

Enzyme lab example



**ASSIGN
BUSTER**

Enzyme Lab Purpose: To compare the action of the enzyme catalase, to a non-protein catalyst under different conditions.

Observations:

Observations	Rate of Reaction	Interpretations
A Sand	0	There is no reaction between sand and hydrogen peroxide because sand does not contain any catalysts or enzymes to break down hydrogen peroxide
B Liver	4	Liver contains large amounts of the enzyme catalase, which break down H ₂ O ₂ into water and oxygen. This made the reaction occur quickly and form bubbles.
C Used liver + Fresh liver	3	The reaction was moderate because the enzymes in the used liver are still active and can be used in the reaction again. The fresh liver can also perform this reaction with its catalase enzyme.

error or impurity of equipment, |||| the reaction was not as strong. ||
Used liver + H₂O₂ | - Reaction occurred quickly and a | 4 | - The enzyme in the
liver is still |||| lot of big bubbles formed and || active and can be used over
again, |||| rose to the top of the test tube || because enzymes never get
used up |

| D | Crushed Liver | - Reaction happened immediately, | 5 | - Liver contains a
large amount of |||| and a lot of bubbling occurred || catalase enzyme,
which breaks down H₂O₂ |||| for a while with large, white || very quickly.
Since the liver is |||| bubbles, and rose to the top of || crushed, this
reaction occurred even |||| the test tube || faster because there is a larger
||||| surface area of the liver for the H₂O₂ ||||| to react with. ||
Crushed Potato | - Very few bubbles that were | 3 | - Since the potato is
crushed, there is |||| small formed and they did not || more surface area for
the H₂O₂ to react |||| rise very high in the test tube || with, but potato does
not contain any ||||| enzymes to break down H₂O₂, so this |||||
reaction was moderate and did not occur ||||| quickly.

| E | Boiled Liver | - No bubbles rose to the top of | 1 | - No reaction and
bubbles formed, |||| the test tube, and a light, white || because the boiling
of the liver caused |||| cover formed on top of the liver || denaturing of the
proteins, and |||| with very little, small bubbles || denatured catalase
proteins can not ||||| function ||| Liver at 37° C | - Reaction occurred
quickly and | 5 | - This reaction occurred and formed |||| large, white
bubbles formed and || large bubbles that rose to the top |||| elevated up
the test tube || because the liver is 37° C, which is ||||| normal human
body temperature. Catalase ||||| operates and breaks down H₂O₂ best at |

|||| this temperature. ||| Liver at 0° C |- No bubbles formed or rose to | 0
|- No reaction occurred when the liver ||| the top of the test tube. No ||
was at 0(C because this condition is ||| reaction occurred. || too cold for
the catalase enzymes to |||| function. Enzyme activity slows down at|||
|| any temperature below 37° C, and it is |||| the slowest at 0 degrees.
Almost no |||| enzyme activity occurs. |

Questions:

1. The differences in the rates were mainly because of the different temperatures of the liver, the different particle sizes of the liver and potato, and the product used with H₂O₂ in the reaction. The reactions that had the fastest rates had the liver as the product used in the reaction with hydrogen peroxide. Also, reactions that had liver at normal body temperature (37° C), and had a larger particle size for the larger surface area had fast rates of reaction.
2. H₂O₂ breaks down when other catalysts that can be oxidized by it are present. Because H₂O₂ is an unstable molecule, some inorganic substances like MnO₂ can be oxidized by it, and they release oxygen gas in the reaction.
3. Temperature affects the rate of enzyme action very much. At low temperatures, the enzyme activity is very slow, because the molecules have low kinetic energy and fewer collisions occur between them. This is proven in part E of the lab, where there was no reaction and enzyme activity when the liver was 0° C. At high temperatures, the enzyme activity increases because the molecules have higher kinetic energy and more collisions occur. However, the maximum temperature the enzyme will stay active until is

about 40° C. After the temperature reaches higher than 40° C, the protein enzyme will start to denature and slow down.

Particle size also affects the rate of enzyme action. Smaller particles allow the rate of enzyme activity to be very high because there is a larger surface area for the enzyme to react with and break down. This is proven in part D of the lab, where there was a very fast and active reaction with crushed liver and hydrogen peroxide. The large surface area of the crushed liver allows more space for the enzymes to work on and break down hydrogen peroxide.

4. No, the results would not be different if the dog liver was used for this investigation. This is because the catalase enzyme will stay active as the temperature increases, up to about 40° C.

If the liver is higher than 40 degrees, the enzyme will denature and not work. Since the dog liver is exactly 40° C, the results will be the same, because the enzyme will work at a temperature of 40° C, but not any higher. In conclusion, this lab helped consolidate the understanding of how enzymes work, and how temperature and particle size affects the rate of enzyme activity. This activity was an interactive way to see how the enzymes actually function, through the liver and potato.