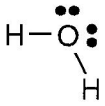
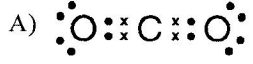
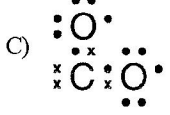
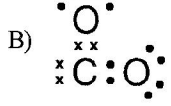



PRACTICE QUESTIONS 2/10/13

Name: _____

- Which species represents a chemical compound?
 - N_2
 - $NaHCO_3$
 - NH_4^+
 - Na
- What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?
 - A chemical bond is formed and energy is released.
 - A chemical bond is formed and energy is absorbed.
 - A chemical bond is broken and energy is released.
 - A chemical bond is broken and energy is absorbed.
- As two chlorine atoms combine to form a molecule, energy is
 - absorbed
 - released
 - destroyed
 - created
- Which of the following atoms has the *greatest* tendency to attract electrons?
 - beryllium
 - boron
 - barium
 - bromine
- Which of the following elements has the *least* attraction for electrons in a chemical bond?
 - oxygen
 - chlorine
 - nitrogen
 - fluorine
- Which element has atoms with the *greatest* attraction for electrons in a chemical bond?
 - oxygen
 - lithium
 - beryllium
 - fluorine
- Based on the *Properties of Selected Elements* chemistry reference table, the atoms of which of these elements have the *strongest* attraction for electrons in a chemical bond?
 - Pt
 - Na
 - N
 - P
- Based on the *Properties of Selected Elements* chemistry reference table, atoms of which of these elements have the *strongest* attraction for the electrons in a chemical bond?
 - P
 - Si
 - Al
 - S
- Which type of bond results when one or more valence electrons are transferred from one atom to another?
 - an ionic bond
 - a polar covalent bond
 - a hydrogen bond
 - a nonpolar covalent bond
- Which type of bond is formed when electrons are transferred from one atom to another?
 - covalent
 - ionic
 - metallic
 - hydrogen
- Which formula represents an ionic compound?
 - H_2O
 - CH_4
 - KCl
 - NH_3
- Which formula represents an ionic compound?
 - HCl
 - NaCl
 - H_2O
 - N_2O
- Which compound contains ionic bonds?
 - CO_2
 - NO_2
 - NO
 - CaO
- Which type of bond is found in sodium bromide?
 - metallic
 - ionic
 - hydrogen
 - covalent
- Which of the following solids has the *highest* melting point?
 - $CO_2(s)$
 - $SO_2(s)$
 - $Na_2O(s)$
 - $H_2O(s)$
- A substance that does *not* conduct electricity as a solid but does conduct electricity when melted is most likely classified as
 - an ionic compound
 - a nonmetal
 - a molecular compound
 - a metal
- What is the correct Lewis electron-dot structure for the compound magnesium fluoride?
 - $Mg \cdot \cdot F \cdot \cdot$
 - $\cdot \cdot F \cdot \cdot \cdot \cdot Mg \cdot \cdot \cdot \cdot F \cdot \cdot$
 - $\left[\cdot \cdot F \cdot \cdot \right]^- Mg^{2+} \left[\cdot \cdot F \cdot \cdot \right]^-$
 - $Mg^+ \left[\cdot \cdot F \cdot \cdot \right]^-$
- The bonds in the compound $MgSO_4$ can be described as
 - neither ionic nor covalent
 - both ionic and covalent
 - covalent, only
 - ionic, only
- Which compound contains *both* ionic and covalent bonds?
 - CH_2O
 - PCl_3
 - $CaCO_3$
 - MgF_2

- 28) Which molecule contains a triple covalent bond?
 A) Cl_2 C) O_2
 B) N_2 D) H_2
- 29) What is the total number of electrons shared in a double covalent bond between two atoms?
 A) 1 B) 2 C) 8 D) 4
- 30) What is the total number of electrons shared in the bonds between the two carbon atoms in a molecule of $\text{H}-\text{C}\equiv\text{C}-\text{H}$?
 A) 8 B) 6 C) 3 D) 2
- 31) Which characteristic is a property of molecular substances?
 A) good heat conductivity
 B) high melting point
 C) low melting point
 D) good electrical conductivity
- 32) Which type of bonding is found in all molecular substances?
 A) metallic bonding C) ionic bonding
 B) covalent bonding D) hydrogen bonding
- 33) The bonds between hydrogen and oxygen in a water molecule are classified as
 A) polar covalent C) nonpolar covalent
 B) metallic D) ionic
- 34) Which substance is correctly paired with its type of bonding?
 A) Br_2 — polar covalent
 B) HCl — nonpolar covalent
 C) NaBr — nonpolar covalent
 D) NH_3 — polar covalent
- 35) Which molecule contains a nonpolar covalent bond?
 A) $\text{O}=\text{C}=\text{O}$ C) $\begin{array}{c} \text{Cl} \\ | \\ \text{Cl}-\text{C}-\text{Cl} \\ | \\ \text{Cl} \end{array}$
 B) $\text{Br}-\text{Br}$ D) $\text{C}\equiv\text{O}$
- 36) Which of these formulas contains the *most* polar bond?
 A) $\text{H}-\text{F}$ C) $\text{H}-\text{Br}$
 B) $\text{H}-\text{I}$ D) $\text{H}-\text{Cl}$
- 37) Which bond is *least* polar?
 A) $\text{P}-\text{Cl}$ C) $\text{N}-\text{Cl}$
 B) $\text{Bi}-\text{Cl}$ D) $\text{As}-\text{Cl}$
- 38) Which molecule is nonpolar?
 A) NH_3 C) CO_2
 B) CO D) H_2O
- 39) Which formula represents a nonpolar molecule?
 A) NH_3 C) HCl
 B) CH_4 D) H_2S
- 40) Which formula represents a nonpolar molecule?
 A) H_2O C) CF_4
 B) NH_3 D) HCl
- 41) Which type of molecule is CF_4 ?
 A) nonpolar, with an asymmetrical distribution of charge
 B) polar, with an asymmetrical distribution of charge
 C) polar, with a symmetrical distribution of charge
 D) nonpolar, with a symmetrical distribution of charge
- 42) Which pair of characteristics describes the molecule illustrated below?


 A) asymmetrical and nonpolar
 B) symmetrical and nonpolar
 C) asymmetrical and polar
 D) symmetrical and polar
- 43) Which Lewis electron-dot diagram is correct for CO_2 ?
 A)  C) 
 B)  D) 
- 44) Conductivity in a metal results from the metal atoms having
 A) highly mobile protons in the nucleus
 B) high ionization energy
 C) high electronegativity
 D) highly mobile electrons in the valence shell
- 45) Metallic bonding occurs between atoms of
 A) sulfur C) copper
 B) carbon D) fluorine
- 46) Which substance contains metallic bonds?
 A) $\text{NaCl}(s)$ C) $\text{C}_6\text{H}_{12}\text{O}_6(s)$
 B) $\text{Hg}(l)$ D) $\text{H}_2\text{O}(l)$
- 47) Molecules in a sample of $\text{NH}_3(l)$ are held closely together by intermolecular forces
 A) caused by different numbers of neutrons
 B) caused by unequal charge distribution
 C) existing between electrons
 D) existing between ions

- 48) Which intermolecular force of attraction accounts for the relatively high boiling point of water?
 A) ionic bonding C) hydrogen bonding
 B) metallic bonding D) covalent bonding
- 49) Based on intermolecular forces, which of these substances would have the *highest* boiling point?
 A) He C) NH₃
 B) CH₄ D) O₂
- 50) Which of the following compounds has the *highest* boiling point?
 A) H₂Se C) H₂Te
 B) H₂O D) H₂S
- 51) Which of these substances has the *strongest* intermolecular forces?
 A) H₂O C) H₂Se
 B) H₂Te D) H₂S
- 52) The *strongest* forces of attraction occur between molecules of
 A) HCl C) HI
 B) HF D) HBr
- 53) The table below shows the normal boiling point of four compounds.

Compound	Normal Boiling Point (°C)
HF(l)	19.4
CH ₃ Cl(l)	-24.2
CH ₃ F(l)	-78.6
HCl(l)	-83.7

Which compound has the *strongest* intermolecular forces?

- A) CH₃F(l) C) HF(l)
 B) HCl(l) D) CH₃Cl(l)

Questions 73 and 74 refer to the following:

Properties of Selected Elements

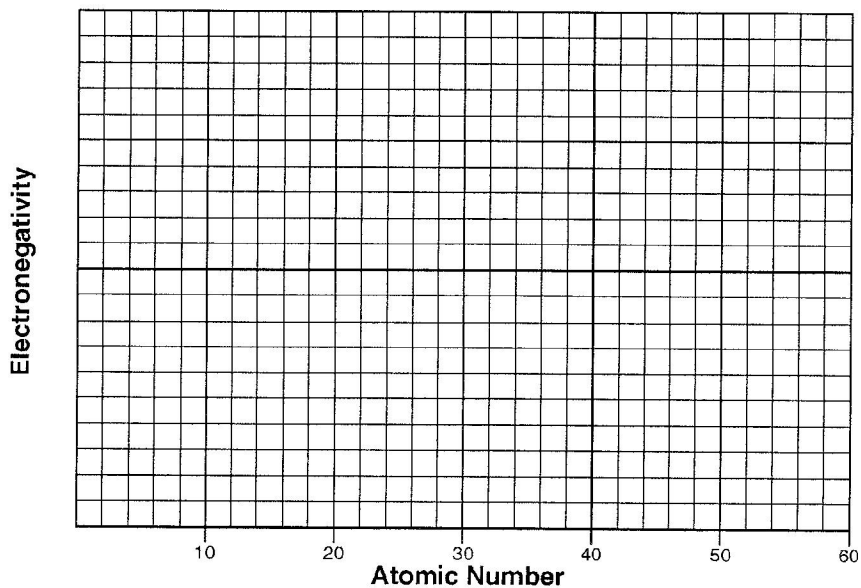
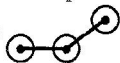
Atomic Number	Symbol	Name	Ionization Energy (kJ/mol)	Electro-negativity	Melting Point (K)	Boiling Point* (K)	Density** (g/cm ³)	Atomic Radius (pm)
1	H	hydrogen	1,312	2.1	14	20	0.00009	37
2	He	helium	2,372	—	1	4	0.000179	32
3	Li	lithium	520	1.0	454	1,620	0.534	155
4	Be	beryllium	900	1.6	1,551	3,243	1.8477	112
5	B	boron	801	2.0	2,573	3,931	2.340	98
6	C	carbon	1,086	2.6	3,820	5,100	3.513	91
7	N	nitrogen	1,402	3.0	63	77	0.00125	92
8	O	oxygen	1,314	3.5	55	90	0.001429	65
9	F	fluorine	1,681	4.0	54	85	0.001696	57
10	Ne	neon	2,081	—	24	27	0.0009	51
16	S	sulfur	1,000	2.6	386	718	2.070	127
17	Cl	chlorine	1,251	3.2	172	239	0.003214	97
18	Ar	argon	1,521	—	84	87	0.001783	88
19	K	potassium	419	0.8	337	1,047	0.862	235
20	Ca	calcium	590	1.0	1,112	1,757	1.550	197
31	Ga	gallium	579	1.8	303	2,676	5.907	141
32	Ge	germanium	762	2.0	1,211	3,103	5.323	137
33	As	arsenic	944	2.2	1,090	889	5.780	139
34	Se	selenium	941	2.6	490	958	4.790	140
35	Br	bromine	1,140	3.0	266	332	3.122	112
51	Sb	antimony	831	2.1	904	1,908	6.691	159
52	Te	tellurium	869	2.1	723	1,263	6.240	142
53	I	iodine	1,008	2.7	387	458	4.930	132
54	Xe	xenon	1,170	2.6	161	166	0.0059	124
55	Cs	cesium	376	0.8	302	952	1.873	267

(adapted)

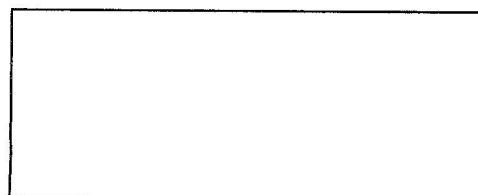
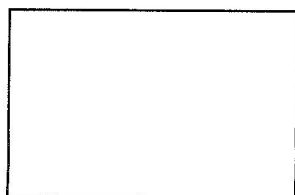
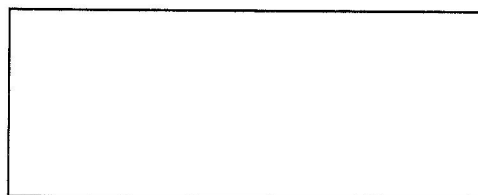
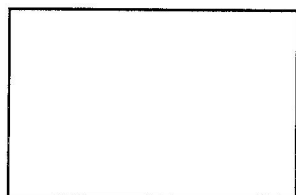
* Boiling point at standard pressure
 ** Density at STP

- 54) (a) On the grid provided, mark an appropriate scale on the axis labeled "Electronegativity" for the data to be graphed in part (b). An appropriate scale is one that allows a trend to be seen.
- (b) On the same grid, plot the electronegativity and atomic number data for fluorine, chlorine, bromine, and iodine from the portion of the *Properties of Selected Elements* chemistry reference table shown. Circle and connect the points.

EXAMPLE:

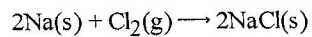


- 55) Explain, in terms of electronegativity, why an H—F bond is expected to be more polar than an H—I bond.
- 56) In the box below, draw the electron-dot (Lewis) structure of an atom of calcium.
- 57) In the box below, draw the electron-dot (Lewis) structure of an atom of chlorine.
- 58) In the box below, draw the electron-dot (Lewis) structure of calcium chloride.
- 59) In the box below, draw the electron-dot (Lewis) structure of calcium oxide (an ionic compound).



Questions 56 and 57 refer to the following:

Given the balanced equation below:



- 60) In the box provided, draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2 .

- 61) Explain, in terms of electrons, why the bonding in NaCl is ionic.

- 62) In the box below, draw the electron-dot (Lewis) structure of hydrogen bromide.

- 65) In the boxes below, draw a correct Lewis electron-dot structure for:

- (a) an atom of hydrogen
- (b) an atom of nitrogen
- (c) a molecule of ammonia (NH_3)

(a) hydrogen

(b) nitrogen

(c) ammonia

- 63) In the box below, draw the electron-dot (Lewis) structure of carbon dioxide.

- 64) In the box below, draw a Lewis electron-dot diagram for a molecule of phosphorus trichloride, PCl_3 .

Questions 61 through 64 refer to the following:

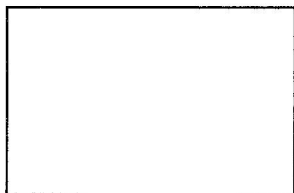
Each molecule listed below is formed by sharing electrons between atoms when the atoms within the molecule are bonded together.

Molecule A: Cl_2

Molecule B: CCl_4

Molecule C: NH_3

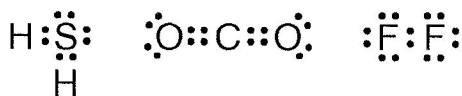
- 66) Draw the electron-dot (Lewis) structure for the NH_3 molecule in the box below.



- 67) Explain why CCl_4 is classified as a nonpolar molecule.
- 68) Explain why NH_3 has stronger intermolecular forces of attraction than Cl_2 .
- 69) Explain how the bonding in KCl is different from the bonding in molecules A, B, and C.

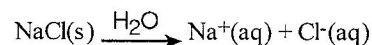
Questions 65 through 67 refer to the following:

The electron-dot diagrams of H_2S , CO_2 , and F_2 are shown below.



- 70) Which atom, when bonded as shown in the diagrams, has the same electron configuration as an atom of argon?
- 71) Explain, in terms of structure and/or distribution of charge, why the CO_2 electron-dot diagram shown is a nonpolar molecule.
- 72) Explain, in terms of electronegativity, why the $\text{C}=\text{O}$ bond in CO_2 is more polar than the $\text{F}-\text{F}$ bond in F_2 in the diagrams shown.

- 73) Given the equation for the dissolving of sodium chloride in water:



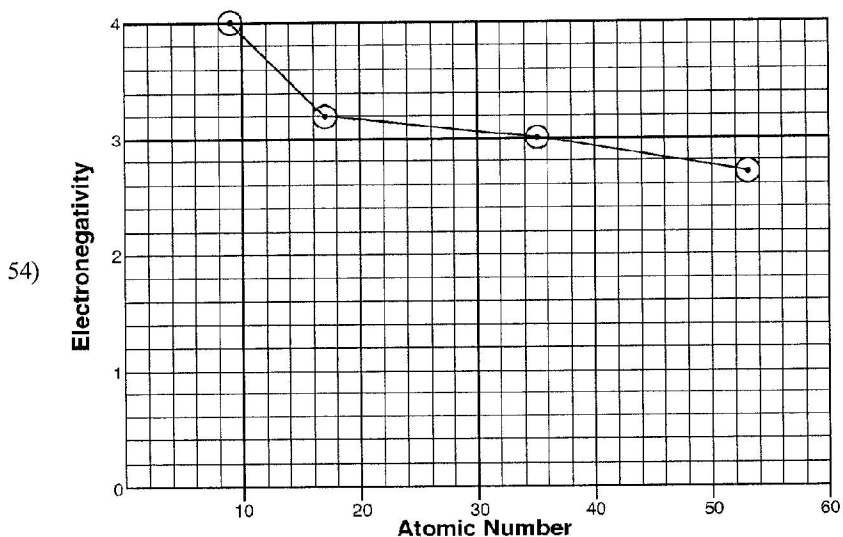
Explain, in terms of particles, why NaCl(s) does *not* conduct electricity.

Questions 69 and 70 refer to the following:

Element X is a solid metal that reacts with chlorine to form a water-soluble binary compound.

- 74) Explain, in terms of particles, why an aqueous solution of the binary compound described conducts an electric current.
- 75) The binary compound described in the statement consists of element X and chlorine in a 1:2 molar ratio. What is the oxidation number of element X in this compound?

- 1) B 2) A 3) B 4) D 5) C
 6) D 7) C 8) D 9) A 10) B
 11) C 12) B 13) D 14) B 15) C
 16) A 17) C 18) B 19) C 20) D
 21) B 22) C 23) C 24) B 25) A
 26) C 27) B 28) B 29) D 30) B
 31) C 32) B 33) A 34) D 35) B
 36) A 37) C 38) C 39) B 40) C
 41) D 42) C 43) A 44) D 45) C
 46) B 47) B 48) C 49) C 50) B
 51) A 52) B 53) C



55) SAMPLE ANSWERS: The difference in electronegativity for an H—F bond is 1.9 and the electronegativity difference for an H—I bond is 0.6. The difference for H—F is greater and therefore H—F is more polar. OR H—F is more polar because F is more electronegative than I.

56) Ca :

57) $\cdot\ddot{\text{Cl}}\cdot$

58) SAMPLE ANSWERS: $[\text{Ca}]^{2+}$ and $[\ddot{\text{Cl}}:]^{-}$ and $[\ddot{\text{Cl}}:]^{-}$ OR $[\text{Ca}]^{2+}$ and $2[\ddot{\text{Cl}}:]^{-}$

59) SAMPLE ANSWERS: $\text{Ca}^{2+} [\ddot{\text{O}}:]^{2-}$ OR $\text{Ca} \Rightarrow \ddot{\text{O}}:$ OR $\text{Ca} \quad \ddot{\text{O}}:$

60) SAMPLE ANSWERS: $\ddot{\text{Cl}}:\ddot{\text{Cl}}:$ OR $\ddot{\text{Cl}}-\overset{\text{xx}}{\underset{\text{xx}}{\text{Cl}}}$

61) SAMPLE ANSWERS: The sodium atom transfers its one valence electron to the chlorine atom. OR $\text{Na} \cdot \rightarrow \cdot \ddot{\text{Cl}} \cdot$ OR Metal loses e^- to nonmetal.

62) $\text{H} \cdot \ddot{\text{Br}} \cdot$ OR $\text{H}-\ddot{\text{Br}}$

63) SAMPLE ANSWERS: $\ddot{\text{O}}=\text{C}=\ddot{\text{O}}$ OR $\ddot{\text{O}}::\text{C}::\ddot{\text{O}}$

64) SAMPLE ANSWERS: $\begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{Cl}} \times \times \begin{array}{c} \times \times \\ \times \times \end{array} \text{P} \begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{Cl}} \times \times$ OR $\begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{Cl}} \times \times \begin{array}{c} \times \times \\ \times \times \end{array} \text{P} \begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{Cl}} \times \times$

65)

H ·

· · N · ·

$\begin{array}{c} \text{H} \\ \times \\ \times \end{array} \ddot{\text{N}} \begin{array}{c} \times \\ \times \end{array}$ OR $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{N} \\ \\ \text{H} \end{array}$

(a) hydrogen (b) nitrogen (c) ammonia

66) SAMPLE ANSWERS:

$\begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{N}} \begin{array}{c} \times \times \\ \times \times \end{array}$

OR

$\begin{array}{c} \times \times \\ \times \times \end{array} \ddot{\text{N}} \begin{array}{c} \times \times \\ \times \times \end{array}$

OR

$\begin{array}{c} \times \times \\ \times \times \end{array} \text{N} \begin{array}{c} \times \times \\ \times \times \end{array}$
--

67) SAMPLE ANSWERS: The molecule is symmetrical in shape and/or charge. OR Electrons are evenly distributed. OR All polar covalent dipoles cancel — no dipole moments. OR no dipoles

68) SAMPLE ANSWERS: NH_3 has polar molecules that attract each other. OR NH_3 has an unshared pair of electrons around the center atom. OR NH_3 is capable of hydrogen bonding. OR unequal distribution of electrons, in strong attraction

69) SAMPLE ANSWERS: KCl — ionic bond; A, B, C — no ionic bonds OR Atoms do not share electrons when bonding. OR There is a transfer of electrons from K to Cl . OR KCl forms by electrostatic attraction. OR Bonding involves a metal with a nonmetal.

70) S OR sulfur

71) SAMPLE ANSWERS: CO_2 ... is symmetrical. OR ...has an even distribution of charge. OR ...is linear with O at each end.

72) SAMPLE ANSWERS: The electronegativity difference... in a carbon-oxygen bond is greater than the electronegativity difference in a fluorine-fluorine bond. OR ...for C and O is 0.9 and the electronegativity difference for F and F is 0.

73) SAMPLE ANSWERS: NaCl(s) ions cannot move (are not mobile). OR no charged particles free to move

74) SAMPLE ANSWERS: The aqueous solution has mobile ions. OR Charged particles can move in water.

75) +2 OR 2 OR two

Answer Key
[New Exam]

1. E

2. B

3. A

4. B

5. E

6. B

7. D

8. C

9. B

10. C

11. C

12. C

13. D

14. A

15. B

16. B

17. A

18. A

19. B

20. D

21. C

22. C

23. E

24. E

25. C

26. D

27. D

28. B

29. C

30. D

31. B

32. A

33. A

34. D

35. A

36. A

37. E

38. C

39. D

40. D

41. A

42. A

43. C

44. D

45. A

46. E

47. B

48. D

49. C

50. D

51. A

52. B

LAST WEDNESDAY

SAT II ANSWERS