

BEE AN ENGINEER: ENGINEERING DESIGN RUBRIC

CRITERIA	EXEMPLARY 5 PTS	PROFICIENT 4 PTS	BASIC 3 PTS	MINIMAL 2 PTS	NO EVIDENCE 1 PT
DEFINE THE PROBLEM	Nature of problem of decreasing pollination was described. Rationale for an engineering solution of manual pollination was described.	The essential problem and engineering need were described but without sufficient detail or with minor errors	The engineering need was described but with little or no connection to the underlying problem or decrease to natural pollination.	Some minimal understanding of difficulties with pollination was shown	Little to no evidence was provided to show an understanding of the essential problem or the engineering solution.
IDENTIFYING CONSTRAINTS AND CRITERIA	At least two constraints were identified and three realistic criteria for evaluating potential solutions were identified.	Sufficient constraints and criteria were identified but could be more completely explained or more focused on the important features.	Fewer than two constraints and three criteria were identified, or the constraints and criteria were confused with each other.	One or two general limits or goals for the solution were described.	Very few or no constraints or criteria were identified.
DEVELOPING ENGINEERING SOLUTIONS	At least three potential solutions were considered. These solutions were refined using research and experimentation on pollination. The leading solution was identified using the criteria.	At least three solutions were considered and evaluated against the project criteria. The solutions would be more effective if there were greater variety and/or better application of science content knowledge.	Multiple solutions were considered, but one was chosen without relying on research or experimentation.	Only one solution was seriously considered and little or no refinement of that solution was evident.	Little to no evidence was provided to show any process of refining ideas into a potential solution.
PROTOTYPING AND REVISING A PROPOSED SOLUTION	The hand pollinator prototype met the goals of the intended design and revisions were made to address the shortcomings in the design.	The prototype met most of the design intent. It had minor shortcomings that were not addressed and may affect the usefulness of the prototype	The prototype followed the major theme of the intended design but the had serious shortcomings that were not addressed and that limited the usefulness of the prototype.	The prototype was largely incomplete and different from the design intent. It was not usable for evaluating the proposed solution.	The prototype did not meet the design intent nor was it aligned to the solution.
TESTING AND EVALUATING A PROPOSED SOLUTION	The hand pollinator prototype was tested to determine how well it met the engineering need. Test results were analyzed and used to identify strengths and weaknesses of the proposed solution in terms of project constraints and criteria.	The prototype was tested, and the results were analyzed against the constraint criteria of the project. Conclusions made in the analysis could be more thorough or better connected to the evidence.	The prototype was tested, and the results were recorded. Analysis was minimal and focused on major performance of the prototype only.	The prototype was tested, and general visual observations were made, but no further analysis were performed.	Little to no evidence was provided of testing the prototype or analysis of the evidence.
STRUCTURE OF THE FLOWER	Detailed and accurate information on the structure of a flower and its role in pollination and reproduction were included.	The structure and function of the flower in pollination were addressed without sufficient details or with some inconsistencies.	There were missing details of the function of the flower in pollination.	There was a significant amount of information missing and the information was incorrect.	Little to no information about the flower and pollination was included.
ROLE OF BEES IN POLLINATION	Information was included on bumblebees, buzz pollination, the structure of flowers and interdependency on bees, the effects of inadequate pollination, and the role of agriculture in decreases in the numbers of pollinators.	Topics were addressed but without sufficient detail.	Topics were addressed but many missing details and information were not completely correct.	Many missing details were evident and there were errors in the descriptions.	Little to no details were provided.
USE OF HAND POLLINATION TO INCREASE CROP YIELDS	Detailed information was provided on the need for hand pollination, its impacts and effectiveness, and the role of hand pollination to increase crop yields.	Any two of the three topics were addressed, or topics were addressed but without sufficient details.	Any two of the three topics were addressed but many details were missing and some of the information was incorrect.	Any one of the three topics was addressed with significant amounts of details missing and some of the information was incorrect.	Little to no information was provided on the three topics.

*This rubric was adapted from Engineering in the Life Sciences by R. L. Custer et al., and NSTA press (pgs. 34-39)