

1. 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 ($^{\circ}\text{C}$)	800	80	1200
Soluble in water	yes	no	no
Solid state conducts electricity	no	no	yes
Molten state conducts electricity	yes	no	yes

What is the correct type of bonding for each solid.

solid X _____

solid Y _____

solid Z _____

2. Base your answer to the following question 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.

Explain in terms of electronegativity differences, why a C–O bond is more polar than a C–H bond.

3. What is the total number of electron pairs shared between the carbon atom and one of the oxygen atoms in a carbon dioxide molecule?

4. 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 .

5. 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.

Compare the strength of the intermolecular forces in a sample of I_2 at STP to the strength of the intermolecular forces in a sample of F_2 at STP.

Base your answers to questions 6 and 7 on the following information.

Carbon and oxygen are examples of elements that exist in more than one form in the same phase.

Graphite and diamond are two crystalline arrangements for carbon. The crystal structure of graphite is organized in layers. The bonds between carbon atoms within each layer of graphite are strong. The bonds between carbon atoms that connect different layers of graphite are weak because the shared electrons in these bonds are loosely held by carbon atoms. The crystal structure of diamond is a strong network of atoms in which the shared electrons are strongly held by the carbon atoms. Graphite is an electrical conductor, but diamond is not. At 25°C , graphite has a density of 2.2 g/cm^3 and diamond a density of 3.51 g/cm^3 .

The element oxygen can exist as diatomic molecules, O_2 , and as ozone, O_3 . At standard pressure the boiling point of ozone is 161 K.

6. Explain, in terms of intermolecular forces, the difference in the boiling points of O_2 and O_3 at standard pressure. Your response must include information about both O_2 and O_3 .

7. Explain, in terms of electrons, why graphite is an electrical conductor and diamond is *not*. Your response must include information about both graphite and diamond.

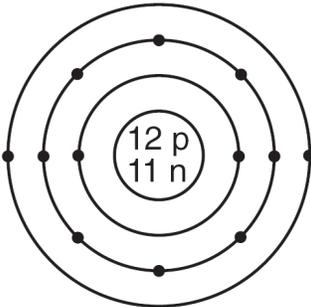
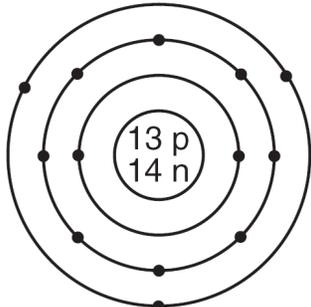
8. Base your answer to the following question on the following information.

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.

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

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

Atomic Diagrams of Magnesium and Aluminum

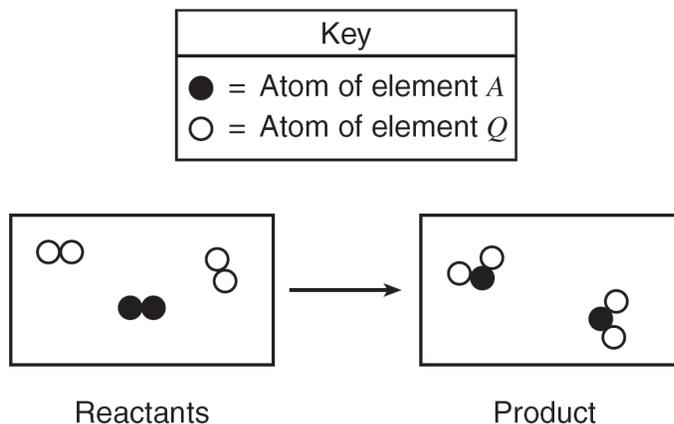
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;">Key</p> <hr style="width: 80%; margin: 0 auto;"/> <p style="margin: 0;">• = electron</p> </div>	Element	Lewis Electron-Dot Diagram	Electron-Shell Diagram
	magnesium	Mg:	
	aluminum	Al:	

Explain why Lewis electron-dot diagrams are generally more suitable than electron-shell diagrams for illustrating chemical bonding.

10. Explain, in terms of electronegativity, why a P–Cl bond in a molecule of PCl₅ is more polar than a P–S bond in a molecule of P₂S₅.

Base your answers to questions **11** through **13** on the information below.

The particle diagrams below represent the reaction between two nonmetals, A_2 and Q_2 .



11. Compare the total mass of the reactants to the total mass of the product.
12. Identify the type of chemical bond between an atom of element A and an atom of element Q .
13. Using the symbols A and Q , write the chemical formula of the product.

Base your answers to questions **14** through **16** on the table below.

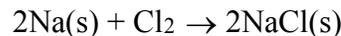
Physical Properties of Four Gases

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

14. Explain, in terms of molecular polarity, why hydrogen chloride is more soluble than hydrogen in water under the same conditions of temperature and pressure.
15. Explain, in terms of intermolecular forces, why hydrogen has a *lower* boiling point than hydrogen bromide.
16. Explain, in terms of electronegativity difference, why the bond in H-Cl is more polar than the bond in H-I.

17. Draw a Lewis electron-dot diagram for a molecule of phosphorus trichloride, PCl_3

Base your answers to questions **18** and **19** on the balanced equation below.



18. Explain, in terms of electrons, why the bonding in NaCl is ionic.
19. Draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2 .

Base your answers to questions **20** through **22** 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

20. Explain how the bonding in KCl is different from the bonding in molecules *A*, *B*, and *C*.
 21. Explain why NH₃ has stronger intermolecular forces of attraction than Cl₂.
 22. Explain why CCl₄ is classified as a nonpolar molecule.
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23. Draw an electron-dot diagram for *each* of the following substances:
 - a* calcium oxide (an ionic compound)
 - b* hydrogen bromide
 - c* carbon dioxide
 24. 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.

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

Properties

low melting point
nearly insoluble in water
non-conductor of electricity
relatively soft solid

- a) State the type of bonding you would expect of this substance.
- b) Explain why this substance is insoluble in water.
- c) Explain why it is soft.
26. 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

- 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.
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27. a) Draw the structural formula for H_2O .
b) Is this molecule polar or nonpolar? Explain your answer.
28. Base your answer to the following question on Base your answers to the questions below on the following information:
- Carbon tetrachloride is a clear, colorless, volatile liquid with a characteristic, sweet odor. The solubility in water is low. Carbon tetrachloride is non-flammable and is stable in the presence of air and light. Decomposition may produce phosgene, carbon dioxide and hydrochloric acid.
- a Draw an electron dot diagram for carbon tetrachloride, CCl_4 .
- b Is carbon tetrachloride a polar or non-polar molecule? Explain your answer.
29. Base your answer to the following question on When hydrogen bromide, a gas, is dissolved in water, the solution is called hydrobromic acid
- a Draw the Lewis electron-dot structure for a molecule of hydrogen bromide, HBr .
- b Is hydrogen bromide a polar or non-polar molecule? Explain

30. 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.

a Draw the Lewis electron-dot structure for a molecule of nitrogen, N_2 .

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