Hypothesis:

The change in temperature will affect how the enzymes react and breakdown the bloodstain on the cloth. As the temperature rises, the reaction of enzymes with breaking down the bloodstain on the cotton cloth will be less effective.

Procedure:

Buy chicken livers, Dynamo and Wisk detergent at one's local market. Rub the blood from the chicken livers onto cotton clothes and leave to dry for a day. Dilute the detergent into a 10% solution with water. Gather and label all bloodstained cotton cloths (A, B, C, etc.). Describe the qualitative properties, appearance and visibility of stain, for each piece of cloth before, during and after the application of the detergent. (Use chart given below to fill data from experiment) Measure 5 drops of each detergent and place them evenly and separate stained cloths. Leave the detergent on cloth for two minutes. While the detergent is left on the cloth, fill two beakers with 100 mL of water at the temperature needed for the trial. After the two minutes, place the cloths into the water and stir gently for two minutes. For this section of the experiment, one will have to have three trials of different temperatures. The first trial will be at room temperature (24 degrees Celsius), the second will be warm (50 degrees Celsius), and the third will be hot (85 degrees Celsius). After stirring the cloths gently for two minutes, take out and dry. When the cloths are dry, observe and note the findings of the stain's visibility and how effective the detergent was in removing the stain.

Materials Available:

-Beakers	-Pit Strips	-Thermometer
-Hot Plate	-Stir rod	-Water
-Ice	-Marker	-Two Different Detergents
-Droppers with .01 HCL + .01 NaOH		-Timer

-Blood was diluted with lx saline solution 6-8 drops were placed on about 4-5 squares of cotton dried at room temperature.

Data:

Termperature of Water (in Celsius)	Piece of cloth with detergent used	Before placing in detergent	After placing in detergent and washing
24 Celsius	A (Dynamo 10%)	Dull brown inside with brown outer ring	Still stained; ring is noticeable but inside color faded.
24 Celsius	B (Wisk 10%)	Dull brown inside with brown outer ring	Somewhat stained; blotchy middle with white spots.
50 Celsius	C (Dynamo 10%)	Dull brown inside with brown outer ring	Light brown middle; ring is more noticeable
50 Celsius	D (Wisk 10%)	Dull brown inside with brown outer ring	Middle is white and fades to brown as it reaches ring.
85 Celsius	E (Dynamo 10%)	Dull brown inside with brown outer ring	Stain became darker other than area detergent was placed.
85 Celsius	F (Wisk 10%)	Dull brown inside with brown outer ring	Stain became darker other than area detergent was placed.

Discussion:

Today detergents make up to 25-30% of the enzyme business by producing the needed enzymes to help break down and clean stains. Otto Rohm, founder of Rohm and Hass, first

used an enzyme in 1913 to improve the effectiveness of laundry detergents. ''Oligosaccharides and dextrin's released from the enzyme's hydrolytic action are soluble; thus, the stain is physically cut off from the surface of the fabric piece by piece, with the enzyme acting as scissors. During the process of hydrolysis, the peptide bonds that hold various amino acids together to form a protein molecule are broken down, releasing smaller polypeptides and individual amino acid units.'' (Sun Wang) The bloodstain was almost, but not completely removed at 85 Celsius. Professor Ward mentioned that the hemoglobin broke down in the higher temperatures, making the stains more noticeable but also helped break down the stain where the detergent was placed. In addition, the white was quite a bit whiter at higher temperatures. In conclusion, the enzymes broke the stain down more effectively in higher temperatures.

WorkCited:

1. Duffy, J.I., *Chemicals by Enzymatic and Microbial Processes,* Noyes Data Corp., New Jersey, 1980, p368-373.
2. Sun Wang, Nam. "Enzymes in Laundry Detergents." *University of Maryland.* Department of Chemical & Biomolecular Engineering, n.d. Web.

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