QUESTIONS FOR THE REVIEW WORKSHOP

(You will need a periodic table. Answers are on page 4.)

1. ___ Deposition of frost on a car’s windshield during a cold night is an example of a:
   A. chemical change  B. physical change  C. both are correct  D. neither is correct

2. ___ Salt water is a(n):
   A. compound  B. heterogeneous mixture  C. homogeneous mixture  D. element

3. ___ Which phase of matter adopts the shape and volume of its closed container?
   A. gas  B. liquid  C. solid  D. ionic

4. ___ How many significant figures should be recorded for the result of the calculation: \( \frac{3.9 + 7.2}{0.3128} \) ?
   A. 5  B. 4  C. 3  D. 2

5. ___ The covalent radius of a uranium atom is 1.96 Angstroms (1 Angstrom = 1 x 10^{-8} cm). The radius expressed in nanometers is:
   A. 196 nm  B. 1.96 x 10^{-9} nm  C. 0.510 nm  D. 0.196 nm

6. ___ The average mass of a chlorine atom is 35.453 amu (atomic mass units). What is the average mass of one chlorine molecule? \( (N_{av} = 6.022 \times 10^{23} \text{ mol}^{-1}) \)
   A. 1.18 x 10^{-22} g  B. 5.89 x 10^{-23} g  C. 70.906 g  D. 4.27 x 10^{-25} g

7. ___ What is the difference between a uranium atom and a uranium ion? The number of:
   A. electrons  B. protons  C. neutrons  D. protons + neutrons

8. ___ Listed are four important postulates of Dalton’s atomic theory. Which one is invalid in the version of the atomic theory currently used by chemists?
   A. Each element is composed of indestructible particles called atoms
   B. All atoms of an element have the same mass and other chemical properties
   C. Atoms combine in simple, integer ratios to form compounds
   D. Atoms of one element cannot change into atoms of another element in a chemical reaction.

9. ___ Select the subatomic particle(s) that is(are) most directly involved in chemical reactions.
   A. electrons  B. protons + electrons  C. neutrons  D. protons + neutrons

10. ___ Select the two subatomic particles that have approximately the same mass.
    I. proton  II. electron  III. neutron
    A. I & II  B. II & III  C. I & III  D. all have the same mass
11. Europium (Z = 63) has two stable isotopes, $^{151}\text{Eu}$ (mass = 150.9197 amu) and $^{153}\text{Eu}$ (mass = 152.9212 amu). Calculate the percent abundance of $^{153}\text{Eu}$.

A. 46.0%  
B. 48.0%  
C. 52.0%  
D. 50.0%

12. Each $^{238}\text{U}^{4+}$ ion has _____ electrons.

A. 96  
B. 146  
C. 92  
D. 88

13. The compound formed when calcium reacts with phosphorus contains ________ bonds.

A. covalent  
B. ionic  
C. amorphous  
D. crystalline

14. The empirical formula of the binary compound formed when calcium reacts with phosphorus is:

A. CaP  
B. CaP$_2$  
C. Ca$_3$(PO$_4$)$_2$  
D. Ca$_3$P$_2$

15. In the binary compound formed when calcium reacts with phosphorus,

A. electrons are transferred from calcium to phosphorus  
B. electrons are transferred from phosphorus to calcium  
C. electrons are shared between calcium and phosphorus  
D. no electron sharing or transfer is involved

16. In the binary compound formed when calcium reacts with phosphorus, both calcium and phosphorus have the same number of electrons as:

A. K  
B. Cl  
C. S  
D. Ar

17. Balance the following chemical reaction: (answers given as a,b,c,d)

$a$ phosphoric acid + $b$ calcium chloride $\rightarrow$ $c$ calcium phosphate + $d$ hydrochloric acid

A. 1,1,1,1  
B. 2,1,4,2  
C. 2,3,1,6  
D. 3,1,6,2

18. Compounds containing C, H and O will combust in an excess of oxygen gas to produce carbon dioxide and water. How many mol of oxygen gas are required to completely combust 3.33 mol of C$_6$H$_6$O$_6$?

A. 50.0 mol  
B. 30.0 mol  
C. 25.0 mol  
D. 15.0 mol

19. Cerium (Z = 58) forms two oxides, CeO$_2$ and Ce$_2$O$_3$. The systematic name of Ce$_2$O$_3$ is:

A. dicerium trioxide  
B. cerium(II) trioxide  
C. cerium(III) oxide  
D. cerium(II) oxide

20. Which of the following elements is a metalloid?

A. Na  
B. As  
C. Al  
D. Cr
21. ___ The name given to the elements in group 15 (5A) of the periodic table is:
   A. chalcogens  B. alkaline earths  C. pnictogens  D. halogens

22. ___ The systematic name of Mg(HSO₃)₂ is:
   A. magnesium hydrogen sulfate  B. magnesium dihydrogen sulfite
   C. magnesium(II) hydrogen sulfite  D. magnesium hydrogen sulfite

23. When 5.00 g of white phosphorus (P₄) burns in 5.00 g oxygen gas, 5.00 g of tetraphosphorus decaoxide (283.89 g/mol) is produced. Use this information to answer the following questions:
   (a) What is the limiting reactant?
   (b) Calculate the theoretical yield, in grams, of tetraphosphorus decaoxide.
   (c) Calculate the percent yield of tetraphosphorus decaoxide.
   (d) How many grams of the reactant that is in excess will be left unreacted?

24. Ilmenite, FeTiO₃, is a valuable mineral which is mined and then converted to the white pigment titanium(IV) oxide used in paints, make-up and sunscreens.
   (a) Calculate the molar mass of ilmenite to 3 significant figures.
   (b) Calculate the mass percent of Ti in ilmenite.
   (c) How many grams of iron are in 1.00 kg of ilmenite?
   (d) How many oxygen atoms are in 1.00 kg of ilmenite? (Nₐᵥ = 6.022 x 10²³ mol⁻¹)

25. Acetylene (26.04 g/mol) is a reactive hydrocarbon used in welding. The percent composition of carbon is 92.26%.
   (a) Determine the empirical formula of acetylene.
   (b) What is the molecular formula of acetylene?
### ANSWERS

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23. (a) $O_2$ is the limiting reactant  
(b) 8.87 g  
(c) 56.4%  
(d) 1.13 g

24. (a) 152 g/mol  
(b) 31.5%  
(c) 367 g  
(d) $1.19 \times 10^{25}$

25. (a) $\text{CH}$  
(b) $\text{C}_2\text{H}_2$