Answer all the questions below and then check your answers.

1. Define the term 'activation energy'.
2. State two ways a catalyst can be used in industry.
3. Explain how a catalyst increases the rate of a reaction using the concept of activation energy.
4. Describe two properties of enzymes.
5. Describe the 'lock and key' model of enzyme action.
6. Explain why catalysts are important in the chemical industry.
7. Discuss how both temperature and pH affect the rate of an enzyme-catalyzed reaction.

Answers

1. Define the term 'activation energy'.

   The minimum amount of energy that particles must have to react.

2. State two ways a catalyst can be used in industry.

   Any two of the following:

   To produce useful products more quickly and cheaply.

   To reduce energy consumption in industrial processes.

   To make reactions happen that would be too slow under normal conditions.

3. Explain how a catalyst increases the rate of a reaction using the concept of activation energy.

   A catalyst provides an alternative reaction pathway. This pathway has a lower activation energy than the uncatalyzed reaction.

   More reactant particles now have enough energy to react, increasing the frequency of successful collisions. This leads to a faster rate of reaction.

4. Describe two properties of enzymes.

   Any two of the following:

   They are proteins.
   They are specific to a particular substrate.
   They are sensitive to changes in temperature and pH.
   They are not used up in the reaction they catalyse.

5. Describe the 'lock and key' model of enzyme action.

Enzymes have a specific active site with a unique shape. The substrate (reactant molecule) fits into the active site like a key in a lock. This forms an enzyme-substrate complex, allowing the reaction to occur more easily. The products are released, and the enzyme is unchanged, ready to catalyze another reaction.

6. Explain why catalysts are important in the chemical industry.

Catalysts speed up reactions, allowing industrial processes to be more efficient and cost-effective. They reduce the need for high temperatures and pressures, saving energy. Some reactions wouldn't be economically viable without catalysts. They enable the production of specific products with high yields.

7. Discuss how both temperature and pH affect the rate of an enzyme-catalyzed reaction.

Temperature:

Increasing temperature increases the rate of reaction up to the enzyme's optimum temperature. This is because the enzyme and substrate molecules have more kinetic energy, leading to more frequent and successful collisions.

Above the optimum temperature, the enzyme denatures. This means its shape changes, the active site no longer fits the substrate, and the reaction stops.

pH:

Enzymes have an optimum pH where they work most efficiently.

Changes in pH away from the optimum can alter the charges on the amino acids in the enzyme. This changes the enzyme's shape and can denature it, leading to a loss of activity.