ANSWER KEY.

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Properties of Ionic Compounds

Chemistry | ANSWER KEY

Use a periodic table. Use the word banks, sentence frames and finished rows where they are given.
Every property of an ionic compound comes from strong attractions between + and − ions locked in a lattice.

1. For each pair, write the compound with the higher melting point and the reason. The first row is done for you.

Pair	Higher melting point	Reason (charges first, then size)
KF or BaO	BaO	2+ and 2− attract more strongly than 1+ and 1−
CsBr or SrS	**SrS**	**2+ and 2− beat 1+ and 1−**
KCl or KI	**KCl**	**Same charges; Cl^- is smaller, so the ions sit closer**

Coulomb's law: bigger charges pull harder; with equal charges, smaller ions pull harder.

2. Decide whether each sample conducts electricity. The first row is done for you.

Sample	Conducts?	Reason (can the ions move?)
solid $CaCl_2$	No	ions locked in the lattice
melted $CaCl_2$	**Yes**	**melting frees the ions to move**
$CaCl_2$ dissolved in water	**Yes**	**water separates the ions**
sugar ($C_{12}H_{22}O_{11}$) dissolved in water	**No**	**sugar is not ionic, so it makes no ions**

Ions conduct only when they can move: melted or dissolved, never as a solid.

3. A student tested three unknown white or gray solids.

Solid	Melting point	Shiny?	Conducts as a solid?	Conducts dissolved in water?
X	80 °C	no	no	no
Y	801 °C	no	no	yes
Z	1085 °C	yes	yes	does not dissolve

(a) Which solid is most likely ionic? Give two pieces of evidence. (b) Which solid is most likely a metal? Give two pieces of evidence.

(a) **Y:** high melting point; conducts dissolved but not as a solid (ions move only once freed). X never conducts.

(b) **Z:** shiny, and it conducts as a solid, which no ionic solid can do (its electrons move freely).

4. $CaCl_2$ dissolves in water. Which end of a water molecule faces Ca^{2+}, and which end faces Cl^-? Explain.

Word bank: oxygen end, hydrogen end, slightly −, slightly +, opposite charges attract

Oxygen ends face Ca^{2+}; hydrogen ends face Cl^-. Opposite charges attract (O is −, H is +).

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5. Write the equation for each compound dissolving in water. The first row is done for you.

Compound	Dissociation equation (with states)
LiBr	$LiBr(s) \rightarrow Li^{+}(aq) + Br^{-}(aq)$
$MgCl_2$	**$MgCl_2(s) \rightarrow Mg^{2+}(aq) + 2Cl^{-}(aq)$**
Na_2S	**$Na_2S(s) \rightarrow 2Na^{+}(aq) + S^{2-}(aq)$**

The subscripts become coefficients, and the charges on each side add to zero.

6. (a) Explain why an ionic crystal shatters when it is hit hard.

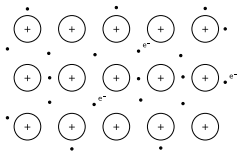
Sentence frame: *A hit shifts a layer of ions, so _____ end up side by side. They _____, so the crystal _____.*

(b) Explain why almost all ionic compounds are solids at room temperature.

(a) **Like charges (+ by +, − by −) end up side by side. They repel, so the crystal shatters.**

(b) **Each ion is held by many opposite charges, too strongly for room temperature to free.**

7. The diagram shows a model of a metal. Use it to complete the table that compares an ionic solid with a metal. The first row is started for you.



	Ionic solid (NaCl)	Metal (Cu)
Particles	Na^{+} and Cl^{-} ions	**Cu cations and free electrons**
Held together by	**ionic bond: + and − ions attract**	**metallic bond: cations and e^{-} sea**
Solid conducts? Why?	**No: the ions cannot move**	**Yes: the electrons move freely**
Hit with a hammer	**shatters (brittle)**	**bends (malleable)**
Shiny (luster)?	**no**	**yes: free e^{-} reflect light**

The metal's electrons are not locked to one atom, which explains every property in the right column.

8. A copper wire bends when it is hammered, but a salt crystal shatters. Explain the difference.

Word bank: layers slide, sea of electrons, like charges, repel, malleable, brittle

Copper: layers slide, but the sea of electrons still surrounds every cation, so it bends (malleable).

Salt: a sliding layer puts like charges together; they repel, so it shatters (brittle).

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