

1 **Hypothesis:**

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

5 **Procedure:**

6 Buy chicken livers, Dynamo and Wisk detergent at one's local market. Rub the blood from
 7 the chicken livers onto cotton clothes and leave to dry for a day. Dilute the detergent into a
 8 10% solution with water. Gather and label all bloodstained cotton cloths (A, B, C, etc.).
 9 Describe the qualitative properties, appearance and visibility of stain, for each piece of cloth
 10 before, during and after the application of the detergent. (Use chart given below to fill data
 11 from experiment) Measure 5 drops of each detergent and place them evenly and separate
 12 stained cloths. Leave the detergent on cloth for two minutes. While the detergent is left on the
 13 cloth, fill two beakers with 100 mL of water at the temperature needed for the trial. After the
 14 two minutes, place the cloths into the water and stir gently for two minutes. For this section
 15 of the experiment, one will have to have three trials of different temperatures. The first trial
 16 will be at room temperature (24 degrees Celsius), the second will be warm (50 degrees
 17 Celsius), and the third will be hot (85 degrees Celsius). After stirring the cloths gently for two
 18 minutes, take out and dry. When the cloths are dry, observe and note the findings of the
 19 stain's visibility and how effective the detergent was in removing the stain.

20 **Materials Available:**

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

1 -Blood was diluted with 1x saline solution 6-8 drops were placed on about 4-5 squares of cotton
 2 dried at room temperature.

3 **Data:**

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Temperature 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.

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6 **Discussion:**

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

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

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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.

Work Sample Evaluation

Subject Area: Biology

Task Title: Soapy Enzymes

Student Work Sample Title: N/A

The document was scored using the *CCR Task Bank Rubric for Scientific Research Plans and Reports*. The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Hypothesis Development			X		
Research Plan			X		
Results and Interpretation		X			
Communication			X		
Organization		X			
Accuracy		X			

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Hypothesis Development: <i>Locating resources in order to develop a thesis or hypothesis</i>	3	7-11	It is evident that some research went into explaining what the concepts are and why enzymes may be added to detergents.
	4		References are provided at the end of the paper, however there is no chemical basis behind laundry detergents.
	3	1-11	The writer links the information in the discussion with the results they observed.
Research Plan: <i>Planning, conducting, and describing an experiment or study</i>	1 & 3		Though the student outlines a good experimental design, the results are not well supported or discussed.
			The student needs to better link concepts with their results.
Results and Interpretation: <i>Describing and interpreting results in relation to the hypothesis</i>	2		The results were presented in a chart that includes interpretations.
	2 & 3		The writer provides weak supporting explanations of the experiment.
Communication: <i>Using subject appropriate language and considering audience</i>	3		The writer does use some scientific writing when explaining the concepts behind detergents.
			The student does use some scientific terminology and concepts throughout the paper.
Organization: <i>Structuring main ideas and incorporating supporting information</i>	1	2-4	The student's expectations and results were weakly supported.
	1 & 2		The student provides a good design and explains the experiment that demonstrates the ideas/concepts they aimed at showing.
Accuracy: <i>Attending to detail, grammar, spelling, conventions, citations, and formatting</i>	2 & 3		The student did provide a chart in the work sample.
			In order to increase the significance of the experiment, all results from the chart discussed are needed.