

Bonding Regents Review

Name: _____

Date: _____

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

At STP, iodine, I₂, is a crystal, and fluorine, F₂, is a gas. Iodine is soluble in ethanol, forming a tincture of iodine. A typical tincture of iodine is 2% iodine by mass.

- _____ 1. Compare the strength of the intermolecular forces in a sample of I₂ at STP to the strength of the intermolecular forces in a sample of F₂ at STP.

_____ _____

Base your answer to the following question on the following information.

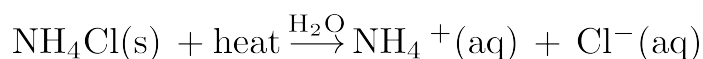
A piece of magnesium ribbon is reacted with excess hydrochloric acid to produce aqueous magnesium chloride and hydrogen gas. The volume of the dry hydrogen gas produced is 45.6 milliliters. The temperature of the gas is 293 K, and the pressure is 99.5 kilopascals.

- _____ 2. Identify the type of bond between the atoms in a molecule of the gas produced in this laboratory investigation.

_____ _____

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

Ammonium chloride is dissolved in water to form a 0.10 M NH₄Cl(aq) solution. This dissolving process is represented by the equation below.



- _____ 3. Determine the minimum mass of NH₄Cl(s) required to produce a saturated solution in 100. grams of water at 40.°C.

- _____ 4. Base your answers to the following questions on the information given below.

Testing of an unknown solid shows that it has the properties listed below.

- (1) low melting point
- (2) nearly insoluble in water
- (3) electricity
- (4) relatively soft solid

a State the type of bonding that would be expected in the particles of this substance.]

b Explain in terms of attractions between particles why the unknown solid has a low melting point.

c Explain why the particles of this substance are poor conductors of electricity.

Base your answer to the following question on In addition to water disinfection, chlorine and its derivatives are used to treat sewage and industrial effluent, and as household and industrial bleaches to maintain and improve hygiene standards.

- _____ 5. Draw the Lewis electron-dot structure for a molecule of chlorine, Cl₂.

Base your answers to questions 6 and 7 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.



_____ 6. Write the chemical formula for *one compound in the equation that contains both ionic bonds and covalent bonds*.

_____ 7. In the space draw a Lewis electron-dot diagram for the reactant containing nitrogen in the equation.

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

Physical Properties of CF₄ and NH₃ at Standard Pressure

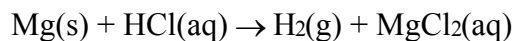
Compound	Melting Point (°C)	Boiling Point (°C)	Solubility in Water at 20.0°C
CF ₄	-183.6	-127.8	insoluble
NH ₃	-77.7	-33.3	soluble

_____ 8. In the space *in your answer booklet*, draw a Lewis electron-dot diagram for CF₄.

_____ 9. Draw a Lewis electron-dot diagram for a molecule of phosphorus trichloride, PCl₃

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

In a laboratory investigation, magnesium reacts with hydrochloric acid to produce hydrogen gas and magnesium chloride. This reaction is represented by the unbalanced equation below.



_____ 10. State, in terms of the relative activity of elements, why this reaction is spontaneous.

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

At STP, iodine, I₂, is a crystal, and fluorine, F₂, is a gas. Iodine is soluble in ethanol, forming a tincture of iodine. A typical tincture of iodine is 2% iodine by mass.

_____ 11. Draw a Lewis electron-dot diagram for a molecule of I₂.

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

Bond energy is the amount of energy required to break a chemical bond. The table below gives a formula and the carbon-nitrogen bond energy for selected nitrogen compounds.

Selected Nitrogen Compounds

Compound	Formula	Carbon-Nitrogen Bond Energy (kJ/mol)
hydrogen cyanide	$\text{H}-\text{C}\equiv\text{N}$	890.
isocyanic acid	$\text{H}-\text{N}=\text{C}=\text{O}$	615
methanamine	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{N}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	293

12. Identify the noble gas that has atoms in the ground state with the same electron configuration as the nitrogen in a molecule of isocyanic acid.
13. Explain, in terms of electronegativity, why a P–Cl bond in a molecule of PCl_5 is more polar than a P–S bond in a molecule of P_2S_5 .
14. Explain, in terms of molecular structure or distribution of charge, why a molecule of methane is nonpolar.

Base your answers to questions 15 and 16 on the table below.

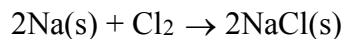
Physical Properties of Four Gases

Name of Gas	hydrogen	hydrogen chloride	hydrogen bromide	hydrogen iodide
Molecular Structure	H-H	H-Cl	H-Br	H-I
Boiling Point (K) at 1 Atm	20.	188	207	237
Density (g/L) at STP	0.0899	1.64	?	5.66

15. Explain, in terms of molecular polarity, why hydrogen chloride is more soluble than hydrogen in water under the same conditions of temperature and pressure.
16. Explain, in terms of electronegativity difference, why the bond in H–Cl is more polar than the bond in H–I.

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



17. Explain, in terms of electrons, why the bonding in NaCl is ionic.

Base your answers to questions 18 through 21 on the information below.

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

Molecule *A*: Cl₂ Molecule *B*: CCl₄ Molecule *C*: NH₃

18. Explain how the bonding in KCl is different from the bonding in molecules *A*, *B*, and *C*.

19. Explain why NH₃ has stronger intermolecular forces of attraction than Cl₂.

20. Explain why CCl₄ is classified as a nonpolar molecule.

21. Draw the electron-dot (Lewis) structure for the NH₃ molecule.

22. Draw an electron-dot diagram for *each* of the following substances:

a calcium oxide (an ionic compound)

b hydrogen bromide

c carbon dioxide

Base your answer to the following question on The table shows some properties of three solids, *X*, *Y* and *Z*.

<i>Properties</i>	<i>X</i>	<i>Y</i>	<i>Z</i>
Melting Point (°C)	800	80	1200
Soluble in water	yes	no	no
Solid state conducts electricity	no	no	yes
Molten state conducts electricity	yes	no	yes

23. What is the correct classification for each solid.

solid X _____

solid Y _____

solid Z _____

Base your answer to the following question on An unknown solid was tested and showed the properties listed below:

Properties

high melting point

soluble in water

conductor of electricity when dissolved in water

non-conductor of electricity as a solid

hard surface

_____ 24. *a* State the type of bonding you would expect of this substance.

b Explain why this substance conducts electricity when dissolved in water.

c Explain why it is hard.

_____ 25. *a*) Draw the structural formula for H₂O.

b) Is this molecule polar or nonpolar? Explain your answer.

Base your answer to the following question on Hydrogen chloride, HCl, a colorless, poisonous gas with an unpleasant, acrid odor. It is very soluble in water and readily soluble in alcohol and ether. It is not flammable, and the liquid is a poor conductor of electricity.

_____ 26. *a* Draw the Lewis electron-dot structure for a molecule of hydrogen chloride, HCl.

b Label your drawing with a "+" to indicate the positive side of this molecule.

c Explain why HCl(g) is capable of being dissolved in water.

Base your answer to the following question on Nitrogen is a Group 15 element which makes up about 78% of the atmosphere by volume. Nitrogen is a colorless, odorless, tasteless diatomic gas. It does not burn, does not support combustion, and is only slightly soluble in water. It is relatively inactive chemically. Nitrogen is present in the protoplasm of all living matter; it and its compounds are necessary for the continuation of life. Nitrogen is present in foods and is important in the human diet.

_____ 27. *a* Draw the Lewis electron-dot structure for a molecule of nitrogen, N₂.

b Why can't humans get nitrogen for their diets by breathing air?