Chemistry 11

Mole Unit Practice Test

Name:
Date:
Block:

D
_____ 1. The number 10.40 has ___ sig figs:
A. 1
B. 2
C. 3
D. 4

A
_____ 2. The number 1200 has ___ sig figs:
A. 2
B. 3
C. 5
D. 6

A
_____ 3. Convert this number to scientific notion: 154000
A. 1.54×10^{5}
B. 1.54×10^{-5}
C. 15.4×10^{4}
D. 154×10^{3}

D
_____ 4. $Cu_4(AsO_3)_2(CH_3CO_2)_2$ has ___ oxygen atoms.
A. 2
B. 3
C. 8
D. 10

C
_____ 5. A student is measuring the molar mass of an object. The unit used would be:
A. mol/g
B. g/L
C. g/mol
D. g

A
_____ 6. A student is reporting the molar concentration of a solution. The unit used would be:
A. mol/L
B. mol/g
C. L/mol
D. g/mol

D
_____ 7. A student is measuring the volume of an object. All of the following units could be used except:
A. L
B. mL
C. cm^3
D. g

A
_____ 8. At the same temperature and pressure, which sample of gas contains the same number of particles as one liter of oxygen, O_2?
A. one liter of He
B. three liters of CO_2
C. two liters of Ne
D. two liters of H_2

A
_____ 9. What is the mass of a single molecule of water?
A. 2.992×10^{-23} grams
B. 1.00 gram
C. 6.022×10^{-22} grams
D. 18.02 grams
E. 2.992×10^{23} grams

Show your work below:

$\frac{18.0\,g}{1\,mol} \times \frac{1\,mol}{6.02 \times 10^{23}\,molecules} = 2.99 \times 10^{-23}\,g/molecule$

A
_____ 10. Another term for molarity is:
A. Concentration
B. Molar mass
C. Molecular formula
D. Moles/gram

C
_____ 11. The percentage of calcium (by mass) in the molecule $Ca_3Fe_2(SiO_4)_3$ is
A. 7.887 %
B. 21.98 %
C. 23.67 %
D. 37.78 %

Show your work below:

MM $Ca_3Fe_2(SiO_4)_3$ = 508.2 g/mol

$$\frac{3(40.1)}{508.2} = 23.67\%$$

A
_____ 12. A molecular formula tells us:
A. The actual number of atoms of each element in a compound
B. The lowest ratio of atoms of each element in a compound
C. All possible multiples of an empirical formula
D. The concentration of that compound in a solution

D
_____ 13. The empirical formula tells us:
A. the actual number of atoms in a compound
B. the concentration of a compound
C. the molar mass of a compound
D. the lowest ratio of each element in a compound

B
_____ 14. A compound has the empirical formula CH_2Cl and a molecular mass of 99.00 g/mol. The molecular formula is:
A. CH_2Cl
B. $C_2H_4Cl_2$
C. $C_3H_6Cl_3$
D. $C_4H_8Cl_4$

A
_____ 15. A compound has the molecular formula C_2H_4. The empirical formula is:
A. CH_2
B. C_2H_5
C. C_5H_{10}
D. $C_{10}H_{20}$

Written:

1. How many atoms are in $Ni(H_2O)_2(NH_3)_3Cl_2$?

21 atoms.

2. The density of $CCl_{4(l)}$ is 1.59 g/mL. How many atoms are there in 2.50 L of CCl_4?

$$2.50\,L \times \frac{1000\,mL}{1\,L} \times \frac{1.59\,g}{1\,mL} \times \frac{1\,mol}{154\,g} \times \frac{6.02\times10^{23}\,molecules}{1\,mol} \times \frac{5\,atoms}{1\,molecule}$$

$$= 7.77\times10^{25}\,atoms$$

3. At STP, 1 mole of argon gas has a volume of 22.4 L.

4. How many molecules of potassium iodide are in 10.0 g of potassium iodide?

$$10.0\,g \times \frac{1\,mol}{166\,g} \times \frac{6.02\times10^{23}\,molecules}{1\,mol} = 3.63\times10^{22}\,molecules$$

5. What molar concentration of KCl is produced by measuring out 1.00 g KCl and adding water up to 0.350 L of solution?

$$1.00\,g \times \frac{1\,mol}{74.6\,g} \times \frac{1}{0.350\,L} = 0.0383\,M$$

6. A 0.600 mol sample of an unknown gas has a mass of 52.8 g and contains only carbon and fluorine.
   A. What is the molar mass of this unknown gas?

$$\frac{52.8\,g}{0.600\,L} = 88.0\,g/mol$$

   B. What is the molecular formula of this unknown gas given that each molecule contains only 1 carbon atom?

CF_4

7. The molar volume of H_2 at 21.0°C, 100.4 kPa is 24.3 L/mol. Calculate the mass of 0.213 L of H_2 at this temperature and pressure.

$$0.213\,L \times \frac{1\,mol}{24.3\,L} \times \frac{2.09\,g}{1\,mol} = 0.0175\,g$$

8. A solution is made by mixing 100.0 mL of 0.200 M $BaCl_2$ and 150.0 mL of 0.400 M NaCl. What is the concentration of each ion in the final solution?

$BaCl_2$

$C_1V_1 = C_2V_2$

$C_2 = \frac{(100\,mL)(0.200\,M)}{250\,mL} = 0.0800\,M$

$BaCl_2 \rightarrow Ba^{2+} + 2Cl^-$

$0.0800\,M \quad 0.160\,M$

NaCl

$C_1V_1 = C_2V_2$

$C_2 = \frac{(150\,mL)(0.400\,M)}{250\,mL} = 0.240\,M$

$NaCl \rightarrow Na^+ + Cl^-$

$0.240\,M \quad 0.240\,M$

$[Ba^{2+}] = 0.0800\,M \quad [Cl^-] = 0.400\,M \quad [Na^+] = 0.240\,M$

9. Find the empirical formula for the following compounds:

a) 15.7% B, 84.3% F

$15.7\,g \times \frac{1\,mol\,B}{10.6\,g} = 1.48\,mol$

$84.3\,g \times \frac{1\,mol\,F}{19.0\,g} = 4.44$

$\div 1.48$

1 B

3 F

BF_3

b) 50.52% C, 5.26% H, 44.22% N

$50.52\,g \times \frac{1\,mol\,C}{12\,g} = 4.206\,mol$

$5.26\,g \times \frac{1\,mol\,H}{1.0\,g} = 5.26\,mol$

$44.22\,g \times \frac{1\,mol\,N}{14\,g} = 3.159\,mol$

$\div 3.159$

$= 1.33\,C$

$= 1.65\,H$

$= 1\,N$

$\div 4\,C$

$\times 3 = 5\,H$

3 N

$C_4H_5N_3$