Crystal Structure and Brittleness

New Regents original practice • Name: _____ Date: _____
Show your work for written answers.

In the ionic crystal model, positive and negative ions repeat in an ordered arrangement. Opposite charges attract and like charges repel.

1 Which pair of neighboring ions attracts in the model?

(1) Na^+ and Na^+

(2) Cl^- and Cl^-

(3) Na^+ and Cl^-

(4) Two positively charged ions

2 Explain why the arrangement of both types of ion matters for holding an ionic crystal together. [1]

Answer and work

3 Which change can create repulsion across neighboring rows in an ionic crystal?

(1) Bring a positive ion next to a negative ion.

(2) Shift one row so positive ions sit next to positive ions.

(3) Move opposite charges closer while leaving the pattern in place.

(4) Add a neutral label outside the crystal.

4 A metal can often bend as its layers shift. Explain one difference between metallic bonding and the ionic-crystal model. [1]

Answer and work

Model of Two Ion Layers

Use the information below to answer the questions.

A model shows a short repeating segment of two layers. Match the top and bottom charges in each column to see which ions face one another. The top layer moves by one ion spacing in the shifted model.

Layer and state	Position 1	Position 2	Position 3	Position 4
Top before shift	+	−	+	−
Bottom before shift	−	+	−	+
Top after shift	−	+	−	+
Bottom after shift	−	+	−	+

5 Before the shift, how many shown columns have opposite charges facing one another?

(1) 0
(2) 1
(3) 2
(4) 4

6 Count the shown columns with like charges after the shift. Use the signs to show the count. [1]

Answer and work

7 Which interaction increases across the layers after the shift?

(1) Attraction between opposite charges
(2) Repulsion between like charges
(3) Sharing of electron pairs between every ion
(4) Attraction between neutrons

8 Use the charge pattern to explain why a strong push can fracture the ionic crystal in this model. [1]

Answer and work