

Learning Outcome: Graduates will understand the scientific inquiry process and be able to critically analyze the physical world using the methodologies and models of science.

Component	1	2*	3	4**	5
A Understanding of problem	Student does not exhibit a clear understanding of the problem; Displays little comprehension of the important elements of the problem; Failed to understand enough to start to work the problem.		Response is free of misconceptions that lead to wrong answers; Student grasps basic parts of the problem as well as the general framework; Understands enough to work most of the problem; Can make a diagram that exhibits some understanding of the model; Can demonstrate some conceptualization of the model.		Student manifests a thorough understanding of concepts and relationships between concepts; Identifies all the important elements of the problem; Organization of the response demonstrates clarity of understanding.
B Use of terms and symbols	Student is unable to communicate scientific concepts through terminology; Fails to employ technical, mathematical, or scientific terms or employs them inappropriately; Fails to use symbols or uses them incorrectly.		Student uses most terminology and symbols correctly; Provides evidence of reasonable understanding of terms and symbols.		Student explains thoughts thoroughly using correct terminology and clearly displayed, appropriate symbols; Communicates ideas clearly and concisely; Demonstrates superior knowledge of scientific language and symbolic usage; Knows all the symbols and terms in a mathematical relationship and their association with the scientific model of interest.
C OPTIONAL COMPONENT Calculations and graphical data presentation	Student provides no evidence of manipulation of mathematical expressions; Commits numerous arithmetic errors; Fails to present data in graphical or tabular format.		Response is mainly accurate with some minor arithmetic errors; Student has sufficient understanding to work the problem, but presentation is not sophisticated; Provides graphical representation but cannot extract abstract information or interpretation; Presents calculations in an orderly manner, but misses some details; Represents data graphically but commits minor errors.		Response is fully mathematically accurate; Solution is clearly displayed with various computation steps shown; Student executes algorithms completely and correctly; Presents data in appropriate graphical or tabular format; Provides clear interpretation and conceptualization of results; Displays results graphically in a clear and illuminating way.
D Solution and data interpretation	Student shows significant misunderstanding of the process; Does not correctly apply or even attempt to apply appropriate solution; Adopts inappropriate strategy for solving the problem; Attempts to use irrelevant information		Student shows understanding of the process; Adopts a reasonable strategy for solving most of the problem; Displays solution in a rote manner indicating a simple conceptualization of the problem; Shows understanding of some of the problem's concepts.		Student shows mastery of the process; Presents a detailed solution characterized by logical sequencing and systematic progression; Offers strong supporting arguments; Uses relevant outside information; Solution reflects excellent problem-solving skills.
E Answer and conclusions	Answer lacks units or units are stated incorrectly; Student offers an invalid answer; Fails to offer any empirical findings.		Answer is stated in correct units; Student expresses empirical findings but is limited in identification of related issues; Is unable to demonstrate complete understanding of the mathematical result and its relationship to the conceptual model.		Answer is stated in correct units with any unit changes clearly illustrated; Student provides a complete response with a clear, unambiguous, accurate explanation; Fully describes findings in words; Convincingly connects the numeric results and the conceptual model.
F Evidence of higher level thinking	No evidence of higher level thinking. Student is unable to combine related concepts – no capacity to interpret or imply results to new situation. Extreme difficulty connecting mathematical relationships or expressing ideas mathematically.		Student combines two related concepts; Substitutes correct values and manipulates equation but still has some difficulty with more complicated relationships or model; Has some difficulty in developing a mathematical relationship from the written form.		Student can solve problems requiring multiple steps with development of concepts evolving into the solution; Can clearly synthesize information and organize it in a path through multiple steps to arrive at the solutions; Has no difficulty connecting mathematical relationships or expressing ideas mathematically; Is capable of interpreting and applying results in a new or modified situation.

- 2 - Exhibits most characteristics of '1' and some characteristics of '3'
- ** 4 - Exhibits most characteristics of '3' and some characteristics of '5'