SI Chemistry - Full Discipline Demo

Introduction to Chemical Compounds

Final Report - Answer Guide

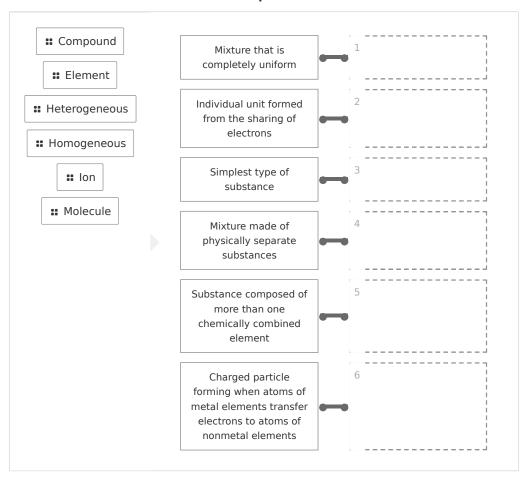
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Test Your Knowledge



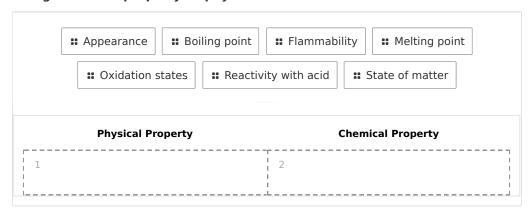
Match each term with the best description.



Correct answers:

- 1 Homogeneous 2 Molecule 3 Element 4 Heterogeneous
- 5 Compound 6 Ion

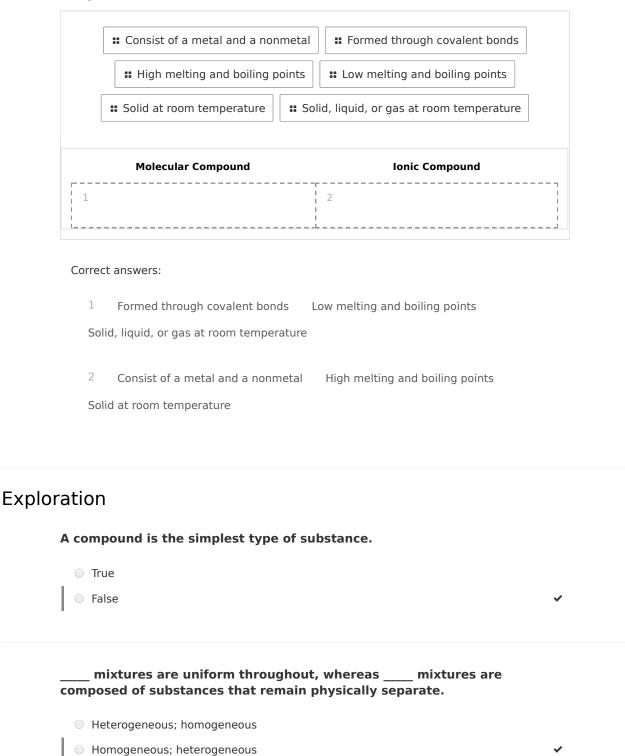
Categorize each property as physical or chemical.



Correct answers:

- 1 Appearance State of matter Melting point Boiling point
- 2 Reactivity with acid Flammability Oxidation states

Categorize each property as being typical of an ionic or a molecular compound.





observed by altering the composition of the substance.	
	✓
False	
Physical properties include the density, melting point, boiling point, and appearance.	
○ True	~
False	
bonds form when atoms from two nonmetals share electrons.	
Covalent	~
• lonic	
Ionic compounds result from	
ionic bonds	
oxidation and reduction reactions	
 the combinations of metals and nonmetals 	
All of the above	✓
lons are	
always metals	
always nonmetals	
charged particles	~
 neutral compounds 	

Chemical properties are the characteristics of a substance that can be



	Individual units called are formed when atoms of nonmetal elements share electrons.
	electrons
	O matter
	○ molecules ✓
	None of the above
Exerc	ise 1
Define property	physical and chemical properties and give at least 3 examples of each type of y.
the con solubili observe Chemic	If properties are the characteristics of a substance that can be observed without altering apposition of the substance. Physical properties include melting point, boiling point, density, ty, appearance, and mass. Chemical properties are the characteristics that can only be add by altering the composition of the substance through chemical changes or reactions. Cal properties include reactivity with air and acid, flammability, thermodynamic stability, on states, and heat of combustion.
	ubstances in Data Table 1 have melting points below room temperature? Are these ces more likely to be ionic or molecular compounds based on melting point alone?
	rubbing alcohol, and cooking oil have melting points below room temperature and are more obe molecular compounds. Ionic compounds have very high melting points.
	ubstances in Data Table 1 have melting points above room temperature? Are these ces more likely to be ionic or molecular compounds based on melting point alone?



compounds.
Which substance in Data Table 2 has the lowest melting point? Explain.
Sugar has the lowest melting point as it melted after 4 minutes in the hot oven.
Were there any substances that were unchanged at the end of the 400° heating step?
Explain what this means about the melting point for the substance(s).
Table salt and baking soda were unchanged. Their melting points must be higher than the oven temperature of 400°F. Students may not include baking soda due to the changes possibly seen during the procedure from the decomposition to sodium carbonate.
Which substances appeared to be soluble in water? Are these likely to be ionic or molecular compounds based alone on solubility? Explain.
Table salt, baking soda, sugar, and rubbing alcohol were all soluble in water. Ionic compounds are typically soluble in water so these substances may be ionic compounds. However, not all ionic compounds are soluble in water so this test alone will not give clear answers on compound types.
Which substances appeared to be insoluble in water? Are these likely to be ionic or molecular compounds based alone on solubility? Explain.

All of the remaining substances: table salt, baking soda, sugar, and cornstarch have melting points above room temperature. Based on this information, we might conclude that these are all ionic



Cornstarch and cooking oil did not dissolve in water. These substances may be molecular compounds as many molecular compounds are not soluble in water. However, many molecular compounds are soluble in water so this test alone will not give clear answers on the type of compound.

Data Table 1: Properties of Household Items

(SAMPLE ANSWER BELOW)

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Substance	State of Matter	Appearance	Melting Point	Boiling Point
Water	Liquid	Colorless, transparent	Lower	Higher
Table Salt	Solid	White, crystalline	Higher	Higher
Baking Soda	Solid	White, fine powder	Higher	Higher
Sugar	Solid	White, crystalline	Higher	Higher
Cornstarch	Solid	White, fine powder	Higher	Higher
Isopropyl Alcohol	Liquid	Colorless, transparent	Lower	Higher
Cooking Oil	Liquid	Yellow, translucent	Lower	Higher

Data Table 2: Melting and Boiling Points of Solids over Time (SAMPLE ANSWER BELOW)

D. Cornstarch Time A. Table Salt B. Baking Soda C. Sugar 1 No change No change No change No change min 2 No change No change No change No change min 3 No change No change No change No change min No change No change No change No change min Greenish brown color No change Melted Slight tan color formed around min edges 6 No change No change Melted Slight tan color min Brown color 7 across all of No change No change min sample Sample turned dark Tan color brown and began to No change No change min rise Sample appeared to be 9 Tan color burning so was removed from No change min the oven 10 No change Tan color min 15 No change No change Tan color



min				
20 min		No change	No change	
25 min	Tan color		No change	No change
30 min		Light brown color		No change

Data Table 3: Solubility in Water (SAMPLE ANSWER BELOW)

(SAMPLE ANSWER BELOW)			
Substance	Observations	Solubility	
Table Salt	Solid dissolved after stirring	Soluble	
Baking Soda	Solid dissolved after stirring	Soluble	
Sugar	Solid dissolved after stirring	Soluble	
Cornstarch	Solid appeared to dissolve after stirring, but after the waiting period the particles settled at the bottom of the glass.	Insoluble	
Isopropyl Alcohol	Liquid disappeared after stirring	Soluble	
Cooking Oil	Mixed when stirred, then separated	Insoluble	

Data Table 4: Ionic vs. Molecular Compound Properties (SAMPLE ANSWER BELOW)

Property	Ionic Compounds	Molecular Compounds
Element Types	Metal and nonmetal	Nonmetal
State of Matter	Solid	Solid, liquid, or gas
Melting Point	High	Variable
Boiling Point	High	Variable
Solubility	Tend to be soluble	Variable

Data Table 5: Conclusions and Compound Types (SAMPLE ANSWER BELOW)

(SAMILE ANSWER BELOW)			
Chemical Formula	Element Types	Properties of substance	Compound Type
Water - H ₂ O	Nonmetal	Liquid at room temperature, melting point lower than room temperature	Molecular
Table Salt - NaCl	Metal and nonmetal	Solid at room temperature, high melting and boiling point, and soluble in water	Ionic
Baking Soda - NaHCO ₃	Metal and nonmetal	Solid at room temperature, high melting and boiling point, and soluble in water	Ionic
Sugar - C ₆ H ₁₂ O ₆	Nonmetal	Solid at room temperature, low melting point, and soluble in water	Molecular
Cornstarch -	Nonmetal	Solid at room temperature, fairly low melting point, and	Molecular



$C_{27}H_{48}O_{20}$		insoluble in water	
Isopropyl Alcohol - C ₃ H ₈ O	Nonmetal	Liquid at room temperature, melting point lower than room temperature, and soluble in water	Molecular
Cooking Oil - C ₅₄ H ₁₀₀ O ₇	Nonmetal	Liquid at room temperature, melting point below room temperature, and insoluble in water	Molecular

Competency Review

mixtures are completely uniform.	
 Heterogeneous 	
Homogeneous	~
Compounds are composed of two or more chemically combined elements	•
○ True	✓
False	
Chemical properties are the characteristics of a substance that can be observed without altering the composition of the substance.	
True	
False	~
Physical properties of a substance include the	
appearance	
density	
 melting point 	
All of the above	~



compounds form when two nonmetal elements combine.	
Heterogeneous	
Homogeneous	
O lonic	
○ Molecular	~
Ionic compounds tend to be soluble in water.	
│ ○ True	~
□ False	
Metal atoms electrons and become charged.	
gain; negatively	
o lose; negatively	
o lose; positively	✓
gain; positively	
While ionic compounds are usually solid at room temperature, molecular compounds are	
○ gas	
O liquid	
solid	
All of the above	~
Molecular compounds are unique because they have a small range of melting and boiling points.	
○ True	
○ False	✓



is a white, crystalline solid at room temperature that is soluble in water, has low melting and boiling points, and held together through covalent bonds.		
Baking soda		
Butter		
Granulated sugar	~	
Table salt		
Table salt is an ionic compound that has high	h melting and boiling points	
○ True	~	
False		
A solid substance is tested in a lab to determ		
The researcher finds that the substance has point and is soluble in water. Based on this i conclude that the substance is a(n)	nformation the researcher can	
point and is soluble in water. Based on this i	nformation the researcher can	
point and is soluble in water. Based on this i conclude that the substance is a(n)	nformation the researcher can	
point and is soluble in water. Based on this i conclude that the substance is a(n) heterogeneous	nformation the researcher can	

Extension Questions

Mixtures of hydrogen and oxygen in varying concentrations can be sparked to produce water. Define mixture and compound, and then explain the differences between a mixture of hydrogen and oxygen and the compound dihydrogen monoxide (also known as water). (SAMPLE ANSWER BELOW)

Mixtures and compounds are both made from different substances; however, the substances in a mixture are not chemically joined as they are in a compound. A mixture of hydrogen and oxygen can have a variable composition, whereas water will always contain equal amounts of hydrogen and oxygen. The atoms are not joined together in the mixture of hydrogen and oxygen, but the atoms are joined in water. Hydrogen and oxygen will retain their own separate properties in the mixture, but water will have different properties than the individual elements have. A mixture of hydrogen and oxygen can physically be separated into the two elements, but water cannot be physically separated into hydrogen and oxygen and instead has to undergo a chemical change, such as a displacement reaction.



