1. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
   A) \( \text{NH}_4 \) and \( \text{NH}_4 \text{Cl} \)  
   B) \( \text{ZnO}_2 \) and \( \text{ZnCl}_2 \)  
   C) \( \text{H}_2\text{O} \) and \( \text{HCl} \)  
   D) NO and \( \text{NO}_2 \)  
   E) \( \text{CH}_4 \) and \( \text{CO}_2 \)

2. Convert 16.8 lb to g. (1 lb = 453.6 g)
   A) 762.0 g  
   B) \( 3.70 \times 10^4 \) g  
   C) 76.2 g  
   D) 7621 g  
   E) 7620 g

3. A set of tested hypotheses that gives an overall explanation of some natural phenomenon is called a(n)
   A) observation.  
   B) measurement.  
   C) theory.  
   D) natural law.  
   E) experiment.

4. Rutherford's experiment was important because it showed that:
   A) radioactive elements give off alpha particles.  
   B) gold foil can be made to be only a few atoms thick.  
   C) a zinc sulfide screen scintillates when struck by a charged particle.  
   D) the mass of the atom is uniformly distributed throughout the atom.  
   E) an atom is mostly empty space.

5. In 1928, 1.0 g of a new element was isolated from 660 kg of the ore molybdenite. The percent by mass of this element in the ore was:
   A) 1.5%  
   B) 6.6%  
   C) 1.0%  
   D) \( 1.5 \times 10^{-4} \)%  
   E) \( 3.5 \times 10^{-3} \)%

6. The state of matter for an object that has both definite volume and definite shape is
   A) solid state.  
   B) liquid state.  
   C) gaseous state.  
   D) elemental state.  
   E) mixed state.

7. Which of the following are incorrectly paired?
   A) Copper, Co  
   B) Silver, Ag  
   C) Iron, Fe  
   D) Lead, Pb  
   E) Sodium, Na

8. Which of the following is an example of a qualitative observation?
   A) A piece of wood is 5.3 cm long.  
   B) Solution 1 is much darker than solution 2.  
   C) The volume of liquid in beaker A is 4.3 mL  
   D) The temperature of the liquid is 60°C.  
   E) none of these

9. It is estimated that uranium is relatively common in the earth's crust, occurring in amounts of 4 g/metric ton. A metric ton is 1000 kg. At this concentration, what mass of uranium is present in 1.0 mg of the earth's crust?
   A) 4 nanograms  
   B) 4 micrograms  
   C) 4 milligrams  
   D) \( 4 \times 10^{-5} \) g  
   E) 4 centigrams
10. The correct name for LiCl is
   A) lithium monochloride
   B) lithium (I) chloride
   C) monolithium chloride
   D) lithium chloride
   E) monolithium monochloride

11. Many classic experiments have given us indirect evidence of the nature of the atom. Which of the experiments listed below did not give the results described?
   A) The Rutherford experiment proved the Thomson "plum-pudding" model of the atom to be essentially correct.
   B) The Rutherford experiment was useful in determining the nuclear charge on the atom.
   C) Millikan's oil-drop experiment showed that the charge on any particle was a simple multiple of the charge on the electron.
   D) The electric discharge tube proved that electrons have a negative charge.

12. Measured quantities, such as length, mass, or time, can best be described as:
   A) sometimes certain.
   B) always certain.
   C) always uncertain.
   D) sometimes uncertain.

13. Which of the following atomic symbols is incorrect?
   A) $^{14}_{6}$C
   B) $^{37}_{17}$Cl
   C) $^{32}_{15}$P
   D) $^{39}_{19}$K
   E) $^{14}_{8}$N

14. A scientist obtains the number 1250.37986 on a calculator. If this number actually has four (4) significant figures, how should it be written?
   A) 1251
   B) 1250.3799
   C) 1250.4
   D) $1.250 \times 10^{3}$
   E) $1.250 \times 10^{-3}$

15. Which of the following statements are true of uranium-238?
   I. Its chemical properties will be exactly like those of uranium-235.
   II. Its mass will be slightly different from that of an atom of uranium-235.
   III. It will contain a different number of protons that an atom of uranium-235.
   IV. It is more plentiful in nature than uranium-235.
   A) III, IV
   B) I, II, III
   C) I, II, IV
   D) II, III, IV
   E) all of these

16. A titration was performed to find the concentration of hydrochloric acid with the following results:

<table>
<thead>
<tr>
<th>Trial</th>
<th>Molarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.25 ± 0.01</td>
</tr>
<tr>
<td>2</td>
<td>1.24 ± 0.01</td>
</tr>
<tr>
<td>3</td>
<td>1.26 ± 0.01</td>
</tr>
</tbody>
</table>

   The actual concentration of HCl was determined to be 1.000 M; the results of the titration are:
   A) both accurate and precise.
   B) accurate but imprecise.
   C) precise but inaccurate.
   D) both inaccurate and imprecise.
   E) accuracy and precision are impossible to determine with the available information.
17. Write the names of the following compounds:
   a) FeSO₄
   b) NaC₂H₃O₂
   c) KNO₂
   d) Ca(OH)₂
   e) NiCO₃

18. All of the following are characteristics of nonmetals except:
   A) poor conductors of electricity
   B) often bond to each other by forming covalent bonds
   C) tend to form negative ions in chemical reactions with metals
   D) appear in the upper left-hand corner of the periodic table
   E) do not have a shiny (lustrous) appearance

19. All of the following are true except:
   A) Ions are formed by adding electrons to a neutral atom.
   B) Ions are formed by changing the number of protons in an atom's nucleus.
   C) Ions are formed by removing electrons from a neutral atom.
   D) An ion has a positive or negative charge.
   E) Metals tend to form positive ions.

20. Using the rules of significant figures, calculate the following:
    \[
    \frac{6.167 + 83}{5.10}
    \]
    A) 17.5  B) 18  C) 17  D) 20  E) 17.48

21. Which of the following has 45 neutrons, 35 protons, and 36 electrons?
    A) \(^{80}_{35}\text{Hg}\)  B) \(^{103}_{45}\text{Rh}^-\)  C) \(^{80}_{35}\text{Br}^-\)  D) \(^{71}_{35}\text{Lu}^-\)  E) \(^{81}_{35}\text{Tl}^-\)

22. A monolayer containing \(3.20 \times 10^{-6}\) g of oleic acid has an area of 20.0 cm². The density of oleic acid is 0.895 g/mL. What is the thickness of the monolayer (the length of an oleic acid molecule)?
    A) \(2.86 \times 10^{-6}\) cm  D) \(1.79 \times 10^{-7}\) cm
    B) \(3.58 \times 10^{-6}\) cm  E) \(1.43 \times 10^{-7}\) cm
    C) \(5.59 \times 10^{-6}\) cm

23. According to the law of definite proportions:
    A) if the same two elements form two different compounds, they do so in the same ratio.
    B) it is not possible for the same two elements to form more than one compound.
    C) the ratio of the masses of the elements in a compound is always the same.
    D) the total mass after a chemical change is the same as before the change.
Answer Key -- unit 1-2 practice test

1. D
   Origin: 2 Atoms, Molecules, and Ions....2

2. E
   Origin: 1 Chemical Foundations....33

3. C
   Origin: 1 Chemical Foundations....6

4. E
   Origin: 2 Atoms, Molecules, and Ions....16

5. D
   Origin: 1 Chemical Foundations....2

6. A
   Origin: 1 Chemical Foundations....56

7. A
   Origin: 2 Atoms, Molecules, and Ions....38

8. B
   Origin: 1 Chemical Foundations....4

9. A
   Origin: 1 Chemical Foundations....1

10. D
    Origin: 2 Atoms, Molecules, and Ions....45

11. A
    Origin: 2 Atoms, Molecules, and Ions....3

12. C
    Origin: 1 Chemical Foundations....12

13. E
    Origin: 2 Atoms, Molecules, and Ions....18

14. D
    Origin: 1 Chemical Foundations....14

15. C
    Origin: 2 Atoms, Molecules, and Ions....32
16. C  
   Origin: 1 Chemical Foundations....10

17. a) iron(II) sulfate  
    b) sodium acetate  
    c) potassium nitrite  
    d) calcium hydroxide  
    e) nickel(II) carbonate  
   Origin: 2 Atoms, Molecules, and Ions....53

18. D  
   Origin: 2 Atoms, Molecules, and Ions....41

19. B  
   Origin: 2 Atoms, Molecules, and Ions....24

20. C  
   Origin: 1 Chemical Foundations....20

21. C  
   Origin: 2 Atoms, Molecules, and Ions....22

22. D  
   Origin: 1 Chemical Foundations....49

23. C  
   Origin: 2 Atoms, Molecules, and Ions....1