bonding

1) Draw an electron-dot diagram for *each* of the following substances:

a CaO(an ionic compound)

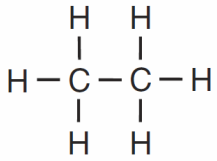
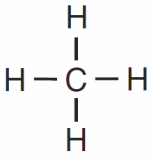
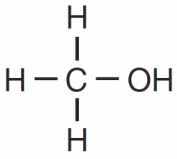
b HBr

c N_2

Base your answers to questions **2** and **3** on the information below and on your knowledge of chemistry.

The formulas and the boiling points at standard pressure for ethane, methane, methanol, and water are shown in the table below.

Information for Four Compounds

Name	Formula	Boiling Point (°C)
ethane		–88.6
methane		–161.5
methanol		64.6
water		100.0

2) Explain, in terms of molecular polarity, why the solubility of methanol in water is greater than the solubility of methane in water.

3) Identify the compound that has the strongest intermolecular forces.

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4) Identify the type of bonding in solid potassium.

Base your answers to questions **5** and **6** on the information below and on your knowledge of chemistry.

Rubbing alcohol is a product available at most pharmacies and supermarkets. One rubbing alcohol solution contains 2-propanol and water. The boiling point of 2-propanol is 82.3°C at standard pressure.

5) Explain, in term of charge distribution, why a molecule of the 2-propanol is a polar molecule.

6) Draw a structural formula formula for the 2-propanol.

Base your answers to questions **7** through **9** on the information below and on your knowledge of chemistry.

The balanced equation below represents a reaction.

$$O_2(g) + \text{energy} \rightarrow O(g) + O(g)$$

7) Explain, in terms of bonds, why energy is absorbed during this reaction.

8) Draw a Lewis electron-dot diagram of one oxygen atom.

9) Identify the type of chemical bond in a molecule of the reactant.

10) Base your answer to the following question on the information below.

Ammonium chloride is dissolved in water to form a 0.10 M $NH_4Cl(aq)$ solution. This dissolving process is represented by the equation below.

$$NH_4Cl(s) + \text{heat} \xrightarrow{H_2O} NH_4{}^+(aq) + Cl^-(aq)$$

Determine the minimum mass of $NH_4Cl(s)$ required to produce a saturated solution in 100. grams of water at 40.°C.

Base your answers to questions **11** through **14** on the information below.

During a fireworks display, salts are heated to very high temperatures. Ions in the salts absorb energy and become excited. Spectacular colors are produced as energy is emitted from the ions in the form of light.

The color of the emitted light is characteristic of the metal ion in each salt. For example, the lithium ion in lithium carbonate, Li_2CO_3, produces a deep-red color. The strontium ion in strontium carbonate, $SrCO_3$, produces a bright-red color. Similarly, calcium chloride is used for orange light, sodium chloride for yellow light, and barium chloride for green light.

11) Explain, in terms of subatomic particles and energy states, how the colors in a fireworks display are produced.

12) Determine the oxidation state of carbon in the salt used to produce a bright-red color.

13) Identify the *two* types of chemical bonds found in the salt used to produce a deep-red color.

14) Write the formula for the salt used to produce green light in a fireworks display.

Base your answers to questions **15** through **17** on the information below.

In 1864, the Solvay process was developed to make soda ash. One step in the process is represented by the balanced equation below.

$$NaCl + NH_3 + CO_2 + H2O \rightarrow NaHCO_3 + NH_4Cl$$

15) In the space draw a Lewis electron-dot diagram for the reactant containing nitrogen in the equation.

16) Explain, in terms of electronegativity difference, why the bond between hydrogen and oxygen in a water molecule is more polar than the bond between hydrogen and nitrogen in an ammonia molecule.

17) Write the chemical formula for *one compound in the equation that contains both ionic bonds and covalent bonds.*

Base your answers to questions **18** through **20** on the information below.

Ozone, $O_3(g)$, is produced from oxygen, $O_2(g)$ by electrical discharge during thunderstorms. The unbalanced equation below represents the reaction that forms ozone.

$$O_2(g) \xrightarrow{\text{electricity}} O_3(g)$$

18) Explain, in terms of electron configuration, why an oxygen molecule is more stable than an oxygen atom.

19) Identify the type of bonding between the atoms in an oxygen molecule.

20) Balance the equation for the production of ozone, using the smallest whole-number coefficients.

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21) Base your answer to the following question on the information below.

Physical Properties of CF_4 and NH_3 at Standard Pressure

Compound	Melting Point (°C)	Boiling Point (°C)	Solubility in Water at 20.0°C
CF_4	−183.6	−127.8	insoluble
NH_3	−77.7	−33.3	soluble

In the space *in your answer booklet*, draw a Lewis electron-dot diagram for CF_4.

22) Base your answer to the following question on the information below.

At STP, iodine, I_2, is a crystal, and fluorine, F_2, is a gas. Iodine is soluble in ethanol, forming a tincture of iodine. A typical tincture of iodine is 2% iodine by mass.

Draw a Lewis electron-dot diagram for a molecule of I_2.

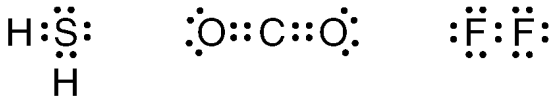
23) Draw a Lewis electron-dot diagram for a molecule of phosphorus trichloride, PCl_3

24) Base your answer to the following question on the balanced equation below.

$$2Na(s) + Cl_2 \rightarrow 2NaCl(s)$$

Draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2.

25) Base your answer to the following question on your knowledge of chemical bonding and on the Lewis electron-dot diagrams of H_2S, CO_2, and F_2 below.



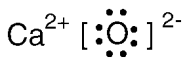
Explain, in terms of electronegativity, why a C–O bond in CO_2 is more polar than the F–F bond in F_2.

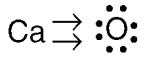
Answer Key

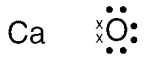
Review # 2: Bonding

1)

a.

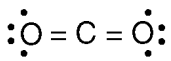


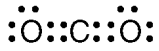




b.

c.





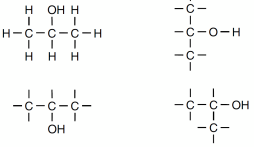
2) –Methanol and water molecules are polar, but methane molecule are nonpolar. –The compounds methanol and water have similar polarities.

3) H_2O/water

4) –metallic bonding –metallic

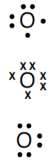
5) – A 2-proponal molecule is polar because it has an asymmetrical distribution of charge. – The charge distribution is uneven. – The center of positive charge and the center of negative charge do *not* coincide

6)



7) –Energy is needed to break the bonds in O_2.

8)



9) –covalent –double covalent –nonpolar –double

10) 47 g ± 1 g.

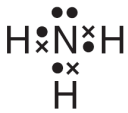
11) —When electrons in the ions move from higher energy states to lower energy states, lights of specific wavelengths are emitted. — Light is emitted when electrons return from higher electron shells to lower electron shells.

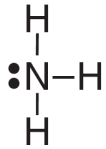
12) +4

13) ionic bonds and polar covalent bonds/covalent and ionic

14) $BaCl_2$

15)





16) – The electronegativity difference is 1.4 for H and O, which is higher than the 0.9 for H and N. – The difference in electronegativity between hydrogen and oxygen is greater than that for hydrogen and nitrogen.

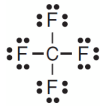
17) $NaHCO_3$ *or* NH_4Cl.

18) – Both atoms in an O2 molecule have achieved a noble gas electron configuration. – An oxygen atom does not have a stable octet of valence electrons.

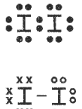
19) – nonpolar covalent – covalent – double covalent

20) 

21)



22)



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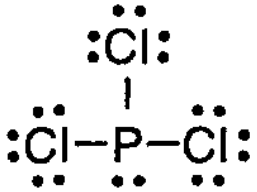

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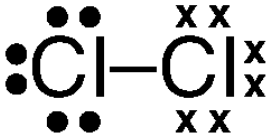

25) Responses include, but are not limited to: The electronegativity difference in a carbon-oxygen bond is greater than the electronegativity difference in a fluorine-fluorine bond The EN difference for C and O is 0.9 and the EN difference for F and F is 0.