Sample

CHEM 1A Winter 2021: Sample Midterm #1

Lecturer: Prof. Fokwa

January 28, 2021

Time: 1 h

Please note: This test has a total of 125 points (Part I) and 5 pts bonus question (Part II). The test covers chapters 1, 2 and 3.

Allowed for the test are: Scantron, pencil, eraser and non-graphing scientific calculator

Part I: Multiple Choices (5 pts each; 125 pts in total)

____ 1. ^{1}H, ^{2}H, and ^{3}H are examples of _____ because they have different numbers of _____.
   a. isotopes; protons
   b. isotopes; neutrons
   c. isotopes; electrons
   d. allotropes; neutrons
   e. allotropes; protons

____ 2. Molecules are represented in various ways. Which statement A–D about molecular representations is *not* correct.
   a. A molecular or chemical formula identifies the elements and the number of atoms of each that comprise a molecule of a compound.
   b. A structural formula shows how the atoms are bonded together but does not necessarily indicate the bond angles or three-dimensional shape of the molecule.
   c. A ball-and-stick model shows bond angles and the three-dimensional shape of a molecule.
   d. A space-filling model best represents the size of the atoms and distribution of electrons in a molecule.
   e. Statements A–D all are correct.

____ 3. Which of the following processes is a chemical reaction?
   a. distillation
   b. combustion
   c. filtration
   d. condensation
   e. sublimation

____ 4. Identify the binary compound that has ionic bonding.
   a. H_2O
   b. NO
   c. LiF
   d. CH_4
   e. CF_4

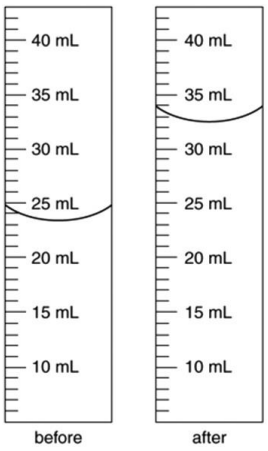
____ 5. Which of the following mixtures can be separated by filtration?
   a. sugar dissolved in coffee
   b. sand and water
   c. gasoline
   d. alcohol dissolved in water
   e. air

____ 6. Cheetahs can run at speeds of up to 60 mi per hour. How many seconds does it take a cheetah to run 10 m at this speed? (1 mi = 1.609 km)
   a. 0.37 s
   b. 0.10 s
   c. 56 s
   d. 18 s
   e. 0.43 s

____ 7. Which of the following is *not* a pure substance?

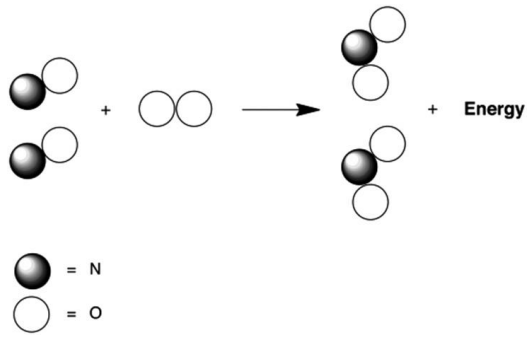
a. Air
b. nitrogen gas
c. oxygen gas
d. argon gas
e. table salt (sodium chloride)

____ 8. An irregularly shaped metal object with a mass of 25.43 g was placed in a graduated cylinder with water. The before and after volumes are shown below. What is the density of the metal?



a. 2.8 g/cm^3
b. 2.906 g/cm^3
c. 0.782 g/cm^3
d. 0.344 g/cm^3
e. 2.734 g/cm^3

____ 9. Which statement A–D about the reaction of nitrogen monoxide with oxygen, which is called combustion and is represented below by the following cartoon, is *not* correct? The reaction product is nitrogen dioxide.



a. Two molecules of nitrogen monoxide combine with one molecule of oxygen.
b. Two atoms of nitrogen combine with four atoms of oxygen to produce two molecules of nitrogen dioxide.
c. The equation is balanced because the number of atoms of each element does not change.
d. The products are two molecules of nitrogen dioxide and released energy.
e. Statements A–D all are correct.

____ 10. Which one of the following statements is *not* correct?

a. Sodium and chlorine are elements.
b. Sodium chloride (table salt) is a compound.
c. Sodium chloride is a pure substance.
d. Sodium chloride is a heterogeneous mixture.
e. Sodium chloride added to water forms a solution.

____ 11. What is the symbol of the ion having 12 protons and 10 electrons?

a. Mg^{2+}
b. Al^{3+}
c. Mg^{2-}
d. Na^{2+}
e. Mg

____ 12. The two major isotopes of bromine are ^{79}Br and ^{81}Br. Assume that the masses of the ^{79}Br and ^{81}Br isotopes are 79.00 u and 81.00 u, respectively. The weighted average atomic mass of bromine is 79.90 u. What are the relative % abundances of each isotope? Estimate without detailed calculations!

Choice	% Abundance of ^{79}Br	% Abundance of ^{81}Br
A	79.0%	21.0%
B	19.0%	81.0%
C	35.1%	64.9%
D	55.0%	45.0%
E	47.0%	53.0%

a. Choice A
b. Choice B
c. Choice C
d. Choice D
e. Choice E

____ 13. Which one of the following statements is *not* consistent with Dalton's atomic view of matter?

a. Atoms of one element can be converted into atoms of another element.
b. Each element is composed of atoms that are identical in size, mass, and chemical properties.
c. Compounds are formed from different atoms in simple whole number ratios.
d. Atoms of different elements can combine in several different proportions to make different compounds.
e. Matter is discrete, as proposed by Democritus.

____ 14. Which statement A–D regarding the terms mole and molar mass is *not* correct?

a. A mole is defined as the number of particles in exactly 12 g of carbon-12.
b. A mole of oxygen gas contains 6.022×10^{23} molecules.
c. Two moles of oxygen atoms can be obtained by decomposing one mole of carbon dioxide.
d. To obtain the molar mass in grams (g/mol) from the atomic mass in atomic mass units(u), multiply by 6.022×10^{23}/mol and divide by 6.022×10^{23} u/g.
e. Statements A–D all are correct.

____ 15. How many moles of ammonia are there in a 346 g sample of pure NH_3 (17.03 g/mol)?

a. 0.0496 mol
b. 20.3 mol
c. 24.7 mol
d. 5,930 mol
e. 3.46 mol

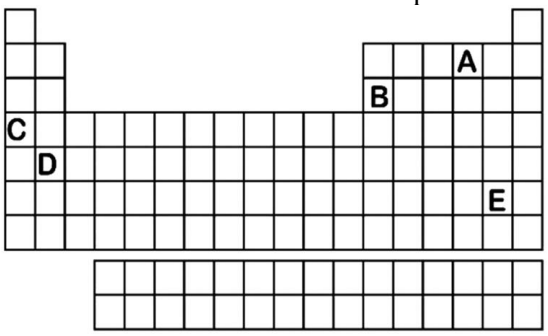
____ 16. How many atoms of each element are there in the compound $Na_3(PO_4)_3$?

a. sodium 3, phosphorus 3, oxygen 12
b. sodium 9, phosphorus 3, oxygen 12
c. sodium 3, phosphorus 1, oxygen 4
d. sodium 3, potassium 1, oxygen 4

____ 17. Based on the element's position in the periodic table, which statement below is *not* correct?
a. The charge on an ion of sodium is 1+.
b. The charge on an ion of magnesium is 2+.
c. The charge on an ion of oxygen is 2−.
d. The charge on an ion of chlorine is 1−.
e. Mg^{2+} has more electrons than Ne.

____ 18. Based on its position in the periodic table, which atom would you predict to form an ionic compound with two bromine atoms?
a. sodium
b. aluminum
c. lithium
d. calcium
e. carbon

____ 19. Which element labeled A–E in the periodic table below will have an ionic charge of –2?



a. A
b. B
c. C
d. D
e. E

____ 20. Which of the following elements would you expect to have the greatest first ionization energy?
a. Si
b. S
c. Na
d. Mg
e. Al

____ 21. Calculate the mass, in grams, of 10 copper atoms.
a. 63.55 g
b. 1.055×10^{-21} g
c. 635.5 g
d. 3.827×10^{26} g
e. 1.827×10^{26} g

____ 22. What is the wavelength of a photon emitted by a Kr^{+} laser with an energy of 3.07×10^{-19} J?
a. $\lambda = 224$ nm
b. $\lambda = 389$ nm
c. $\lambda = 417$ nm
d. $\lambda = 647$ nm
e. $\lambda = 534$ nm

____ 23. What is the photon energy of the yellow-orange light ($\lambda = 589$ nm) produced by sodium vapor streetlights?
a. 3.37×10^{-19} J
b. 6.63×10^{-18} J
c. 2.99×10^{-20} J
d. 1.45×10^{-17} J
e. 7.45×10^{-16} J

____ 24. What is the wavelength (λ, in m) of a radio station operating at a frequency of 99.6 MHz?

a. 3.01×10^{6} m
b. 3.01 m
c. 3.32×10^{-7} m
d. 0.332 m
e. 3.32 m

____ 25. Which of these regions of the electromagnetic spectrum has the longest wavelength?

a. Visible
b. Infrared
c. Gamma rays
d. Ultraviolet
e. X-rays

Part II: Bonus Question (5 pts)

____ 26. How many C atoms are in 56.10 grams of C_2H_4?

a. 2
b. 2.408×10^{24}
c. 6.022×10^{23}
d. 1.204×10^{24}
e. 2×10^{23}