1. (4). What is the formula of the sulfide of lithium?
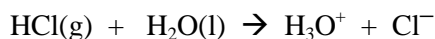
    Li_2S

2. (4). How many neutrons are present in the nucleus of chlorine-35?
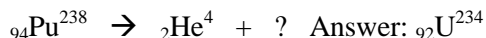
    18

3. (5). What is the pH of 0.0010 M NaOH?

    11.0.

4. (5). Hydrogen chloride, a gas, dissolves in water with the evolution of a considerable amount of heat. Write a chemical equation that explains this observation.
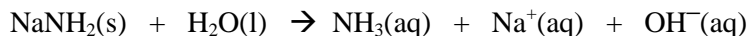
    $HCl(g) + H_2O(l) \rightarrow H_3O^+ + Cl^-$

5. (5). Provide the missing product in the following nuclear reaction:

    $_{94}Pu^{238} \rightarrow {_2}He^4 + ?$ Answer: $_{92}U^{234}$

6. (10). Sodium amide, $NaNH_2$, reacts with water in a Brønsted acid-base reaction as follows:

    $NaNH_2(s) + H_2O(l) \rightarrow NH_3(aq) + NaOH(aq)$
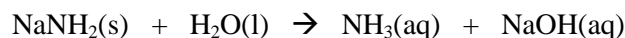
    a. Write the net ionic equation for this reaction.

    $NaNH_2(s) + H_2O(l) \rightarrow NH_3(aq) + Na^+(aq) + OH^-(aq)$

    b. Which is the stronger base, __X__sodium amide or ____sodium hydroxide?

7. (4). What is the oxidation number of chlorine in NaOCl? Answer: +1.

8. (5). The half-life of C-14 is about 6000 years. After 18,000 years, what percentage of the original amount of the isotope would remain? Answer: Three half-lives or 12.5%.

9. (4). Although helium is a gas under normal conditions, it becomes a liquid at about 4 K. The principal force of attraction holding atoms together in its liquid phase is:

    a. ____Ion-ion
    b. ____Dipole-dipole
    c. __X__London dispersion (induced dipole-induced dipole)
    d. ____Hydrogen bonding

10. (4). One of the following combinations would likely form a homogeneous mixture. Check it.

    a.   ____gasoline and water

    b.   __X__glucose and water

    c.   ____olive oil and vinegar

    d.   ____sodium chloride and hexane (C_6H_{14})

11. (5). Balance the following equation:

 C_4H_6 +   11/2 O_2 →   4 CO_2 +   3 H_2O
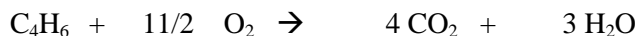
12. (5). Identify the element that has the same electronic configuration as Se^{2-}. Answer: Kr.

13. (5). Check the one reaction below that does not go to completion (99%). (Note: equations are not necessarily balanced):

    a.   ____$Na_2CO_3(aq)$ + HCl(aq) → NaCl(aq) + $CO_2(g)$ + $H_2O(l)$

    b.   _X___$Na_2SO_4(aq)$ + $KNO_3(aq)$ → $NaNO_3(aq)$ + $K_2SO_4(aq)$

    c.   ____NaCl(aq) + $AgNO_3(aq)$ → AgCl(s) + $NaNO_3(aq)$

    d.   ____NaOAc(aq) + HCl(aq) → NaCl(aq) + HOAc(aq)

14. (5). Consider the following balanced equation:

    2 Al(s) + 6HCl(aq) → 2 $AlCl_3(aq)$ +   3 $H_2(g)$
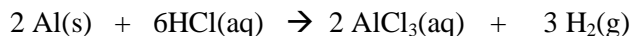
    If 54.0 g of aluminum reacts with an excess of HCl, what volume of hydrogen will be produced at STP? Answer: 3 x 22.4 = 67.2 L.

15. (5). Which is the limiting reagent in the reaction of 50.0 g $Ca(OH)_2$ with 50.0 g CO_2:
    $Ca(OH)_2$ + CO_2 → $CaCO_3$ + H_2O
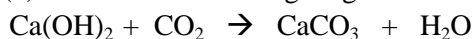
    1:1 mole ratio. $Ca(OH)_2$, 50/74 = 0.68 moles. CO_2, 50/44 = 1.14 moles. Therefore L.Rgt = $Ca(OH)_2$.

16. (12). Give a specific example of each of the following:

a.   The <u>proper</u> name of manganese dioxide, MnO_2. Answer: Manganese(IV) oxide.

b.   An isotope of carbon-14. Answer: C-12 or C-13.

c.   The metal whose electronic configuration is Ar)$4s^2$ $3d^5$: Answer: Mn.

d.   The conjugate acid of HPO_4^{2-}. Answer: $H_2PO_4^-$

17. (6). Boron trifluoride (BF_3) does not obey the octet rule and has dipole moment of zero. Draw the Lewis structure showing all valence electrons, predict its geometric shape and specify the F-B-F bond angle. (B is the central atom). Answer: BF_3 is planar because it lacks the lone pair of electrons that would force it into a tetrahedral geometry per VSEPR theory.

18. (5). One liter of steam ($H_2O(g)$) at 120 deg C and 1.00 atm pressure is heated to 240 deg C at constant volume. What is the final pressure of the steam?

   P1/T1 = P2/T2. T1 = 393 K; T2 = 513 K. Solve for P2.
   .

19. (4). In osmosis, the flow of water molecules across a semipermeable membrane is from

   _____ more concentrated solution to less concentrated;

   __X__less concentrated solution to more concentrated.

20. (5). Write the equilibrium constant expression, K, for the following reaction:

   $$N_2(g) + 3H_2(g) = 2NH_3(g)$$
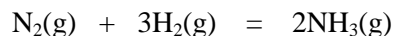
   Answer: $K = [NH_3]^2/[N_2][H_2]^3$ or $(p(NH_3))^2/(p(N_2))(p(H_2)^3)$

21. (5). What is the pH of an acetic acid (0.100 M) – sodium acetate (0.200 M) buffer solution? The pKa of acetic acid is 4.75.

Use Henderson-Hasselbalch equation.

22. (5). Amanda von Weisenheimer obtained the following data using the ideal gas law: weight of unknown gas = 0.121 g; number of moles of unknown gas = 0.00168 moles. What is the molecular weight of Amanda's unknown gas?

Answer: 72 g/mole.

23. (6). Consider the bond dissociation reaction, $H_2(g) \rightarrow 2 H(g)$.
   a. Is the reaction _____exothermic or _X___endothermic?
   b. Is ΔS __X__positive or _____negative?

24. (5). What is the molarity of a solution made up by dissolving 24.0 g Na_2SO_4 in water and diluting to a final volume of 500 mL?

   Answer: 24.0/(142x0.5) = 0.338 M.