

## Unit VI Answers

### Pg 233

1. One mole is defined as the number of atoms in exactly 12 grams of carbon-12.
2.  $6.022 \times 10^{23}$  particles
3. There is Avogadro's number of particles in one mole. Since we can't usually count individual atoms we count moles of atoms by measuring mass (and convert with molar mass) or volume ( and convert using molarity for solutions or molar volume for gases).
4. They both have the same number of ions – one mole or  $6.022 \times 10^{23}$
5. 1.11 mole is greater than 1.000 mole ( $6.022 \times 10^{23}$  particles)
6. a)  $1.20 \times 10^{24}$  ions of Iron (III) ions      b)  $2.7 \times 10^{24}$  molecules of boron trichloride  
c)  $1.5 \times 10^{23}$  potassium ions                      d)  $3.626 \times 10^{24}$  molecules of oxygen
7. a)  $3.61 \times 10^{24}$  sodium ions                      b)  $7.23 \times 10^{24}$  sodium ions      c)  $3.08 \times 10^{24}$  sodium ions
8. a) 0.500 mole water (molecules)              b) 0.1661 mol carbon (atoms)c) 0.09316 mole of sodium ions
9. a)  $2.86 \times 10^{-7}$  grams of helium              b) 15.22 grams of methane      c) 200.5 grams of calcium ions
10. a)  $4.745 \times 10^{23}$  iodide ions  
molecules    b)  $3.3 \times 10^{22}$  copper (II) ions      c)  $3.97 \times 10^{22}$  sulfur dioxide
11. 206.3 grams of ibuprofen
12. a) 26.7 grams of calcium                      b)  $5\bar{0}$  grams of boron-11              c)  $7.032 \times 10^{-4}$  grams of sodium ions
13. a)  $1.204 \times 10^{24}$  molecules of hydrogen      b)  $1.21 \times 10^{23}$  molecules HF      c)  $2.7 \times 10^{24}$  molecules glucose

### Pg240

8. 51.99 grams/mole (or amu)                      9. 10.80 grams/mole (or amu)
10. a) 168.35 g/mole                                      b) 122.55 g/mole                              c) 180.18 g/mole  
d) 132.08 g/mole                                      e) 75.08 g/mole
11. a) SrS; 119.69 g/mole;  $1.76 \times 10^{-2}$  mole SrS      b) PF<sub>3</sub>; 87.97 g/mole;  $2.40 \times 10^{-2}$  mole PF<sub>3</sub>  
c) Zn(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>; 183.49 g/mole;  $1.15 \times 10^{-2}$  mole zinc acetate  
d) Hg(BrO<sub>3</sub>)<sub>2</sub>; 456.39 g/mole;  $4.62 \times 10^{-3}$  mole Hg(BrO<sub>3</sub>)<sub>2</sub>  
e) Ca(NO<sub>3</sub>)<sub>2</sub>; 164.10 g/mole; 0.0129 mole Ca(NO<sub>3</sub>)<sub>2</sub>
12. a) 158.18 g/mole; 790.90 g Ca(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>              b) 357.49 g/mole; 1787.4 g Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>  
c) 183.20 g/mole; 916.00 g C<sub>7</sub>H<sub>5</sub>NO<sub>3</sub>S                      d) 180.17 g/mole; 900.85 C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>

### Pg 248

4. a) BCl<sub>3</sub>                      b) SO<sub>2</sub>                      c) NaNO<sub>3</sub>
5. SO<sub>2</sub>

6. a)  $\text{CaSO}_4$ ; 29.44% Ca, 23.55% S and 47.01% O  
 b)  $\text{SiO}_2$ ; 46.75% S and 53.25% O  
 c)  $\text{AgNO}_3$ ; 63.50% Ag, 8.247% N and 28.26% O  
 d) NO; 46.68% N and 53.32% O
7. a) 64.62% Ag, 14.39% C, 1.82% H and 19.17%O  
 b) 55.39% Pb, 18.95% Cl and 25.66% O  
 c) 27.93% Fe, 24.06% S and 48.01% O  
 d) 39.81% Cu, 20.09% S and 40.10% O
8. Experimental error will affect the amounts measured.

**Pgs 251-256**

1. Avogadro's number is the number of particles in a mole. The mole is a standard unit to count Avogadro's number of particles.
2. Molar mass is the quantity to measure the number of grams in one mole of a substance.
3. The ratio in a formula indicates the number of atoms. Since atoms can only come in whole parts and still be atoms the formula must be in a ratio of whole numbers.
14. 10 grams of nitrogen
16. The molar mass is the value of the atomic mass in units of grams/mole.
17. To determine the molar mass of a compound, add up the molar masses of each element in the compound.
18. The percent composition indicates the ratios of the elements by mass in a substance. The percent composition can be used to determine the empirical formula for a compound.
22.  $1.2 \times 10^{24}$  sodium ions
23.  $1.20 \times 10^{24}$  molecules of sucrose
24.  $3.01 \times 10^{22}$  molecules of carbon dioxide
25.  $7.53 \times 10^{21}$  atoms of mercury
26.  $1.56 \times 10^{24}$  atoms of aluminum
27.  $5.815 \times 10^{24}$  nickel (II) ions
28. a)  $1.88 \times 10^{24}$  formula units  $\text{MgCl}_2$   
 b)  $3.76 \times 10^{24}$  chloride ions
29. 41.5 mole of magnesium oxide
30.  $2.49 \times 10^{-7}$  mole of gold atoms
31. 12.5 mole of benzene
32.  $1.553 \times 10^{-10}$  mole
33.  $6.82 \times 10^{-2}$  mole of sodium ions
34. 0.60 mole of oxygen
35. 0.006192 grams of phosphorous
36. 420.8 g of sodium chloride
37.  $1.46 \times 10^{-8}$  grams of carbon dioxide
38. 79.5 grams of iron (III) sulfate
39. 81.6 grams of oxygen
40. 0.908 grams of neon
41. 160 grams of sodium chloride

42. a) 127 g I<sub>2</sub>      b) 675 g PbS      c) 233 g C<sub>4</sub>H<sub>10</sub>      d) 103 g Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>      e) 35.4 g CuSO<sub>4</sub>
43. a) 58.44 g NaCl    b) 36.04 g H<sub>2</sub>O      c) 260 g Ca(OH)<sub>2</sub>      d) 163 g Ba(NO<sub>3</sub>)<sub>2</sub>
44. 3.24 x 10<sup>22</sup> atoms of gold      45. 1.337 x 10<sup>24</sup> formula units of zinc chloride
46. 9.36 x 10<sup>21</sup> molecules of naphthalene      47. 2.79 x 10<sup>24</sup> atoms of aluminum
48. 5.53 mole of water
49. a) 4.99 x 10<sup>-2</sup> moles of ammonium sulfate      b) 61 moles of Ca(OH)<sub>2</sub>      c) 7.49 x 10<sup>-2</sup> mole H<sub>2</sub>SO<sub>4</sub>
50. 0.16 mole C<sub>13</sub>H<sub>18</sub>O<sub>2</sub>      51. 7.25 mole of sodium nitrite
52. 7.236 x 10<sup>-3</sup> moles of calcium      53. 57.8 mole of propane
54. 107.88 amu      55. 79.90 amu      56. 121.8 amu      57. 55.84 amu
58. a) LiCl 42.39 g/mole    b) Na<sub>2</sub>SO<sub>4</sub> 142.05 g/mole    c) CuCN 89.57 g/mole    d) C<sub>3</sub>H<sub>6</sub> 42.09 g/mole  
 e) K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> 294.20 g/mole    f) Mg(NO<sub>3</sub>)<sub>2</sub> 148.32 g/mole    g) 231.55 g/mole  
 h) 112.10 g/mole      i) S<sub>4</sub>N<sub>4</sub> 184.32 g/mole    j) CsBr<sub>3</sub> 372.60 g/mole    k) 194.22 g/mole
62. AgNO<sub>3</sub>      63. P<sub>2</sub>O<sub>3</sub>      64. C<sub>2</sub>H<sub>6</sub>O      65. C<sub>9</sub>H<sub>18</sub>N<sub>6</sub>      66. C<sub>6</sub>H<sub>6</sub>
67. Co<sub>2</sub>C<sub>8</sub>O<sub>8</sub>      68. C<sub>18</sub>H<sub>34</sub>O<sub>2</sub>      69. C<sub>4</sub>H<sub>4</sub>N<sub>2</sub>
70. a) 35.00 % N, 5.05% H and 59.96 % O  
 b) 21.23% O and 78.77% Sn  
 c) 13.55% Y, 41.23% Ba, 28.62% Cu and 16.81% O
71. 37.56% ammonium ion      72. 40.04% Ca, 12.00% C and 47.96% O
73. 22.57% N, 6.51% H, 19.35% C and 51.56% O
74. a) 0.050 mole sodium phosphate      b) 0.406 mole calcium nitrate      c) 0.128 mole sulfur dioxide
75. a) 0.00152 mole sodium ions      b) 0.0072 mole calcium ions
76. 2.81 x 10<sup>22</sup> atoms Pt      77. 40 moles H      78. 27.2% Na, 16.4% N and 56.4% O; NaNO<sub>3</sub>
79. 28.09 amu      80. 3 atoms Fe; 3 mole Fe      81. 180.18 g/mole      82. 3.00 mole chlorine
83. Aluminum phosphate is 22.12% aluminum while aluminum chloride is 20.23% aluminum so the aluminum phosphate has more aluminum per unit of mass.
84. a) 227.15 g/mole      b) 37.01% C, 2.22% H, 18.50% N and 42.26% O

**Pg 467**

2. Molarity, M, is moles of solute/liter of solution

3. Measure 5.0 grams of sodium chloride, dissolve it in some water and then increase the solution volume to 100 ml.
4. No; the total volume does not always equal the sum of the parts.
5. 438 parts per million (ppm)
6. 1.63 ppm He
7. 4.00 g NaOH
8. 1.1 M LiCl
9. 0.838 M NaOCl
10. 5.30 g AgNO<sub>3</sub>
11.  $5.8 \times 10^3$  g Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> and  $2.0 \times 10^3$  g water
12. KCl; there is the same number of moles of each substance but KCl has the greater formula mass.

**Pgs 488-492**

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|--|---|--|
| 47. 0.7776 M NaOH                          | 48. 0.734 M H <sub>3</sub> PO <sub>4</sub>              | 49. 2.0 mole AgNO <sub>3</sub>                           |
| 50. 0.250 M NaOH                           | 51. 1.61 M CuCl <sub>2</sub>                            | 52. 0.282 M KI   |
| 53. 0.123 M H <sub>3</sub> PO <sub>4</sub> | 54. $6.5 \times 10^{-5}$ M NaCN                         | 55. 5.85 g NaOH  |
| 56. 6.27 g HCl                             | 57. 5.02 M HCl  | 58. 5.4 M NaCl   |
| 59. 0.259 g LiF                            | 60. 163 g C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> | 61. 0.74 M C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> |