

Chapter 4 Test

Name: KEY
Class: _____
Date: _____

Molar Relationships

Part I

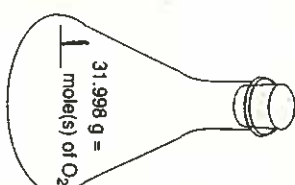
Select the response that best completes each statement or answers each question. Write the letter of each answer in the space provided on the left. Use a periodic table and calculator as necessary.

1. A mole measures C
 - a. mass
 - b. volume
 - c. quantity
 - d. density
2. A mole is the amount of a substance that contains a/c particles.
 - a. 6.02×10^{23}
 - b. 6.02×10^{26}
 - c. 6.02×10^{23}
 - d. 6.02×10^{26}
3. The molar mass for potassium chloride is closest to a
 - a. 74.6 g
 - b. 75.4 g
 - c. 74.6 mol
 - d. 75.4 mol
4. The molar mass for ZnBr₂ is closest to b
 - a. 100 g
 - b. 225.2 g
 - c. 100 mol
 - d. 225.2 mol
5. Which of the following contain equal numbers of atoms? a
 - a. 47.88 g Ti and 65.39 g Zn
 - b. 22 g Ti and 30 g Zn
 - c. 65.39 g Ti and 65.39 g Zn
 - d. 47.88 moles Ti and 65.39 moles Zn
6. Which of the following contain equal numbers of atoms? d
 - a. 78.96 g Se and 78.96 g Sr
 - b. 78.96 g Se and 87.62 g Sr
 - c. 157.92 g Se and 175.24 g Sr
 - d. both b and c
7. For the element aluminum, the number 26.982 represents the c
 - a. atomic mass unit and atomic number
 - b. number of atoms in a mole and the number of grams in a mole
 - c. mass of an atom in amu and the number of grams in a mole
 - d. atomic mass and the molarity of its solution
8. How many moles are in 90 grams of silicon? C
 - a. 0.321 mol
 - b. 2527.74 mol
 - c. 3.21 mol
 - d. 3.21×10^{-3} mol

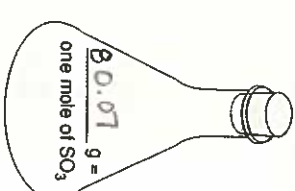
65
80
205

For question 9, fill in the blanks with the missing information.

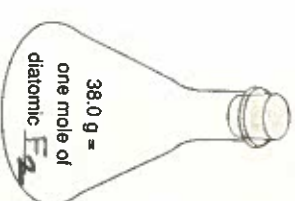
9. Each of the flasks below contains Avogadro's number of molecules of a gaseous element.



a.



b.



c.

Solve these problems. Show your work and circle your answer. Use the periodic table and a calculator as necessary.

10. Find the molar mass for each of the following. Round to the nearest tenth of a gram.

a. oxygen gas $\rightarrow O_2 = 2(16.0 \text{ g/mol}) = 32.0 \text{ g/mol}$

b. $CaCO_3 \rightarrow 40.08 \text{ g/mol} + 12.0 \text{ g/mol} + 3(16.0 \text{ g/mol}) = 100.08 \text{ g/mol}$

11. What is the mass of 2 moles of each of the following compounds? Round to the nearest tenth of a gram.

a. $MgSO_4 \rightarrow 2 \text{ mol } MgSO_4 = 240.38 \text{ g}$

b. $C_2H_6 \rightarrow 2 \text{ mol } C_2H_6 = 60.1 \text{ g}$

c. $Na_2CO_3 \rightarrow 2 \text{ mol } Na_2CO_3 = 187.96 \text{ g}$

12. How many lithium atoms contain the same amount of mass as an iron atom?

$Fe = 55.85 \text{ g/mol}$

$55.85 \text{ g Li} = 1 \text{ mol Li}$
 $6.94 \text{ g Li} = 1 \text{ mol Li}$
 $6.02 \times 10^{23} \text{ atoms Li}$

$= 4.845 \times 10^{24} \text{ atoms Li}$

Use the factor label method as you solve these problems:

13. Calculate the molar mass of each compound.

a. 3 moles of compound A have a mass of 60 grams.

$$\frac{60 \text{ g}}{3 \text{ mol}} = 20 \text{ g/mol}$$

b. 1.50×10^{23} molecules of compound B have a mass of 60 grams.

$$\frac{60 \text{ g}}{1.50 \times 10^{23} \text{ molecules}} = 0.25 \text{ g/mol}$$

c. 3.0 grams of compound C contain 1.5×10^{23} molecules.

$$\frac{3.0 \text{ g}}{1.5 \times 10^{23} \text{ molecules}} = 0.02 \text{ g/mol}$$

14. How many moles of C are in 68 g of carbon?

$$\frac{68 \text{ g}}{12 \text{ g/mol}} = 5.67 \text{ mol}$$

15. How many molecules of KCl are there in 0.63 moles of KCl?

$$0.63 \text{ mol} \times 6.02 \times 10^{23} \text{ molecules/mol} = 3.81 \times 10^{23} \text{ molecules}$$

Critical Thinking

16. Suppose you need to pack 24,000 booklets into 200 boxes. Explain how you would do this without counting on the books. Explain how your method compares with the way moles are used in chemistry.

Part II

Select the response that best completes each statement or answers each question. Write the letter of each answer in the space provided on the left. Use a periodic table and calculator as necessary.

17. _____ is the measure of how much substance a solution contains.

- a. Avogadro's number
b. Molar mass
c. Concentration
d. Volume

18. The concentration of a solution in moles per liter is called its _____.

- a. molar mass
b. molarity
c. volume mass
d. ppm

19. A 5.65 M solution means there are 5.65 moles of KCl in _____ of the solution.

- a. 1 gram
b. 5.65 liters
c. 1 mL
d. 1 L

20. A 10 mL sample of 100 mL of solution A of known molarity has _____.

- a. the same molarity as solution A
b. the same molar mass as solution A
c. 0.1 of the molarity of solution A
d. 0.1 of the molar mass as solution A

21. Fill in the blanks in the table below. Refer to a periodic table if necessary.

Formula	Grams dissolved (g)	Moles dissolved (mol)	Volume (L)	Molarity (M)
a. CaCl_2	11.11 g	0.10	1	0.10
b. KCl	241.7 g	3.24	2.40	1.35

Critical Thinking

22. Explain how to prepare a 2.5 M solution of NaCl.

Put 146.25 g into 1 L volumetric flask and dilute to the line.

Part III

Solve the following problems. Show your work. Use a periodic table and calculator if necessary.

23. Fill in the blanks in the table below. Space is available below the table to show your work.

Compound	Percent Composition	
	Molecular Formula Mass	% Fe % O
a. Fe_2O_3	159.7 g	69.9% 30.1%
b. Fe_3O_4	231.55 g	72.4% 27.6%

24. A compound composed of phosphorus and oxygen is analyzed and found to have 61.94 g P and 80.00 g O. The molecular mass of this compound is 283.87 g. Find the empirical formula and the molecular formula for the compound.

a. What is the empirical formula?

P_2O_5

b. What is the molecular formula?

P_4O_{10}

$$\frac{61.94 \text{ g P}}{30.97 \text{ g/mol}} = \frac{2 \text{ mol P}}{2}$$

$$= 1 \times 2 = 2 \text{ P} \quad 50 = 2.5 \times 2$$