

Understanding the chemistry of biological processes

Education in Chemistry

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Answers

1. Enzymes act as a template and hold the substrates (reactants) in place so they are in the proper position and orientation for the reaction to proceed. Also, they surround the substrates with functional groups that stabilise the transition state.
2. It binds in a pocket inside the enzyme rather than on the surface.
3. Hydrogen bonds from a number of amino acids and electrostatic interactions with an iron-sulfur cluster.
4. Once the reaction had taken place the enzyme was left in its original form unchanged.
5. The enzyme can flex and move around the substrate, enclosing it while the reaction occurs.
6. The substrates are both peptides and the products are the cross-linked peptide plus alanine.
7. Ampicillin binds to the serine in the active site of the transpeptidase enzyme. The β -lactam ring opens and the carbonyl group forms an ester bond with the serine in the active site. While the ampicillin is bound to the enzyme's active site, it cannot bind the peptides it is meant to cross-link.
8. β -lactamase reacts with ampicillin to open the β -lactam ring and then releases the ampicillin in an inactive form so it cannot bind to transpeptidase.
9. In the active site of the enzyme there is a hydroxyl group in the serine. In the ampicillin molecule there is a carbonyl in the β -lactam ring.
10. The lysine side chain contains an amine group that is likely to be at least partly positively charged at neutral pH. The carboxyl group on ampicillin is likely to be negatively charged and this could mean there is electrostatic interaction to hold the ampicillin in the active site.
- 11.

