

**Teacher’s Guide**

**Pimple Patches and What They Offer**

***October 2023***

**Table of Contents**

[***Anticipation Guide***](#_1fob9te)***2***

Activate students’ prior knowledge and engage them before they read the article.

[***Reading Comprehension Questions***](#_3znysh7) ***3***

These questions are designed to help students read the article (and graphics) carefully. They can help the teacher assess how well students understand the content and help direct the need for follow-up discussions and/or activities. You’ll find the questions ordered in increasing difficulty.

[***Graphic Organizer***](#_fbh2674qb7v5) ***5***

Thishelps students locate and analyze information from the article. Students should use their own words and not copy entire sentences from the article. Encourage the use of bullet points.

[***Answers***](#_djipzn7z1r1b) ***6***

Access the answers to reading comprehension questions and a rubric to assess the graphic organizer.

[***Additional Resources***](#_8qbtv1wio6jt) ***9***

Here you will find additional labs, simulations, lessons, and project ideas that you can use with your students alongside this article.

***[Chemistry Concepts and Standards](#_gy1yjx1c39og) 10***



# Anticipation Guide

**Directions: *Before reading the article*,** in the first column, write “A” or “D,” indicating your **A**greement or **D**isagreement with each statement. Complete the activity in the box.

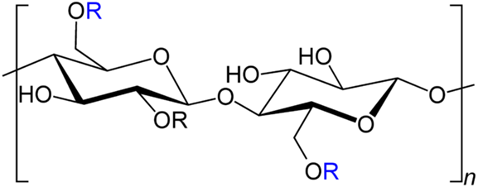
As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Pimples are caused by hormones producing excess oil. |
|  |  | 2. Everyone who gets pimples has acne-prone skin. |
|  |  | 3. Pimple patches are waterproof. |
|  |  | 4. Using a pimple patch more than once is recommended. |
|  |  | 5. Pimple patches can stop a pimple from appearing. |
|  |  | 6. Pimple patches contain a polymer gel that creates a moist environment. |
|  |  | 7. All pimple patches contain medication. |
|  |  | 8. Tea tree oil can be very moisturizing. |
|  |  | 9. Microneedle pimple patches are used for deep, painful pimples. |
|  |  | 10. Wearing a face mask can cause more pimples to form. |

# Student Reading Comprehension Questions

**Directions**: Use the article to answer the questions below.

1. What is it that causes a pimple to form?
2. Why do people tend to get acne during puberty?
3. People often use the words “acne” and “pimples” to describe the same thing. What, if any, is the difference between acne and pimples?
4. There are three main reasons that a pimple patch can speed up the healing of a pimple. List these and explain why each speeds healing.
5. A hydrocolloid is a substance that forms a gel when it is mixed with water. These are typically made from different types of hydrophilic (water-loving) polymers.
   1. What is a polymer?
   2. What structural feature of hydrophilic polymers allows them to attract water to form the gel?
6. A basic pimple patch can be made using a hydrocolloid, along with a thin outer plastic layer, without containing any medication. Explain the physical process involving the hydrocolloid that helps the pimple to heal.
7. Large organic structures are typically represented using a line structure, rather than a full Lewis structure. The end of each line segment represents a carbon atom, while hydrogen atoms that are attached to the carbons are not shown. Since carbon atoms have four bonding sites, the number of implied hydrogen atoms can be easily determined.
   1. Using the line structure for salicylic acid, found in the article, draw a complete Lewis structure, including all bonding and nonbonding electrons.
   2. Using the line structure for niacinamide in the article, determine the molecular formula for the molecule.
8. Below is a diagram showing a section of hydroxymethylcellulose. (“R” is a symbol used in chemical structures to represent a generalized group of atoms or molecules that could be attached at that point.)
   1. Draw in the lone pairs of electrons that are not shown (ignore the R group).
   2. Draw three water molecules in any appropriate part of the diagram to show how water is attracted to the hydroxymethylcellulose.



1. A hydrocolloid is a type of colloid. What is a colloid and how is it different from a solution?
2. A hydrogel is a solid network of hydrophilic polymers that is insoluble and can incorporate water into its pores, thus swelling to a larger size. Both hydrogels and hydrocolloids are composed of polymer molecules and water, but they are used very differently. Explain why a hydrocolloid is better than a hydrogel for use in a pimple patch.

# Graphic Organizer

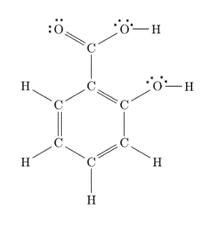
**Directions**: As you read, complete the graphic organizer below to describe the chemistry of pimple patches.

|  |  |  |
| --- | --- | --- |
| **Ingredient** | **What it is (chemically)** | **Purpose** |
| **Hydrocolloid** |  |  |
| **Adhesive** |  |  |
| **Salicylic acid** |  |  |
| **Hyaluronic acid** |  |  |
| **Benzoyl peroxide** |  |  |
| **Niacinamide** |  |  |

**Summary:** On the back of this sheet, write three interesting facts about pimple patches you learned from the article to share with a friend who is considering using them.

# Answers to Reading Comprehension Questions & Graphic Organizer Rubric

1. What is it that causes a pimple to form?  
   When there is excess sebum (oils) it stops the dead skin cells from being shed and traps them in the pore. These are also likely to become infected through bacteria.
2. Why do people tend to get acne during puberty?  
   During puberty, the glands that produce sebum (sebaceous glands) can become overstimulated due to the change in hormones. This produces excess sebum which can get trapped in the pores.
3. People often use the words “acne” and “pimples” to describe the same thing. What, if any, is the difference between acne and pimples?  
   Acne is the name of the condition. Pimples are a symptom of the condition. Acne causes pimples, but pimples can also be caused by factors not associated with the skin condition.
4. There are three main reasons that a pimple patch can speed up the healing of a pimple. List these and explain why each speeds healing.  
   The patch prevents you from touching the pimples, which can further irritate or infect them.  
   The hydrocolloid in the patch draws fluid out of the wound which helps to clean out the pore.  
   The outer film on the patch prevents the evaporation of water, providing the moist environment needed for healing to occur.
5. A hydrocolloid is a substance that forms a gel when it is mixed with water. These are typically made from different types of hydrophilic (water-loving) polymers.
   1. What is a polymer?  
      A chain of repeating smaller units that are bonded end to end to create a molecule that is a continuous long strand.
   2. What structural feature of hydrophilic polymers allows them to attract water to form the gel?  
      Multiple hydroxyl (-OH) groups along the polymer chain can attract the water molecules through hydrogen bonding interactions.
6. A basic pimple patch can be made using a hydrocolloid, along with a thin outer plastic layer, without containing any medication. Explain the physical process involving the hydrocolloid that helps the pimple to heal.  
   Since the hydrocolloid is hydrophilic, it attracts the fluids from the pimple to clear out the pore. A feature of hydrocolloids is that they can attract water and oils which will become trapped as the gel matrix forms, sequestering the fluids away from the pore so it can heal.
7. Large organic structures are typically represented using a line structure, rather than a full Lewis structure. The end of each line segment represents a carbon atom, while hydrogen atoms that are attached to the carbons are not shown. Since carbon atoms have four bonding sites, the number of implied hydrogen atoms can be easily determined.
   1. Using the line structure for salicylic acid, found in the article, draw a complete Lewis structure, including all bonding and nonbonding electrons.



* 1. Using the line structure for niacinamide in the article, determine the molecular formula for the molecule.  
     C6N2H6O

1. Below is a diagram showing a section of hydroxymethylcellulose. (“R” is a symbol used in chemical structures to represent a generalized group of atoms or molecules that could be attached at that point.)
   1. Draw in the lone pairs of electrons that are not shown (ignore the R group).  
      There should be 2 pairs of electrons added to each oxygen atom.
   2. Draw three water molecules in any appropriate part of the diagram to show how water is attracted to the hydroxymethylcellulose.  
      Water molecules should be drawn such that the H atoms of water are pointing toward an O atom of the polymer chain (or attached with a dashed line) or the O atoms of water are pointing toward the H atoms of the -OH groups (or attached with a dashed line).
2. A hydrocolloid is a type of colloid. What is a colloid and how is it different from a solution?  
   A colloid has two parts, like a solution, but the parts are dispersed throughout a medium, rather than dissolved. In a solution, water molecules surround each individual solute particle. In a colloid, water molecules are attracted to larger clusters or single macromolecules that cannot dissolve. In a colloid, one substance is dispersed throughout another. In a hydrocolloid, it is hydrophilic polymers that are dispersed throughout water.
3. A hydrogel is a solid network of hydrophilic polymers that is insoluble and can incorporate water into its pores, thus swelling to a larger size. Both hydrogels and hydrocolloids are composed of polymer molecules and water, but they are used very differently. Explain why a hydrocolloid is better than a hydrogel for use in a pimple patch.  
   Hydrocolloids actively draw water or fluid into the polymer network; as it soaks up oil or fluid from a pimple or wound, it swells. Hydrocolloids are good for wounds that are producing liquids. A hydrogel doesn’t have as much room as a hydrocolloid to draw the water away from the wound because the polymers are in a more rigid, less water loving, network. Hydrogels are best for dry wound applications.

**Graphic Organizer Rubric**

If you use the Graphic Organizer to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

# 

# Additional Resources and Teaching Strategies

**Additional Resources**

* **Labs and demonstrations**
  + Royal Society Lab investigation:<https://edu.rsc.org/experiments/investigating-hydrogels-in-nappies-and-hair-gel/689.article>
  + AACT-Changing a Monomer to a Polymer:<https://teachchemistry.org/classroom-resources/changing-a-monomer-to-a-polymer>
  + Inquiring Minds Want to Know: Growing Plastic Beads<https://www.canr.msu.edu/resources/inquiring-minds-want-to-know-growing-plastic-beads>

* **Simulations**
  + Video: What’s the Deal with Acne?<https://www.acs.org/pressroom/reactions/library/whats-the-deal-with-acne.html>
* **Lessons and lesson plans**
  + AACT-Molecular Spaghetti

<https://teachchemistry.org/classroom-resources/molecular-spaghetti>

* + AACT-Watch the Baby! Superabsorbent Polymer

<https://teachchemistry.org/classroom-resources/watch-the-baby-superabsorbent-polymer>

* + ACS Activity- Bandages for Faster Healing

<https://www.acs.org/education/outreach/celebrating-chemistry-editions/2023-ncw/bandages-for-faster-healing.html>

**Teaching Strategies**

Consider the following tips and strategies for incorporating this article into your classroom:

* **Alternative to Anticipation Guide:** Before reading, ask students if they or their friends have used pimple patches. Ask students how they think pimple patches work. Their initial ideas can be collected electronically via Jamboard, Padlet, or similar technology.
  + As they read, students can find information to confirm or refute their original ideas.
  + After they read, ask students what they learned about the chemistry of chemistry cosmetics.
* After students have read and discussed the article, ask students what information they would like to share with friends and family about pimple patches, and whether they will treat pimples differently based on the information in the article.
* Consider showing the ACS Reactions Video: “What’s the Deal With Acne?” (3:56)<https://youtu.be/KrMbwDil1hc?si=godzEJuexeet9q4Z> . Although the video does not describe pimple patches, it does review the causes of pimples and some ways to treat them, including salicylic acid, benzoyl peroxide, and retinoids.

# Chemistry Concepts and Standards

**Connections to Chemistry Concepts**

The following chemistry concepts are highlighted in this article:

* Functional groups
* Molecular structure
* Polymers

**Correlations to Next Generation Science Standards**

This article relates to the following performance expectations and dimensions of the NGSS:

**HS-PS1-3.** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

**HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Disciplinary Core Ideas:**

* PS.1.A: Structure and Properties of Matter
* ETS.1.C: Optimizing the Design Solution

**Crosscutting Concepts:**

* Cause and effect
* Structure and function
* Stability and change

**Science and Engineering Practices:**

* Constructing explanations (for science) and designing solutions (for engineering)

**Nature of Science:**

* Science addresses questions about the natural and material world.

See how *ChemMatters* correlates to the[**Common Core State Standards** online](https://www.acs.org/content/acs/en/education/resources/highschool/chemmatters/teachers-guide.html).