Example Questions for Quiz 6 – Solutions
Chapters 9 – Chemical Bonds
and
Chapter 10 – Chemical Reactions

Here are some questions that are similar to what will be on Quiz 6.
The quiz will have a total of 20 points selected from these possibilities.
You may use your equation and symbol sheets as well as your Periodic Table of Elements.

1. (1 points) In the following chemical reaction, the (**reactants**, ~~products~~) are at the left side of the double arrow.

$$2H_2 + O_2 \Rightarrow 2H_2O + \text{energy}$$

2. (1 point) In the following chemical reaction, the (~~hydrogen and oxygen~~, **water**) molecules are the most tightly held together and therefore are in a lower energy state.

$$2H_2 + O_2 \Rightarrow 2H_2O + \text{energy}$$

3. (2 points) In the lab, we produced hydrogen and oxygen gases in a plastic bag, but the reaction $2H_2 + O_2 \Rightarrow 2H_2O + \text{energy}$ did not happen even though they were colliding into each other many times every microsecond. This was because at room temperature they did not collide with sufficient speed to overcome the reaction __**energy**__ __**barrier**__.

4. (5 points) Write the chemical formula that shows how methane gas CH_4 burns in the presence of oxygen O_2 by inserting the smallest, correct 4 numbers and word:

$$\mathbf{\_\_1\_\_\ CH_4 + \_\_\_2\_\_\ O_2 \Rightarrow \_\_\_1\_\_\ CO_2 + \_\_2\_\_\ H_2O + \_\_\_energy\_\_\_}$$

5. (5 points) When a sodium atom loses its outermost electron, it becomes a (**positive**, ~~negative~~) sodium ___**ion**___ and its remaining electrons have a non-reactive structure very similar to that of a __**neon**___ atom.

6. (5 points) When a chlorine atom gains an electron, it becomes a (~~positive~~, **negative**) chlorine ___**ion**___ and its electrons then have a non-reactive structure very similar to that of a ___**argon**___ atom.

7. (6 points) The three general classes of chemical bonds that hold molecules and crystals together are __**ionic**__ bonds when the atoms completely lose or gain each other's outermost electrons, __**covalent**__ bonds when adjacent atoms share their outermost electrons, and _**metallic**_ bonds when the outermost electrons are shared by an entire crystal formed by the atoms.

8. (2 points) Salt crystals NaCl are held together by __**ionic**___ bonds.

9. (2 points) Gold crystals are held together by _**metallic**_ bonds.

10. (2 points) Methane molecules are held together by _**covalent**_ bonds.

11. (2 points) Oxygen molecules are held together by _**covalent**_ bonds.

12. (4 points) Water molecules are held together primarily by **_covalent_** bonding, but it is not evenly balanced. The shared electrons spend more time around the oxygen atom. This uneven bonding forms what is called an electric **_dipole_** moment that turns out to be very important in determining the properties of water and water solutions.

13. (2 points) The electromagnetic energy within a microwave oven is transferred to the **__dipole__** moments of water molecules in the food causing the food to heat up.

14. (2 points) The formula for the ionic compound formed by Na and Cl ions is **__NaCl___**.

15. (2 points) The formula for the ionic compound formed by Ca and Cl ions is **__$CaCl_2$__**.

16. (2 points) The formula for the ionic compound formed by Mg and O ions is **___MgO___**.

17. (2 points) The formula for the ionic compound formed by H and F ions is **___HF____**.

18. (2 points) The formula for the ionic compound formed by H and S ions is **___H_2S___**.

19. (3 points) The formula for the hydroxide polyatomic ion formed by one O and one H is **__$(OH)^-$___**.
Be sure to put parentheses around it and show its net charge.

20. (3 points) The formula for the carbonate polyatomic ion formed by one C and three O's is **__$(CO_3)^{--}$__**.
Be sure to put parentheses around it and show its net charge.

21. (3 points) The formula for the ammonium polyatomic ion formed by one N and four H's is **__$(NH_4)^+$__**.
Be sure to put parentheses around it and show its net charge.

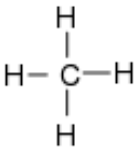
22. (2 points) The formula for the ionic compound formed by an Mg and OH ions is **__$Mg(OH)_2$__**.

23. (2 points) The formula for the ionic compound formed by an Na and OH ions is **___NaOH__**.

24. (2 points) The formula for the ionic compound formed by an Ca and CO_3 ions is **__$CaCO_3$__**.

25. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for CO_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

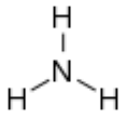
26. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for methane CH_4 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



27. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for molecular oxygen O_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

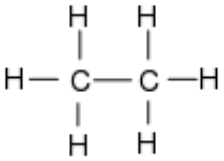
28. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for molecular nitrogen N_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

29. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for ammonia NH_3 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

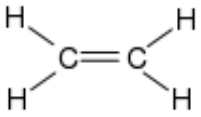


30. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for Cl_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

31. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for ethane C_2H_6 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

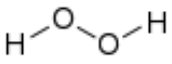


32. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for ethylene C_2H_4 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

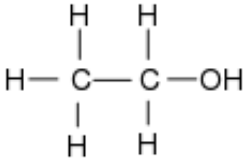


33. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for acetylene C_2H_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**

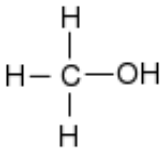
34. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for hydrogen peroxide H_2O_2 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



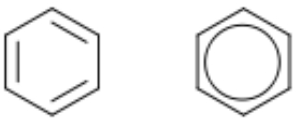
35. (5 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for ethyl alcohol C_2H_5OH in the space to the right. (This is the alcohol that makes people do foolish things when drunk.) **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



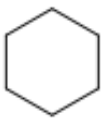
36. (5 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for methyl alcohol CH_3OH in the space to the right. (This is the alcohol that blinds a person when drunk). **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



37. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for benzene C_6H_6 in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



38. (4 points) Based on our lab molecular models of covalent compounds, draw the bonding diagram for cyclohexane C_6H_{12} . in the space to the right. **Be sure to show the correct bonding - single, double, or triple - in your diagram.**



39. (2 points) What is the molecular weight of water H_2O? (Give your answer with an accuracy of 0.01 g.)

$$2\times 1.01\,\text{g}+1\times 16.00\,\text{g}=18.02\,\text{g}$$

40. (2 points) What is the molecular weight of methane CH_4? (Give your answer with an accuracy of 0.01 g.)

$$1\times 12.01\,\text{g}+4\times 1.01\,\text{g}=16.05\,\text{g}$$

41. (3 points) What is the molecular weight of ethyl alcohol C_2H_5OH? (Give your answer with an accuracy of 0.01 g.)

$$2\times 12.01\,\text{g}+5\times 1.01\,\text{g}+1\times 16.00\,\text{g}+1\times 1.01\,\text{g}=46.08\,\text{g}$$

42. (2 points) What is the molecular weight of water NaCl? (Give your answer with an accuracy of 0.01 g.)

$$1\times 22.99+1\times 35.45\,\text{g}=58.44\,\text{g}$$

43. (3 points) What is the molecular weight of the common cooking sugar sucrose $C_{12}H_{22}O_{11}$? (Give your answer with an accuracy of 0.01 g.)

$$12\times 12.01\,\text{g}+22\times 1.01\,\text{g}+11\times 16.00\,\text{g}=342.34\,\text{g}$$

44. (2 points) How many atoms or molecules are in 2 mols of a substance?

$$2\,\text{mol}\times 6.02\times 10^{23}\,\text{atoms or molecules/mol}=12.04\times 10^{23}\,\text{atoms or molecules}$$

45. (2 points) How many moles are in 54.06 g of water?

$$\frac{54.06\,\text{g}}{\left(2\times 1.01\,\text{g}+1\times 16.00\,\text{g}\right)}=3.00\,\text{mol}$$

46. (6 points) Balance the following equation for the combustion of ethyl alcohol by putting in 4 numbers and adding a word.

$$\_\_1\_\_\,C_2H_5OH+\_\_3\_\_\,O_2\Rightarrow\ \_\_2\_\_\,CO_2+\_\_3\_\_\,H_2O+\_\_\_energy\_\_$$

47. (8 points) Balance the following equation for the combustion of octane, the major component of gasoline, by putting in 4 numbers and adding a word.

$$\_\_2\_\_\,C_8H_{18}+\_25\_\,O_2\Rightarrow\ \_16\_\,CO_2+\_18\_\,H_2O+\_\_energy\_\_$$