CHM151 Exam 1 100 Pts Fall 2007 Name: Key

The people sitting on either side of you must have a DIFFERENT COLORED exam than you. Be sure to write your name on BOTH your EXAM and your GREEN SCANTRON. You may write on the exam but must transfer your answers to your green scrantron and must WRITE THE EXAM COLOR ON THE GREEN SCANTRON..

1. Which of the following elements are the least reactive?

   A. alkali metals
   B. noble gases
   C. halogens
   D. alkaline earth metals
   E. metalloids

2. Select the answer with the correct number of decimal places for the following sum:

$$13.914\ cm + 243.1\ cm + 12.00460\ cm =$$

   A. 269.01860 cm
   B. 269.0186 cm
   C. 269.019 cm
   D. 269.02 cm
   E. 269.0 cm

   ↑ place

3. Aluminum oxide, Al_2O_3, is used as a filler for paints and varnishes as well as in the manufacture of electrical insulators. Calculate the number of moles in 47.51 g of Al_2O_3.

   A. 2.377 mol
   B. 2.146 mol
   C. 1.105 mol
   D. 0.4660 mol
   E. 0.4207 mol

$$\frac{47.51\,g \mid mol}{101.96\,g} = 0.46596$$

4. Balance the following equation for the combustion of benzene:

$$2C_6H_6(l) + 15O_2(g) \rightarrow 6H_2O(g) + 12CO_2(g)$$

   A. $C_6H_6(l) + 9O_2(g) \rightarrow 3H_2O(g) + 6CO_2(g)$
   B. $C_6H_6(l) + 9O_2(g) \rightarrow 6H_2O(g) + 6CO_2(g)$
   C. $2C_6H_6(l) + 15O_2(g) \rightarrow 6H_2O(g) + 12CO_2(g)$
   D. $C_6H_6(l) + 15O_2(g) \rightarrow 3H_2O(g) + 6CO_2(g)$
   E. $2C_6H_6(l) + 9O_2(g) \rightarrow 6H_2O(g) + 12CO_2(g)$

5. Bromine is the only nonmetal that is a liquid at room temperature. Consider the isotope bromine-81, $^{81}_{35}Br$. Select the combination which lists the correct atomic number, neutron number, and mass number, respectively.

   A. 35, 46, 81
   B. 35, 81, 46
   C. 81, 46, 35
   D. 46, 81, 35
   E. 35, 81, 116

35 81 − 35 = 46 81

Key

6. Which of the following is the empirical formula for hexane, C_6H_{14}?

A. $C_{12}H_{28}$
B. C_6H_{14}
C. C_3H_7
D. $CH_{2.3}$
E. $C_{0.43}H$

7. Gadolinium oxide, a colorless powder which absorbs carbon dioxide from the air, contains 86.76 mass % Gd. Determine its empirical formula.

A. Gd_2O_3
B. Gd_3O_2
C. Gd_3O_4
D. Gd_4O_3
E. GdO

Gd: $\frac{86.75\text{g}}{157.3} = 0.5515 \div 0.5515 = 1 \times 2$

O: $\frac{13.24\text{g}}{16.00} = 0.8275 \div 0.5515 = 1.5$

8. The speed needed to escape the pull of Earth's gravity is 11.3 km/s. What is this speed in mi/h?

A. 65,500 mi/h
B. 25,300 mi/h
C. 18,200 mi/h
D. 1,090 mi/h
E. 5.02×10^{-3} mi/h

$\frac{11.3 \times 10^3 \text{ m}}{1\text{ s}} \left| \frac{3600\text{ s}}{1\text{ h}} \right| \frac{\text{km}}{2.54 \times 10^{-2}\text{ m}} \left| \frac{1\text{ ft}}{12\text{ in}} \right| \frac{\text{mi}}{5280\text{ ft}}$

9. Aluminum oxide (used as an adsorbent or a catalyst for organic reactions) forms when aluminum reacts with oxygen.

$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

82.49g 117.65g ?g

A mixture of 82.49 g of aluminum ($\mathcal{M}$ = 26.98 g/mol) and 117.65 g of oxygen ($\mathcal{M}$ = 32.00 g/mol) is allowed to react. What mass of aluminum oxide ($\mathcal{M}$ = 101.96 g/mol) can be formed?

A. 155.8 g
B. 200.2 g
C. 249.9 g
D. 311.7 g
E. 374.9 g

Based on Al: $\frac{82.49\text{g Al}}{26.98\text{g Al}} \left| \frac{2\text{ mol } Al_2O_3}{4\text{ mol Al}} \right| \frac{101.96\text{g}}{1\text{ mol}} = 155.9\text{g } Al_2O_3$

Based on O_2: $\frac{117.65\text{g } O_2}{32.00\text{g}} \left| \frac{2\text{ mol } Al_2O_3}{3\text{ mol } O_2} \right| \frac{101.96\text{g}}{1\text{ mol}} = 249.9\text{g } Al_2O_3$

10. Which of the following represents the largest volume?

A. 10,000 µL
B. 1000 pL
C. 100 mL
D. 10 nL
E. 10 cm^3

$10{,}000 \times 10^{-6}\text{ L} = 1 \times 10^{-2}$
$1000 \times 10^{-12}\text{ L} = 1 \times 10^{-9}$
$100 \times 10^{-3}\text{ L} = 1 \times 10^{-1}$
$10 \times 10^{-9}\text{ L} = 1 \times 10^{-8}$
$10 \times 10^{-3}\text{ L}$ (10 mL) $= 1 \times 10^{-4}$

11. Sodium oxide combines violently with water. Which of the following gives the formula and the bonding for sodium oxide?

A. NaO, ionic compound
B. NaO, covalent compound
C. Na_2O, ionic compound
D. Na_2O, covalent compound
E. Na_2O_2, ionic compound

$Na^+_2\ O^{2-}_1$

Ionic (metal - nonmetal)

Key

12. Which of the following ions occurs commonly?

A. P^{3+}
B. Br^{7+}
C. O^{6+}
D. Ca^{2+}
E. K^-

13. Calculate the number of oxygen atoms in 29.34 g of sodium sulfate, Na_2SO_4.

A. 1.244×10^{23} O atoms
B. 4.976×10^{23} O atoms
C. 2.409×10^{24} O atoms
D. 2.915×10^{24} O atoms
E. 1.166×10^{25} O atoms

$$29.34\,g \left| \frac{mol\ Na_2SO_4}{142.05\,g} \right| \frac{4\,O_x}{1\,Na_2SO_4} \left| \frac{6.02\times10^{23}}{mol} \right.$$

14. Ammonia, an important source of fixed nitrogen that can be metabolized by plants, is produced using the Haber process in which nitrogen and hydrogen combine.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

?g 325g

How many grams of nitrogen are needed to produce 325 grams of ammonia?

A. 1070 g
B. 535 g
C. 267 g
D. 178 g
E. 108 g

$$325\,g\,NH_3 \left| \frac{mol}{17.034\,g} \right| \frac{1\,mol\,N_2}{2\,mol\,NH_3} \left| \frac{28.02\,g}{mol} \right. = g\,N_2$$

15. Select the answer that expresses the result of this calculation with the correct number of significant figures and with correct units.

4 Sig Figs

$$16.18\,cm \times 9.6114\,g \div 1.4783\,cm^2 =$$

A. 105.2 g/cm^3
B. 105.2 g/cm^2
C. 105.2 g/cm
D. 72.13 g/cm^2
E. 72.13 g/cm

$$\frac{cm \cdot g}{cm^2} =$$

16. Select the best statement.

A. Physical changes may be reversed by changing the temperature.
B. Physical changes alter the composition of the substances involved.
C. Physical properties are not valid characteristics for identifying a substance.
D. Physical properties are mostly extensive in nature.
E. Physical changes are usually accompanied by chemical changes.

Key

17. A dose of medication was prescribed to be 35 microliters. Which of the following expresses that volume in centiliters?

A. 3.5×10^{5} cL
B. 3.5×10^{4} cL
C. 3.5 cL
D. 3.5×10^{-4} cL
E. 3.5×10^{-3} cL

$35 \times 10^{-6}\ L \mid \frac{C}{10^{-2}} = cL$

18. Kaolinite, a clay mineral with the formula $Al_4Si_4O_{10}(OH)_8$, is used as a filler in slick-paper for magazines and as a raw material for ceramics. Analysis shows that 14.35 g of kaolinite contains 8.009 g of oxygen. Calculate the mass percent of oxygen in kaolinite.

A. 1.792 mass %
B. 24.80 mass %
C. 30.81 mass %
D. 34.12 mass %
E. 55.81 mass %

$\frac{8.009\ g}{14.35\ g} \times 100 =$

19. The distance between carbon atoms in ethylene is 134 picometers. Which of the following expresses that distance in meters?

A. 1.34×10^{-13} m
B. 1.34×10^{-12} m
C. 1.34×10^{-10} m
D. 1.34×10^{-7} m
E. 1.34×10^{-6} m

$134 \times 10^{-12}\ m =$

20. Magnesium fluoride is used in the ceramics and glass industry. What is the mass of 1.72 mol of magnesium fluoride?

A. 43.3 g
B. 62.3 g
C. 74.5 g
D. 92.9 g
E. 107 g

$1.72\ \cancel{mol} \mid \frac{62.3\ g}{\cancel{mol}} = g$

21. The mass of a sample is 550 milligrams. Which of the following expresses that mass in kilograms?

A. 5.5×10^{8} kg
B. 5.5×10^{5} kg
C. 5.5×10^{-4} kg
D. 5.5×10^{-6} kg
E. 5.5×10^{-1} kg

$550 \times 10^{-3}\ g \mid \frac{k}{10^{3}} = kg$

****More questions on the next page (25 total)****

Key

22. Which of the following is a chemical change?

A. boiling of water
B. melting wax
C. broiling a steak on a grill
D. condensing water vapor into rainfall
E. carving a piece of wood

23. Calculate the molar mass of $Ca(BO_2)_2 \cdot 6H_2O$.

A. 273.87 g/mol
B. 233.79 g/mol
C. 183.79 g/mol
D. 174.89 g/mol
E. 143.71 g/mol

24. Household sugar, sucrose, has the molecular formula $C_{12}H_{22}O_{11}$. What is the % of carbon in sucrose, by mass?

A. 26.7 %
B. 33.3 %
C. 41.4 %
D. 42.1 %
E. 52.8 %

$\frac{144.12}{342.29} \times 100 =$ molar mass

25. Determine the molecular mass of iron (III) bromide hexahydrate, a substance used as a catalyst in organic reactions.

A. 403.65 amu
B. 355.54 amu
C. 317.61 amu
D. 313.57 amu
E. 295.56 amu

$FeBr_3 \cdot 6H_2O$