



CHM 151 EXAM 1 FALL 2004 100 PTS NAME: Key

1. An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons?  
(p = proton, n = neutron, e = electron)

- A. 15 p, 16 n, 15 e
- B. 16 p, 15 n, 16 e
- C. 16 p, 31 n, 16 e
- D. 32 p, 31 n, 32 e
- E. 16 p, 16 n, 15 e

$$\text{S } 16p^+ 16e^-$$

$$31 - 16 = 15n$$

2. Convert 500 milliliters to quarts. Given 1L = 1.06 qt.

- A. 1.88 qt
- B. 0.47 qt
- C. 0.53 qt
- D.  $4.7 \times 10^5$  qt
- E.  $5.3 \times 10^5$  qt

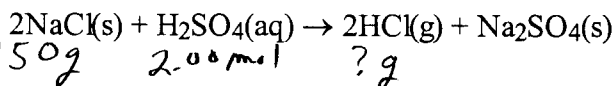
$$\frac{500 \text{ mL} \times 10^{-3} \text{ L}}{1 \text{ L}} \times \frac{1.06 \text{ qt}}{1 \text{ L}} = 0.53 \text{ qt}$$

3. How many moles of oxygen atoms are there in 10 moles of  $\text{KClO}_3$ ?

- A. 3 mol
- B. 3.3 mol
- C. 10 mol
- D. 30 mol
- E.  $6.02 \times 10^{24}$  mol

$$\frac{10 \text{ mol } \text{KClO}_3 \times 3 \text{ mol O}}{1 \text{ mol } \text{KClO}_3} = 30 \text{ mol O}$$

4. Hydrochloric acid can be prepared by the following reaction:

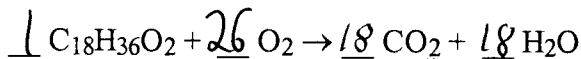


150g      2.00 mol      ? g

How many grams of HCl can be prepared from 2.00 mol  $\text{H}_2\text{SO}_4$  and 150 g NaCl?

- A. 7.30 g
- B. 93.5 g
- C. 146 g
- D. 150 g
- E. 196 g

5. What is the coefficient preceding  $\text{O}_2$  when the following combustion reaction of a fatty acid is properly balanced?



- A. 1
- B. 8
- C. 9
- D. 26
- E. 27

Based on NaCl

$$\frac{150 \text{ g NaCl} \times \frac{1 \text{ mol}}{58.45 \text{ g}} \times 2 \text{ mol HCl} \times 36.458 \text{ g}}{2 \text{ mol NaCl}} = 93.56 \text{ g HCl}$$

Based on  $\text{H}_2\text{SO}_4$

$$\frac{2.00 \text{ mol } \text{H}_2\text{SO}_4 \times 2 \text{ mol HCl} \times 36.458 \text{ g}}{1 \text{ mol } \text{H}_2\text{SO}_4} = 145.8 \text{ g HCl}$$

6. An oxide ion,  $O^{2-}$ , has:

- A. 8 protons and 10 electrons
- B. 10 protons and 8 electrons
- C. 8 protons and 9 electrons
- D. 8 protons and 7 electrons
- E. 10 protons and 7 electrons

gained  $2 e^-s$

7. Which of the following elements is most likely to be a good conductor of electricity?

- A. N
- B. S
- C. He
- D. Cl
- E. Fe metal

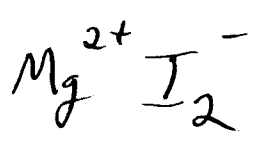
8. The mass of  $1.63 \times 10^{21}$  silicon atoms is

- A.  $2.71 \times 10^{-23}$
- B.  $4.58 \times 10^{22}$  g.
- C. 28.08 g.
- D.  $1.04 \times 10^4$  g.
- E.  $7.60 \times 10^{-2}$  g.

$$\frac{1.63 \times 10^{21} \text{ Si atoms}}{6.02 \times 10^{23} \text{ atoms/mol}} \times 28.09 \frac{\text{g}}{\text{mol}} = \text{g}$$

9. What is the formula for the ionic compound formed by magnesium and iodine?

- A. MgI
- B. Mg<sub>2</sub>I
- C. MgI<sub>2</sub>
- D. MgI<sub>3</sub>
- E. Mg<sub>3</sub>I

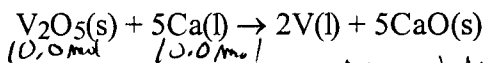


10. If 0.274 moles of a substance weighs 62.5 g, what is the molar mass of the substance, in units of g/mol?

- A.  $2.28 \times 10^2$  g/mol
- B.  $1.71 \times 10^1$  g/mol
- C.  $4.38 \times 10^{-3}$  g/mol
- D.  $2.17 \times 10^2$  g/mol
- E. none of these

$$\frac{62.5 \text{ g}}{0.274 \text{ mol}} = \frac{\text{g}}{\text{mol}}$$

11. Vanadium (V) oxide reacts with calcium according to the chemical equation below. When 10.0 mole of  $V_2O_5$  are mixed with 10.0 mole of Ca, which is the limiting reagent?



- A.  $V_2O_5$   
 B. Ca  
 C. V  
 D. CaO  
 E. Neither reagent is limiting.

$$\frac{10 \text{ mol } V_2O_5}{1 \text{ mol } V_2O_5} \bigg| \frac{5 \text{ mol Ca}}{5 \text{ mol Ca}} = 50 \text{ mol Ca}$$

12. Which pair of elements would be most likely to form an ionic compound?

- A. P and Br  
 B. Zn and K  
 C. F and Al  
 D. C and S  
 E. Al and Rb

non metal + metal

13. Which one of the following represents a physical change?

- A. lard, when heated, changes to liquid  
 B. bleach turns hair yellow  
 C. sugar, when heated, becomes brown  
 D. milk turns sour  
 E. battery cables corrode

14. Which of the following samples contains the greatest number of atoms?

- A. 100 g of Pb  
 B. 2.0 mole of Ar  
 C. 0.1 mole of Fe  
 D. 5 g of He  
 E. 20 million  $O_2$  molecules

$$\frac{100 \text{ g Pb}}{207.2 \text{ g/mol}} = 0.483 \text{ mol Pb}$$

$$\frac{5 \text{ g He}}{4 \text{ g/mol}} = 1.25 \text{ mol He}$$

much less than one mole

15. How many moles of  $CF_4$  are there in 171 g of  $CF_4$ ?

- A. 0.51 mol  
 B. 1.94 mol  
 C. 4.07 mol  
 D. 88.0 mol  
 E. 171 mol

$$\frac{171 \text{ g } CF_4}{88.01 \text{ g/mol}} = 1.94 \text{ mol}$$

16. The elements in a column of the periodic table are known as
- A. metalloids.
  - B. a period.
  - C. noble gases.
  - D. a group.
  - E. nonmetals.
17. Do the indicated arithmetic and give the answer to the correct number of significant figures.

$$(1.5 \times 10^{-4} \times 61.3) + 2.01 =$$

- A. 2.0192
- B. 2.0
- C. 2.019
- D. 2.02
- E. 2.019195

$$\begin{array}{r} 0.009195 \\ + 2.01 \\ \hline 2.019195 \end{array}$$

18. Balance the equation using the smallest set of whole numbers. What is the coefficient for H<sub>2</sub>O?



- A. 1
  - B. 2
  - C. 3
  - D. 5
  - E. none of these
19. Iron has a density of 7.86 g/cm<sup>3</sup>. The volume occupied by 55.85 g of iron is

- A. 0.141 cm<sup>3</sup>
- B. 7.11 cm<sup>3</sup>
- C. 2.8 cm<sup>3</sup>
- D. 439 cm<sup>3</sup>
- E. None of the above.

$$\frac{55.85 \text{ g}}{7.86 \text{ g/cm}^3} = 7.106 \text{ cm}^3$$

20. Which one of the following does not represent 1.00 mol of the indicated substance?

- A.  $6.02 \times 10^{23}$  C atoms
- B. 26.0 g Fe
- C. 12.01 g C
- D. 65.38 g Zn
- E.  $6.02 \times 10^{23}$  Fe atoms

21. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound?

- A. C<sub>10</sub>H<sub>6</sub>O    B. C<sub>9</sub>H<sub>18</sub>O    C. C<sub>16</sub>H<sub>28</sub>O<sub>4</sub>    D. C<sub>20</sub>H<sub>12</sub>O<sub>2</sub>    E. C<sub>18</sub>H<sub>36</sub>O<sub>2</sub>

22. 6.0 km is how many micrometers?

- A. 6.0 × 10<sup>6</sup> m  
 B. 1.7 × 10<sup>-7</sup> m  
 C. 6.0 × 10<sup>9</sup> m  
 D. 1.7 × 10<sup>-4</sup> m  
 E. 6.0 × 10<sup>3</sup> μm

$$\frac{6.0 \times 10^3 \text{ m}}{10^{-6}} =$$

C:  $\frac{76.0 \text{ g/mol}}{12.01 \text{ g}} = 6.33 \div 0.7 = 9$  (Emp/M<sub>4</sub>: 142.23)

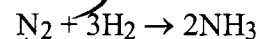
H:  $\frac{12.8 \text{ g/mol}}{1.01 \text{ g}} = 12.67 \div 0.7 = 18$  (x)

O:  $\frac{11.2 \text{ g/mol}}{16.0 \text{ g}} = 0.7 \div 0.7 = 1$  (2)

(284.5)

23. What is the maximum number of grams of ammonia, NH<sub>3</sub>, that can be obtained from the reaction of 10.0 g of H<sub>2</sub> and 80.0 g of N<sub>2</sub>?

- A. 28.4 g    B. 48.6 g    C. 56.7 g    D. 90.0 g    E. 97.1 g



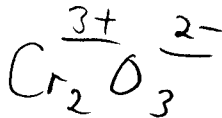
Based on N<sub>2</sub>: 80.0 g N<sub>2</sub>

Based on H<sub>2</sub>: 10.0 g

$$\frac{80.0 \text{ g N}_2}{28.02 \text{ g/mol}} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{17.03 \text{ g NH}_3}{1 \text{ mol NH}_3} = 97.2 \text{ g NH}_3$$

24. The stock system name for Cr<sub>2</sub>O<sub>3</sub> is:

- A. chromium(III) oxide  
 B. dichromium trioxide  
 C. chromium(VI) oxide  
 D. chromium trioxide  
 E. chromium(II) oxide



25. How many significant figures does the result of the following operation contain? 8.52010 × 7.9

- A. 2    B. 3    C. 4    D. 5    E. 6

26. The Hope diamond weighs 44.0 carats. Determine the volume occupied by the diamond, given that its density is 3.5 g/cm<sup>3</sup> at 20°C, and that 1 carat = 0.200 g.

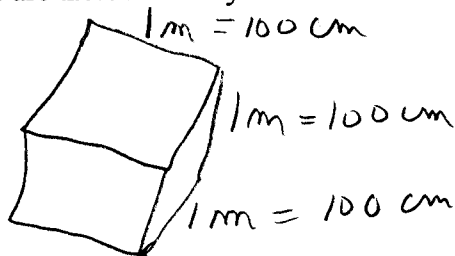
- A. 2.5 cm<sup>3</sup>  
 B. 0.40 cm<sup>3</sup>  
 C. 0.016 cm<sup>3</sup>  
 D. 63 cm<sup>3</sup>  
 E. 150 cm<sup>3</sup>

$$\frac{44.0 \text{ carat}}{1 \text{ carat}} \times \frac{0.200 \text{ g}}{1 \text{ carat}} \times \frac{1 \text{ cm}^3}{3.5 \text{ g}} = 2.5 \text{ cm}^3$$

Based on H<sub>2</sub>:  $\frac{10 \text{ g H}_2}{2.02 \text{ g/mol}} \times \frac{2 \text{ mol NH}_3}{3 \text{ H}_2} \times \frac{17.03 \text{ g NH}_3}{1 \text{ mol NH}_3} = 56.26 \text{ g NH}_3$

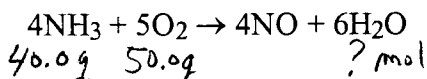
27. How many cubic centimeters are there in exactly one cubic meter?

- A.  $1 \times 10^{-6} \text{ cm}^3$
- B.  $1 \times 10^{-3} \text{ cm}^3$
- C.  $1 \times 10^{-2} \text{ cm}^3$
- D.  $1 \times 10^4 \text{ cm}^3$
- E.  $1 \times 10^6 \text{ cm}^3$



$$(100)^3 \text{ cm}^3 = 10^6 \text{ cm}^3$$

28. Ammonia reacts with diatomic oxygen to form nitric oxide and water vapor:



What is the theoretical yield of water, in moles, when 40.0 g  $\text{NH}_3$  and 50.0 g  $\text{O}_2$  are mixed and allowed to react?

- A. 1.30 mol
- B. 1.57 mol
- C. 1.87 mol
- D. 3.53 mol
- E. None of the above.

$$\frac{40.0 \text{ g NH}_3}{17.03 \text{ g/mol}} \times \frac{6 \text{ mol H}_2\text{O}}{4 \text{ mol NH}_3} = 3.52 \text{ mol H}_2\text{O}$$

$$\frac{50.0 \text{ g O}_2}{32.0 \text{ g/mol}} \times \frac{6 \text{ mol H}_2\text{O}}{5 \text{ mol O}_2} = 1.87 \text{ mol H}_2\text{O}$$

29. Calculate the formula mass of potassium permanganate  $\text{KMnO}_4$ .

- A. 52 amu
- B. 70 amu
- C. 110 amu
- D. 158 amu
- E. 176 amu

$$\begin{array}{r} 4 \times 16 = \\ 1 \times 55 = \\ 1 \times 39 = \\ \hline 158 \end{array}$$

30. Which one of the following represents a chemical change?

- A. boiling water to form steam
- B. bleach turns hair yellow
- C. melting butter
- D. mixing powdered zinc and sulfur at room temperature
- E. cutting a bar of sodium metal into pieces with a knife

*Key*

31. Choose the response that includes all the items listed below that are pure substances.

1. orange juice   2. steam   3. wine   4. carbon dioxide   5. vegetable soup

A. 1, 3, 5

B. 2, 4

C. 1, 3, 4

D. 4 only

E. all of them are pure

32. Atoms of the same element with different mass numbers are called

A. ions.

B. neutrons.

C. allotropes.

D. chemical families.

E. isotopes.

33. How many significant figures are there in 1.3070 g?

A. 6

B. 5

C. 4

D. 3

E. 2