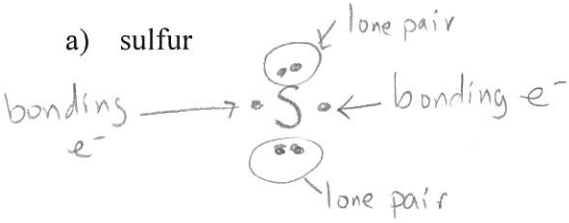
Bonding Review Worksheet

1. Complete the following chart: (first line is done as an example)

isotope symbol	isotope name	atomic number (Z)	mass number (A)	number of protons	number of neutrons
$^{235}_{92}U$	uranium-235	92	235	92	143
		51	123		
				49	121
$^{180}_{72}Hf$					

2. Draw Lewis (dot) diagrams for the following elements:
circle and label *lone pairs* and *bonding electrons*

a) sulfur



b) carbon

3. What is the **name** for the *electron configuration* that main group elements attempt to achieve through chemical bonding?

- stable octet

4. Ionic compounds achieve the configuration named above by electron transfer.
Write an electron transfer equation for the formation of:

a) zinc suflide

b) magnesium chloride

↖ the brackets indicate a transfer and not sharing. These are ionic compounds.

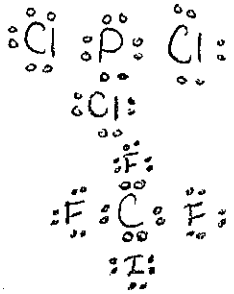
5. Molecular compounds achieve the stable electron configuration by sharing electrons.

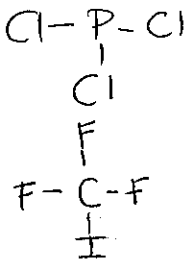
a) What is the name of this bond type?

covalent

b) Draw Lewis diagrams (also called Lewis structures) for: (do 1st on scrap paper)

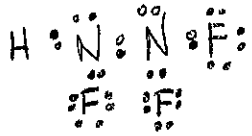
i) PCl_3

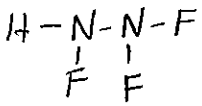




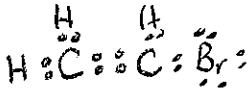
ii) CF_3I

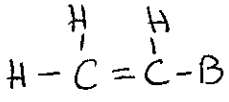
iii) N_2HF_3



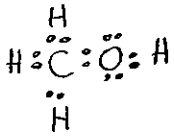


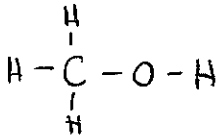
iv) C_2H_3Br





v) CH_3OH

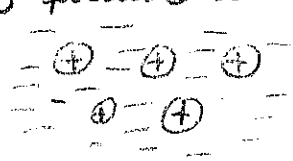




6. Draw structural formulas (not VSEPR structures) for the compounds in 5b. Do them beside your Lewis diagrams in the space above.

7. Summarize metallic bonding in one short phrase. – a network of positive ions in a sea of electrons

– the attraction between positive ions & the sea of electrons



8. Complete the following chart:

I or M	Name	Chemical Formula
M	dinitrogen pentasulfide	N_2S_5
I	aluminium carbonate	$Al_2(CO_3)_2(s)$
I	copper (I) chromate	Cu_2CrO_4
I	strontium hydroxide	$Sr(OH)_2(s)$
I	potassium permanganate	$KMnO_4$
M	glucose	$C_6H_{12}O_6(s)$

9. Figure 1.19 on page 37 of Inquiry into Chemistry shows that:
   - atomic size ↓ as you move from left to right in a given period
   - electronegativity ↑ as you move from left to right in a given period
   - electronegativity ↓ as you move from top to bottom in a given group

   Explain each of these trends.

   - because there are more protons in the nucleus they pull the electrons closer
   - because the molecule is smaller electrons from other atoms can get closer & are therefore more attracted
   - the atoms get larger & have more electrons around them so electrons from other atoms are not as attracted

10. Explain how electronegativity accounts for the type of bond, ionic or covalent, that occurs between two different elements. Recall Figure 1.22 on page 40.

    - when there is a large difference in electronegativity (≥ 1.7 or) the electrons transfer & bond is ionic,
    - when the difference is less (≥ 1.7 or <) the electrons are shared - the bigger this number the less equal the sharing

11. For each of the following pairs of atoms, predict whether a bond between them will be non-polar covalent, slightly polar covalent, polar covalent, or mostly ionic. **Use the symbols shown in Figure 1.23 on page 41 to indicate polarity if the bond is polar covalent.**

    oxygen and hydrogen $\overset{\delta^-}{O}\ (3.4) - \overset{\delta^+}{H}\ (2.2)$ polar covalent

    sodium and chlorine ionic

    carbon and selenium $C\ (2.6) - Se\ (2.6)$ – nonpolar covalent

    carbon and hydrogen $\overset{\delta^-}{C}\ (2.6) - \overset{\delta^+}{H}\ (2.2)$ – slightly polar

12. The shape of an ionic crystal is determined by 2 factors. They are:
    -
    -

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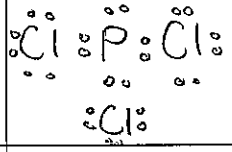
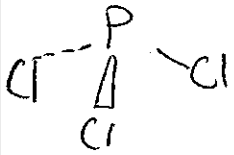
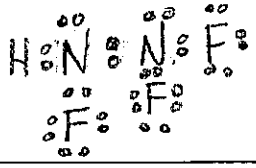
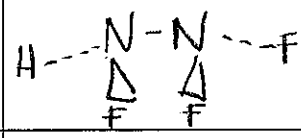
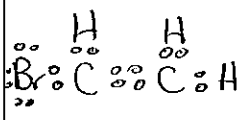
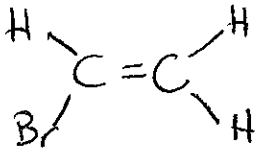
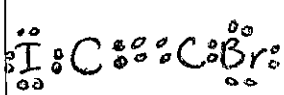
13. Atoms get smaller as you move from left to right across a period on the periodic table. Monatomic ions do the opposite. Explain why.

14. Complete the following chart:

name and/or formula	Lewis Diagram	around central atom # LP	around central atom # BP	name of shape around each central atom	VSEPR Diagram	Polar or Non-polar
phosphorus trichloride PCl_3		1	3	pyramidal		polar
N_2HF_3		1	3	pyramidal		polar
bromoethene C_2H_3Br		0	3	trigonal planar		polar
C_2IBr		0	2	liner		polar

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15. Rank, in order of decreasing strength, the following repulsive interactions:

bonding pair/bonding pair, lone pair/lone pair, lone pair/bonding pair

16. Explain why diamond is a hard, brittle solid, while graphite is strong, flexible, and slippery, even though both are composed of pure carbon.

- diamond has a perfect tetrahedral structure and all the bonds are equal

- in graphite the bonds are not all the same strength ↓ the weaker ones break easier making it flexible & slippery.

17. Covalent and ionic bonds are each examples of intramolecular forces.

Intermolecular forces can be divided into 3 types:

- London dispersion
- dipole-dipole
- hydrogen bonding

18. For each of the intermolecular forces in question 16, state how to determine whether or not it is present and state the main factor determining its relative strength if this is applicable.

- everything has this force - the more electrons the stronger the force.
- molecules that are polar have it. The more polar the more force.
- occurs when O is bonded to N, F or H. More hydrogens bonds → more force

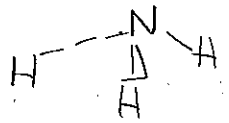
19. Predict which of the following pairs of substances will have the higher boiling point. State all bond types involved. Note, these are not all molecular substances.

a) CHF_3 – more L.D. – higher – dipole-dipole or CH_3F – L.D – dipole-dipole

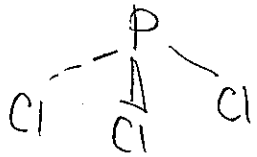
b) NaCl – ionic – Higher! or C_2F_6 molecular – L.D.

c) V – Metallic – higher or Li_2O Ionic

d) NH_3 or PCl_3



– L.D
– dipole-dipole
– hydrogen bonding



– more L.D.
– dipole-dipole

20. Explain, using the metallic bonding model, why metals are malleable.

21. Define or describe the following terms:
electronegativity

network solid

lone pair

tetrahedral shape

polar molecule

ionic crystal lattice

polar covalent bond

orbital

Answers – next page

more practice → p. 138 # 35, 38, 41, 43, 44, 47, 48, 49, 50
→ Nelson text

Answers

1.

isotope symbol	isotope name	atomic number (Z)	mass number (A)	number of protons	number of neutrons
$^{235}_{92}U$	uranium-235	92	235	92	143
$^{123}_{51}Sb$	antimony-123	51	123	51	72
$^{170}_{49}In$	indium-170	49	170	49	121
$^{180}_{72}Hf$	hafnium-180	72	180	72	108

2. p. 8
3. p. 18
4. p. 20-1
5. p. 9, 23-25
6. p. 31
7. p. 32, 76
8. p. 10-3, 32-4
9. p. 36-8
10. p. 39-40
11. p. 39-40
12. p. 48-9
13. p. 49
14. p. 52-56 (shape), p. 57-9 (polarity)
15. p. 52
16. p.60-1
17. p. 63—8
18. p. 63-8\
19. p. 63-8
20. p. 75
21. throughout – I encourage to look for the answers in your text rather than just looking them up in the glossary