CHEM 1004
Test #1
Spring 2011 (Buckley)

Multiple choice. (2 points each) Circle the letter corresponding to the best answer for each of the following questions.

1. In looking over a huge amount of physical data, a scientist makes a statement that summarizes those data. This statement could best be described as a:
   
   a. hypothesis  
   b. law  
   c. theory  
   d. model  
   e. premise

2. Which of the following statements is true of a scientific theory?
   
   a. a theory can never be proven wrong  
   b. a theory is an individual’s guess as to what will happen in a certain situation  
   c. a theory is tentative – it can be modified or even discarded as more evidence comes in  
   d. a theory has been proven to be true and is absolute  
   e. a theory summarizes data from many, many observations

3. The statement that mass in a chemical change is conserved is based on many years of observation. This statement is best categorized as:
   
   a. a hypothesis  
   b. a theory  
   c. a model  
   d. a law  
   e. a conjecture

4. Which of the following is an example of a physical change?
   
   a. The gasoline in your car is burned as you drive to school.  
   b. The water in an ice cube tray freezes.  
   c. A match is lit.  
   d. Your body takes in food and converts it to energy.  
   e. An egg is hardboiled.
5. Which of the following is an example of a chemical change?
   a. Hydrogen and oxygen form water.
   b. A piece of copper wire is bent into a circle.
   c. Water on the stove is boiled.
   d. Sodium metal is cut with a knife.
   e. A machine makes a nail by cutting a piece of wire and shaping the ends.

6. Which of the following is a chemical property?
   a. Iron rusts when exposed to moist air.
   b. The melting point of table salt is 801 °C.
   c. The density of copper is 8.96 g/cm³
   d. Chlorine gas has a green color.
   e. A certain plastic breaks easily below a temperature of -50 °C.

7. Which of the following is a physical property?
   a. Sodium and chlorine combine to form table salt.
   b. Chlorine can kill the bacteria in a swimming pool.
   c. At 25 °C potassium is a solid.
   d. Aluminum reacts with oxygen in the air to form an oxide coating.
   e. Nitroglycerin is an explosive compound.

8. Which of the following statements is reasonable? (You might want to consider your answers to questions 6 and 7).
   a. a chemical property is of a substance is independent of the presence of any other substance
   b. a physical change occurs when a substance interacts with another substance
   c. a physical property of a substance involves another substance
   d. a chemical change occurs when a substance is transformed into another substance
   e. a physical change occurs when a substance is transformed into another substance

9. Though we haven’t done formulas officially yet, you probably have the idea that H₂O represents a substance that is composed of hydrogen and oxygen somehow combined together. Which of the following formulas would be that of a compound?
   a. H₂
   b. Na
   c. O₂
   d. NH₃
   e. S₈
10. The air in the room is an example of:
   a. a pure substance composed of elements
   b. a pure substance composed of compounds
   c. a heterogeneous mixture
   [ ] a homogeneous mixture
   e. a homogenous pure substance

11. A cup of water has a small amount of sugar dissolved in it. This is an example of a
   a. pure substance – element
   b. pure substance – compound
   [ ] homogeneous mixture
   d. heterogeneous mixture
   e. heterogeneous pure substance

12. Which of the following is not an SI base unit?
   a. L
   b. m
   c. K
   d. mol
   e. second

13. Which of the SI units is currently defined by a prototype – i.e., a physical specimen?
   a. candela
   b. meter
   c. second
   [ ] kilogram
   e. temperature

14. How many mm$^3$ are present in 1 m$^3$?
   a. $1 \text{ m}^3 = 1 \times 10^{-6} \text{ mm}^3$
   b. $1 \text{ m}^3 = 1 \times 10^6 \text{ mm}^3$
   c. $1 \text{ m}^3 = 1 \times 10^9 \text{ mm}^3$
   [ ] $1 \text{ m}^3 = 1 \times 10^9 \text{ mm}^3$
   e. $1 \text{ m}^3 = 1 \times 10^3 \text{ mm}^3$
15. When 50.0-g of hydrogen are reacted with 450.0-g of oxygen, the products have a total mass of 500.0-g. This statement is an example of which law?

a. The law of multiple proportions
b. The law of conservation of mass
\[\text{Correct Answer} \]
c. The law of constant proportions
d. The law of gravity

16. The ratio by mass of phosphorous to fluorine in phosphorous trifluoride is always 1.0 to 1.8. This statement is an example of which law?

a. The law of conservation of mass
b. The law of constant proportions
c. The law of multiple proportions
d. The law of conservation of energy

17. Which of the following is not a part of John Dalton’s Atomic theory?

a. Matter is continuous.
b. Atoms recombine in chemical changes.
c. Compounds are formed when atoms of elements combine in fixed proportions.
d. Matter is composed of particles called atoms.
\[\text{Correct Answer} \]

18. The person primarily credited with proposing the periodic chart in its current format is:

a. Dmitri Mendeleev
b. John Newlands
c. Lothar Meyer
d. Johann Dobereiner
e. Beguyer de Chancourtois

19. (5 points) Make the following conversions.

a. \(2.35 \times 10^{-3} \text{ m} = \frac{2.35}{10^{-3}} \text{ mm}\)
b. \(0.000834 \text{ mg} = \frac{8.34}{10^{-6}} \text{ kg}\)
c. \(34.5 \text{ mL} = \frac{34.5}{10^{-3}} \text{ L}\)
d. \(5.36 \times 10^{18} \text{ cm} = \frac{5.36 \times 10^{18}}{10} \text{ mm}\)
e. \(0.0354 \text{ m}^2 = \frac{354}{10} \text{ cm}^2\)
20. (4 points) The density of magnesium is 1.738 g/cm³. Show your work.

a. How many grams of magnesium are contained in a block that has a volume of 345 cm³?

\[ \rho \text{ g Mg} = \frac{345 \text{ cm}^3 \times 1.738 \text{ g Mg}}{1 \text{ cm}^3} = 600 \text{ g Mg} \]

b. What volume of magnesium would be required to obtain a mass of 25.6 g?

\[ \rho \text{ cm}^3 \text{ Mg} = \frac{25.6 \text{ g Mg}}{1 \text{ cm}^3 \times 1.738 \text{ g Mg}} = 14.7 \text{ cm}^3 \]

21. (4 points) State whether each of the following claims is falsifiable or not. Give a brief description of your rationale for choosing your answer.

a. Human beings can live to be over 150 years old. **FALSIFIABLE**
   
   **ONE CASE OF A PERSON LIVING TO BE OLDER THAN 150 YEARS WOULD falsify this claim.**

b. A doctor indicates that arthritis may be cured through her powers if the victim believes enough in the process. **NOT FALSIFIABLE**
   
   DOCTOR COULD ALWAYS INDICATE IT DIDN'T WORK BECAUSE THE PATIENT DIDN'T BELIEVE

b. Water can be made to freeze at 2 °C. **NOT FALSIFIABLE**
   
   JUST BECAUSE WE CAN'T DO IT DOESN'T MEAN IT CAN'T BE DONE

d. Driving at lower speeds improves gas mileage. **FALSIFIABLE**
   
   ONE CASE WHERE THIS IS NOT TRUE WOULD INVALIDATE THE CLAIM.