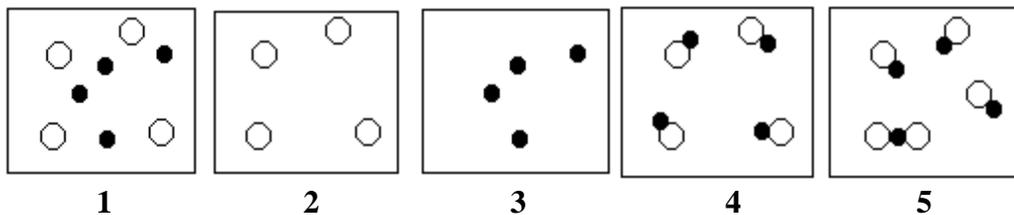Multiple Choice (4 points each): Answer on blue form; be sure to code in your name and ID.

Answers

1. Which of the following figures represent(s) a pure substance? Circles are atoms and connected circles are molecules.

1. e

a. 1
b. 2
c. 3
d. 4
e. 2, 3, and 4

2. Which of the above figures represent(s) a mixture of elements?

2. a

a. 1
b. 4
c. 5
d. 1 and 5
e. 4 and 5

3. Which of the following describes a chemical property of gold?

3. b

a. Gold is a yellow metal.
b. Gold is an inert (nonreactive) metal.
c. Gold is a soft metal.
d. Gold is a very dense metal.
e. Gold is a good conductor of heat and electricity.

4. The average velocity of carbon dioxide molecules at 0^oC is 3.62×10^4 cm/sec. Which of the following calculations would convert this value to the velocity in miles per hour?

4. c

a. $\dfrac{1\,sec}{3.62x10^4\,cm} \times \dfrac{2.54cm}{1in} \times \dfrac{12in}{1ft} \times \dfrac{5280\,ft}{1mi} \times \dfrac{1hr}{3600\,sec}$

b. $\dfrac{1\,sec}{3.62x10^4\,cm} \times \dfrac{2.54}{cm} \times \dfrac{1ft}{12in} \times \dfrac{1mi}{5280\,ft} \times \dfrac{3600\,sec}{1hr}$

c. $3.62x10^4 \dfrac{cm}{sec} \times \dfrac{1in}{2.54cm} \times \dfrac{1ft}{12in} \times \dfrac{1mi}{5280\,ft} \times \dfrac{3600\,sec}{1hr}$

d. $3.62x10^4 \dfrac{cm}{sec} \times \dfrac{2.54cm}{1in} \times \dfrac{12in}{1ft} \times \dfrac{5280\,ft}{1mi} \times \dfrac{3600\,sec}{1hr}$

e. $3.62x10^4 \dfrac{cm}{sec} \times \dfrac{1in}{2.54cm} \times \dfrac{12in}{1ft} \times \dfrac{5280\,ft}{1mi} \times \dfrac{1hr}{3600\,sec}$

5. Which one of the following lists gives the symbols for the elements phosphorus, potassium, silver, chlorine, and sulfur, in that order?

       a. K, Ag, Po, Cl, S   b. P, K, Ag, Cl, S
       c. P, Po, Ag, Cl, S   d. Ph, K, Ag, S, Cl
       e. Ph, Po, Ag, Cl, S

5. b

6. Which one of the following statements about the isotopes of a given element is correct?

       a. The atoms have the same number of protons but differing numbers of neutrons.
       b. the atoms have the same number of neutrons but differing numbers of electrons.
       c. The atoms have the same number of electrons but differing numbers of protons.
       d. The atoms have the same number of neutrons but differing numbers of protons.
       e. The atoms have the same number of protons but differing numbers of electrons.

6. a

7. Atom X has 10 protons, 10 neutrons, and 10 electrons. Atom Y has 10 protons, 10 neutrons, and 9 electrons. Atom X and atom Y are

       a. isotopes
       b. isoelectronic
       c. isobars
       d. X is the atom and Y the 1+ ion of X
       e. both are ions with different charges

7. d

8. Calculate the average atomic mass of byzanium, a fictional element, if it has three isotopes with the following abundances and masses:

       ^{45}Bz   44.99 amu   30.0%
       ^{47}Bz   46.99 amu   60.0%
       ^{48}Bz   48.00 amu   10.0%

       a. 45.9 amu   b. 46.5 amu
       c. 46.7 amu   d. 47.0 amu
       e. 140 amu

8. b

9. Of the following, the only empirical formula is

       a. N_2F_2 b. N_2F_4
       c. H_2C_2 d. $H_2N_2O_2$
       e. HNF_2

9. e

10. A binary compound of bismuth and oxygen contains 89.7% bismuth, Bi. What is the empirical formula of the compound?

       a. Bi_2O_3 b. BiO c. Bi_2O
       d. BiO_2 e. Bi_3O_2

10. a

11. Which of the following does not describe 44.0 g of propane, C_3H_8? | 11. c
    a. One mole of propane.
    b. The amount of propane that contains 8.0 g of hydrogen.
    c. The amount of propane that contains $33.0 \times 6.02 \times 10^{23}$ molecules of
      propane.
    d. The amount of propane that contains $8 \times 6.02 \times 10^{23}$ hydrogen atoms.
    e. The amount of propane that contains 36.0 g of carbon.

12. Which of the following samples contains the smallest number of molecules? | 12. d
    a. 1 g of phosphorus, P_4 b. 1 g of chlorine, Cl_2
    c. 1 g of nitrogen, N_2 d. 1 g of arsenic, As_4
    e. 1 g of sulfur, S_8

13. A sample of fructose, a fruit sugar, $C_6H_{12}O_6$, that contains 24 g of carbon also | 13. b
contains _____ g of oxygen.
    a. 24 g   b. 32 g
    c. 48 g   d. 64 g
    e. 96 g

14. The elements Li, Na, K, Rb, Cs, and Fr are called | 14. e
    a. alkaline earth metals   b. halogens
    c. noble metals   d. structural metals
    e. alkali metals

15. Which of the following elements would be expected to have chemical properties | 15. a
most similar to phosphorus?
    a. Sb   b. S
    c. Ar   d. Ge
    e. Si

16. Which one of the following nitrogen compounds should not exist? | 16. c
    a. N_2O_3 b. NP
    c. NS   d. NCl_3
    e. NH_3

17. The oxoanion $SO_3{}^{2-}$ is named | 17. a
    a. sulfite ion   b. sulfur trioxide
    c. sulfate ion   d. sulfur trioxide
    e. trioxosulfide

18. The *will-o'-the-wisp*, the faint light sometimes seen over marshland at night, is | 18. e
attributed by some people to the burning of a compound of phosphorus and
hydrogen. What is the formula of this compound?
    a. PH   b. P_2H
    c. PH_2 d. P_3H
   e. PH_3

19. The correct name for VO_2 is
    a. vanadium dioxide   b. vanadium peroxide
    c. vanadium(II) oxide   d. vanadium(IV) oxide
    e. vanadium(II) peroxide

19. d

20. Which of the following is named incorrectly?
    a. $Sn_3(PO_4)_4$ tin(IV) phosphate
    b. $Fe(OH)_2$ iron(III) hydroxide
    c. K_3P potassium phosphide
    d. $FeSO_4$ iron(II) sulfate
    e. NO_2 nitrogen dioxide

20. b

21. An aqueous solution of HF would be named
    a. hydrogen fluoride   b. perfluoric acid
    c. hypofluorous acid   d. hydrofluoric acid
    e. fluoric acid

21. d

22. The formula for terbium phosphate is $Tb_3(PO_4)_4$. On the basis of this information, the formula for the sulfate of terbium would be expected to be
    a. $Tb_2(SO_3)_3$ b. Tb_2S_3
    c. TbS_2 d. $Tb_2(SO_4)_3$
    e. $Tb(SO_4)_2$

22. e

23. Which anion does not carry a one minus (1-) charge?
    a. chloride   b. cyanide
    c. hydroxide   d. hydride
    e. oxide

23. e

24. When the calcium ion combines with the phosphate ion, the following neutral compound is produced.
    a. $CaPO_3$ b. $CaPO_4$
    c. $Ca_3(PO_4)_2$ d. Ca_2PO_4
    e. $Ca(PO_4)_2$

24. c

25. Which of the following equations is balanced?
    a. $P_4(s) + 4O_2(g) ---> P_4O_{10}(s)$
    b. $3KClO_3(s) ---> 2KClO_4(s) + KCl(s)$
    c. $2PbS(s) + 3O_2(g) ---> 2PbO(s) + 2SO_2(g)$
    d. $3NHNO(g) + 2O_2(g) ---> 2NO_2(g)$
    e. $2Li(s) + Se(s) ---> Li_3Se(s)$

25. c

26. For a balanced chemical equation, which statement is not true?   26. c
     a. Mass of reactants must equal mass of products.
     b. Same number of each each type of atom must be present on both sides of the equation.
     c. Same number of moles of particles must be present on both sides of the equation.
     d. Coefficients represent the number of moles of each reactant needed or product formed.
     e. Subscripts represent the number of each type of atom in each reactant or product.

27. The reaction, $C_6H_{12}O_6 \longrightarrow 6C + 6H_2O$, is labelled a   27. d
     a. rearrangement reaction   b. direct synthesis reaction
     c. single-displacement reaction   d. decomposition reaction
     e. double-displacement reaction

28. Consider the following diagram of a chemical reaction   28. c
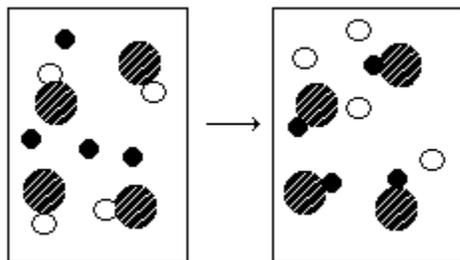
            reactants   products

This type of reaction is labelled a
     a. direct synthesis reaction   b. double-displacement reaction
     c. single-displacement reaction   d. decomposition reaction
     e. hydrolysis reaction

29. Many metal carbonates decompose upon heating to produce   29. d
     a. the pure metal
     b. the metal bicarbonate
     c. the metal and carbonic acid
     d. the metal oxide and carbon dioxide gas
     e. carbon monoxide gas

30. Calculate the number of moles of oxygen that are required to completely convert 0.50 mole of FeO to Fe_3O_4.   30. e
     $6FeO + O_2 \longrightarrow 2Fe_3O_4$
     a. 3.0   b. 0.16
   c. 1.0   d. 0.25
     e. 0.083

31. Calculate the number of grams of methane (CH_4) required to react with 50.0 g of chlorine.

      $3CH_4 + 4Cl_2 ---> 2CH_3Cl + CH_2Cl_2 + 4HCl$

      a. 66.5   b. 8.45

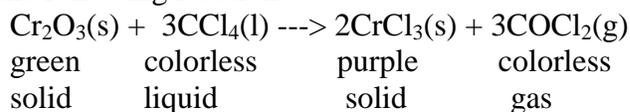   c. 37.6   d. 16.9

      e. 4.23

31. b

32. Anhydrous chromium(III) chloride, $CrCl_3$, is prepared by reacting Cr_2O_3 with CCl_4 at 800°C. Identify the limiting reagent(LR) and calculate the number of grams left over of the reagent in excess, given 10.0 g of Cr_2O_3 and 24.0 g of CCl_4.

      $Cr_2O_3 + 3CCl_4 ---> 2CrCl_3 + 3 COCl_2$
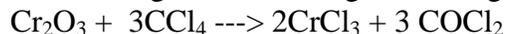
      a. LR CCl_4, 2.1 g Cr_2O_3 b. LR CCl_4, 3.70 g Cr_2O_3

      c. LR Cr_2O_3 , 10.0 g CCl_4 d. LR Cr_2O_3, 3.70 g CCl_4

      e. LR Cr_2O_3, 6.75 g CCl_4

32. a

33. Consider the following reaction

      $Cr_2O_3(s) + 3CCl_4(l) ---> 2CrCl_3(s) + 3COCl_2(g)$

      green   colorless   purple   colorless

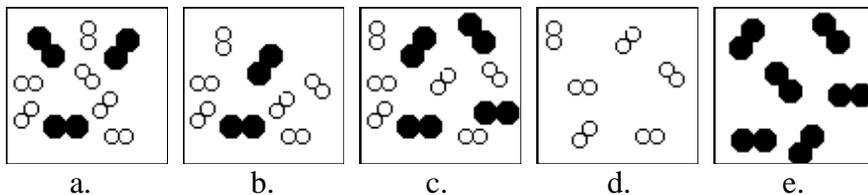   solid   liquid   solid   gas

When the green solid is mixed with the colorless liquid, the mixture starts to bubble and fume. When all action has stopped, a dry purple solid containing solid green specks remains. Which substance is the limiting reactant?

      a. Cr_2O_3 b. CCl_4

      c. $CrCl_3$ d. $COCl_2$

      e. there is no limiting reactant

33. b

34. Consider the reaction, $2H_2(g) + O_2(g) ---> 2H_2O(g)$

In which picture of the reactants is $H_2(g)$ the limiting reactant?

34. c

     a.   b.   c.   d.   e.