property?
A) Average atomic radii of an ideal gas
B) Melting and freezing points at two different pressures
C) Mass of chemical sample at 1atm
D) Heat capacity of 5M NaCl

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Short Answer Problems:

1. A compound composed of hydrogen and carbon contains 85.7% C and 14.3% H, and has a molar mass of 84 g/mol. What is the empirical formula and molecular formula of the compound?

2. Iron (Fe) can be produced by the following reaction:

$Fe_3O_4(s) + 2C(s) \rightarrow 2CO_2(g) + 3Fe(s)$

What is the percent yield of Fe if 950 g of Fe_3O_4 were used and 533 g of Fe were isolated from the reaction mixture?

3. How many potassium (K) atoms are present in 57.7 mg of K_2MnF_6?