1) The chemical formula for silver carbonate is $Ag_2CO_3$. The formula mass of silver carbonate is:
   A) 114.127 g/mole
   B) 120.420 g/mole
   C) 167.877 g/mole
   D) 223.862 g/mol
   E) 275.745 g/mole

2) A compound has a molar mass of 222.13 g/mol. What number is $x$ in the chemical formula $Al_2O_xSi_2$?
   A) 1
   B) 2
   C) 3
   D) 5
   E) 7

3) What is the maximum daily dose of the laxative $Na_2HPO_4$ (in mass) if the maximum daily allowance is 47.02 mmol?
   A) 6.675 g
   B) 6.675 mg
   C) 6.675 kg
   D) 6.675 μg
   E) 13.35 mg

4) If one serving of cake contains 14.3 mg of cholesterol, which is 37.0 μmol of cholesterol, what is the formula mass of cholesterol?
   A) 529 g/mol
   B) 386 g/mol
   C) 259 g/mol
   D) 0.386 g/mol
   E) 0.259 g/mol

5) A 106-g sample of $Na_2CO_3$ contains:
   A) 3.00 g of oxygen
   B) 1 mol of carbon atoms
   C) $6.022 \times 10^{23}$ oxygen atoms
   D) 1 sodium atom
   E) 2 sodium atom

6) What volume will $4.25 \times 10^3$ ft$^3$ of air occupy when it is heated from 10 °C to 564 °C at constant pressure?
   A) $1.43 \times 10^2$ ft$^3$
   B) $1.34 \times 10^3$ ft$^3$
   C) $1.26 \times 10^4$ ft$^3$
   D) $2.40 \times 10^4$ ft$^3$
   E) $2.96 \times 10^4$ ft$^3$

7) In which state does matter undergo a large change in volume on heating?
                  I Solid        II Liquid      III Gas
   A) I Only
   B) II only
   C) III only
   D) I and III only
   E) I and II only

8) The amount of heat required to effect the transition of one mole of a substance from the liquid to the gas phase is called the:
   A) molar heat of fusion
   B) melting point
   C) normal boiling point
   D) molar heat of vaporization
   E) atmospheric condensation point

9) Which of these hydrides has the highest boiling point?
   A) HF
   B) HCL
   C) HBr
   D) HI
   E) HH

10) A substance in the liquid phase at room temperature:
   A) - is more volatile than carbon dioxide
   B) - has a vapor pressure that is greater than the pressure of the surrounding atmosphere
   C) - has a vapor pressure that is lower than the pressure of the surrounding atmosphere
   D) - is less volatile than sodium chloride
   E) - experiences weaker secondary forces compared to the gas phase

11) If the empirical formula of a compound is $C_2H_4O$ and the weight of 1 mol of the compound is 132.16 g, what is its molecular formula?

    A) $C_2H_4O$
    B) $C_4H_8O_2$
    C) $C_6H_{12}O_3$
    D) $C_8H_{16}O_4$
    E) $C_{10}H_{20}O_5$

(End of multiple-choice questions)

12) How many electrons are lost by 47.0 grams of aluminum when its atoms are oxidized to ions?

13) What follows is the combustion reaction of $C_5H_8O_4$ in oxygen.

$$\_\_\_\_ C_5H_8O_4 + \_\_\_\_O_2 \rightarrow \_\_\_\_CO_2 + \_\_\_\_H_2O$$

    A) Balance the chemical equation by putting the correct numbers in the blanks above, even if that number is a 1(do not leave blank!). (8 pt)

    B) What is the mass in grams of $CO_2$ that would be produced if 52.0 g of $C_5H_8O_4$ were allowed to react completely in excess oxygen?

    C) What is the oxidation number for carbon in the $C_5H_8O_4$ molecule?

14) The temperature of a sample of argon gas is 108.0° C at 1824.0 torr and 888.0 mL. What will be the new Celsius temperature after the conditions of the same gas are changed to 922.0 torr and 0.571 L? (760 torr = 1 atm)

15)     59.27 g of $F_2$ and an unknown amount of $H_2$ form a mixture contained in a 7.650 L container at 53.01° C. The mixture exerts a total pressure of 7.022 atm on the surface of the container.

A)    What is the total number of moles of gas in the container?

B)    What is the mass of $H_2$ present in the container (in grams)?

C)    What is the partial pressure of $H_2$ in the container (in atmospheres)?

16)    Fill in the following table with a yes or a no answer to the question "Does this secondary force operate between the molecules of the given compound?" (It may be necessary for you to draw correct Lewis structures to determine whether a compound is polar or non-polar).

| Compound | London Force | Dipole-dipole | Hydrogen Bond |
|---|---|---|---|
| $H_2O$ | | | |
| H<br>  \<br>   $C=O$<br>  /<br> H | | | |
| $CF_4$ | | | |
| $CHF_3$ | | | |
| $[NO_2]^-$ | | | |
| $[NO_3]^-$ | | | |
| $NCl_3$ | | | |
| $NHCl_2$ | | | |

17) Explain how hydrogen bonding, and the associated structure of ice, causes ice to be less dense than liquid water.