Inside the Dressing

How molecular attractions shape a wound-care material

HS-PS2-6 "Communicate scientific and technical information about why the molecular-level structure (intermolecular forces) is important in the functioning of designed materials. (SEP: 8; DCI: PS1.A, PS2.B, ETS1.A…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two molecular attractions, circle two functions of the dressing, and number three linked phrases that trace a molecular feature to a function.

Why an Alginate Dressing Works

1. A wound dressing must absorb fluid without sticking to a healing cut. One option is alginate, a long-chain material made from brown seaweed. Along each chain are carboxylate groups with negative charges. Water molecules are polar: their slightly positive ends are attracted to those groups. This attraction draws water into the dressing, where the chains form a water-filled gel. The gel can hold wound fluid while keeping the wound surface moist. A designer therefore needs more than a label such as "absorbent." The useful property begins with the arrangement of charged groups along the alginate chains.

2. If the chains simply separated in water, the dressing could lose its shape. Manufacturers add calcium ions, Ca^{2+}, which attract negatively charged groups on neighboring alginate chains. Each ion can help link chains into a network. These links hold the gel together even as water enters. A pad with more calcium links generally swells less and keeps its shape better; a pad with fewer links can take in more fluid but may become weaker. The design challenge is to balance two functions: absorbing wound fluid and staying intact when the used dressing is removed.

3. Imagine testing two alginate pads of equal dry mass. Pad A has more calcium links than Pad B. After both sit in the same amount of water for the same time, Pad B gains more mass, but it tears more easily when lifted. The comparison supports a molecular explanation rather than a claim that one pad is simply "better." Water is attracted to charged groups in both pads, yet the number of links changes how far the chains can spread. Choosing a pad requires stating the need: high fluid uptake, reliable removal, or a workable balance of both.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do charged groups on alginate chains help the dressing hold wound fluid?

2. Explain how calcium ions help the dressing keep its shape when wet.

3. Pad B gains more mass but tears more easily than Pad A. Explain both results using the pads' molecular structures.

4. A clinic needs a pad that stays intact during removal, even if it absorbs less fluid. Which pad better meets that need? Support your choice with a molecular explanation.

3 YOUR TURN

Your own words

A lab can coat safety goggles with either a polymer whose surface has many polar O-H groups, which can form hydrogen bonds with water, or a nonpolar polymer that attracts water weakly. In 4 to 5 sentences, recommend a coating, explain how its molecular structure could affect fog and visibility, and propose one way to test its performance.

Inside the Dressing

PART 1 · READ AND MARK

Underline two molecular attractions, circle two functions of the dressing, and number three linked phrases that trace a molecular feature to a function. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do charged groups on alginate chains help the dressing hold wound fluid?	**The negatively charged groups attract the slightly positive ends of water molecules, drawing fluid into the gel.**
2	Explain how calcium ions help the dressing keep its shape when wet.	**Calcium ions attract charged groups on neighboring chains, linking them into a network that stays together as water enters.**
3	Pad B gains more mass but tears more easily than Pad A. Explain both results using the pads' molecular structures.	**Pad B has fewer calcium links, so its chains can spread farther and take in more water. With fewer links holding the chains together, it also tears more easily.**
4	A clinic needs a pad that stays intact during removal, even if it absorbs less fluid. Which pad better meets that need? Support your choice with a molecular explanation.	**Pad A. Its greater number of calcium links holds neighboring chains together more firmly, and the passage reports that Pad B tears more easily.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I recommend the polymer with many polar O-H groups for the safety goggles. Its O-H groups can form hydrogen bonds with condensed water, helping the water spread across the coating instead of remaining in separate droplets. A thin, even water film should scatter less light than many droplets, making it easier to see. I would expose both coated lenses to warm, moist air and compare how clearly a printed sign appears through each one.

For the marking job, accept either water attraction or calcium links as a three-step structure-to-function chain. For the open task, accept a different recommendation only if the molecular explanation, visibility claim, and proposed test are scientifically consistent.