

## Grading Rubrics: Examples of Rubric Creation

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Creating a rubric takes time and requires thought and experimentation. Here you can see the steps used to create two kinds of rubric: one for problems in a physics exam for a small, upper-division physics course, and another for an essay assignment in a large, lower-division sociology course.

### Physics Exam Problems

In STEM disciplines (science, technology, engineering, and mathematics), assignments tend to be analytical and problem-based. Often holistic rubrics are the most efficient, consistent, and fair way to grade a problem set. When starting to grade a problem, it is important to think about the relevant conceptual ingredients in the solution. Then look at a sample of student work to get a feel for student mistakes. Decide what rubric you will use (e.g., holistic or analytic, and how many points). Apply the holistic rubric by marking comments and sorting the students' assignments into stacks (e.g., five stacks if using a five-point scale). Finally, check the stacks for consistency and mark the scores. The following is a sample homework problem from a UC Berkeley Physics Department undergraduate course in quantum mechanics.

#### Homework Problem

A free electron of mass  $m_0$  is initially at rest until a photon of energy  $E$  Compton scatters off of it. Find the equation describing the maximum recoil energy of the electron and evaluate it for  $E = 1 \text{ MeV}$ .

#### Learning Objective

Understand Compton scattering and apply the concepts in a calculation. The discovery of Compton scattering was important in the early development of Quantum Mechanics because it illustrates the quantum nature of light and cannot be correctly described using classical electromagnetism.

#### Desired Traits: Conceptual Elements Needed for the Solution

- Compton scattering for photon: the relationship between the change in photon wavelength and angle of scattering (derived using energy and momentum conservation)
- Relationship between photon wavelength and energy
- How the electron recoil energy relates to the change in photon energy
- How to maximize this relationship
- Evaluate for the given photon energy

#### Scale

A note on analytic rubrics: If you decide you feel more comfortable grading with an analytic rubric, you can assign a point value to each concept. The drawback to this method is that it can sometimes unfairly penalize a student who has a good understanding of the problem but makes a lot of minor errors. Also,

one must assign a point-value to every type of error made by your students, and the variety of mistakes can be staggering. Because the analytic method tends to have many more parts, the method can take quite a bit more time to apply. In the end, your analytic rubric should give results that agree with the common-sense assessment of how well the student understood the problem. This sense is well captured by the holistic method.

A holistic rubric, closely based on a rubric by Bruce Birkett and Andrew Elby:

Points	If...
5	The student clearly understands how to solve the problem. Minor mistakes and careless errors can appear insofar as they do not indicate a conceptual misunderstanding. <sup>[a]</sup>
4	The student understands the main concepts and problem-solving techniques, but has some minor yet non-trivial gaps in their reasoning.
3	The student has partially understood the problem. The student is not completely lost, but requires tutoring in some of the basic concepts. The student may have started out correctly, but gone on a tangent or not finished the problem.
2	The student has a poor understanding of the problem. The student may have gone in a not-entirely-wrong but unproductive direction, or attempted to solve the problem using pattern matching or by rote.
1	The student did not understand the problem. They may have written some appropriate formulas or diagrams, but nothing further. Or they may have done something entirely wrong.
0	The student wrote nothing or almost nothing.

<sup>[a]</sup> This policy especially makes sense on exam problems, for which students are under time pressure and are more likely to make harmless algebraic mistakes. It would also be reasonable to have stricter standards for homework problems.

## Sociology Research Paper

An introductory-level, large-lecture course is a difficult setting for managing a student research assignment. With the assistance of an instructional support team that included a GSI teaching consultant and a UC Berkeley librarian<sup>[b]</sup>, sociology lecturer Mary Kelsey developed the following assignment:

Write a seven- to eight-page essay in which you make an argument about the relationship between social factors and educational opportunity. To complete the assignment, you will use electronic databases to gather data on three different high schools (including your own). You will use this data to locate each school within the larger social structure and to support your argument about the relationship between social status and public school quality. In your paper you should also reflect on how your own personal educational opportunities have been influenced by the social factors you identify. Course readings and materials should be used as background, to define sociological concepts and to place your argument within a broader discussion of the relationship between social status and individual opportunity. Your paper should be clearly organized, proofread for grammar and spelling, and all scholarly ideas must be cited using the ASA style manual.

This was a lengthy and complex assignment worth a substantial portion of the course grade. Since the class was very large, the instructor wanted to minimize the effort it would take her GSIs to grade the papers in a manner consistent with the assignment's learning objectives. For these reasons Dr. Kelsey and the instructional team gave a lot of forethought to crafting a detailed grading rubric.

## Desired Traits

- Argument
- Use and interpretation of data
- Reflection on personal experiences
- Application of course readings and materials
- Organization, writing, and mechanics

## Scale

For this assignment, the instructional team decided to grade each trait individually because there seemed to be too many independent variables to grade holistically. They could have used a five-point scale, a three-point scale, or a descriptive analytic scale. The choice depended on the complexity of the assignment and the kind of information they wanted to convey to students about their work.

Below are three of the analytic rubrics they considered for the Argument trait and a holistic rubric for all the traits together. Lastly you will find the entire analytic rubric, for all five desired traits, that was finally used for the assignment. Which would you choose, and why?

### Five-Point Scale

Grade/ Point	Characteristics
5	Argument pertains to relationship between social factors and educational opportunity and is clearly stated and defensible.
4	Argument pertains to relationship between social factors and educational opportunity and is defensible, but it is not clearly stated.
3	Argument pertains to relationship between social factors and educational opportunity but is not defensible using the evidence available.
2	Argument is presented, but it does not pertain to relationship between social factors and educational opportunity.
1	Social factors and educational opportunity are discussed, but no argument is presented.

### Three-Point Scale

Grade/ Point	Characteristics
3	Argument pertains to relationship between social factors and educational opportunity and is clearly stated and defensible.
2	Argument pertains to relationship between social factors and educational opportunity

	but may not be clear or sufficiently narrow in scope.
<b>1</b>	Social factors and educational opportunity are discussed, but no argument is presented.

### Simplified Three-Point Scale, numbers replaced with descriptive terms

<b>Ideal Outcome</b>	<b>Proficient</b>	<b>Fair</b>	<b>Inadequate</b>
Argument pertains to relationship between social factors and educational opportunity and is clearly stated and defensible			

### Holistic Rubric

For some assignments, you may choose to use a holistic rubric, or one scale for the whole assignment. This type of rubric is particularly useful when the variables you want to assess just cannot be usefully separated. We chose not to use a holistic rubric for this assignment because we wanted to be able to grade each trait separately, but we've completed a holistic version here for comparative purposes.

<b>Grade/Point</b>	<b>Characteristics</b>
<b>A</b>	The paper is driven by a clearly stated, defensible argument about the relationship between social factors and educational opportunity. Sufficient data is used to defend the argument, and the data is accurately interpreted to identify each school's position within a larger social structure. Personal educational experiences are examined thoughtfully and critically to identify significance of external social factors and support the main argument. Paper reflects solid understanding of the major themes of the course, using course readings to accurately define sociological concepts and to place the argument within a broader discussion of the relationship between social status and individual opportunity. Paper is clearly organized (with an introduction, transition sentences to connect major ideas, and conclusion) and has few or no grammar or spelling errors. Scholarly ideas are cited correctly using the ASA style guide.
<b>B</b>	The paper is driven by a defensible argument about the relationship between social factors and public school quality, but it may not be stated as clearly and consistently throughout the essay as in an "A" paper. The argument is defended using sufficient data, reflection on personal experiences, and course readings, but the use of this evidence does not always demonstrate a clear understanding of how to locate the school or community within a larger class structure, how social factors influence personal experience, or the broader significance of course concepts. Essay is clearly organized, but might benefit from more careful attention to transitional sentences. Scholarly ideas are cited accurately, using the ASA style sheet, and the writing is polished, with few grammar or spelling errors.
<b>C</b>	The paper contains an argument about the relationship between social factors and public school quality, but the argument may not be defensible using the evidence available. Data, course readings, and personal experiences are used to defend the argument, but in a perfunctory way, without demonstrating an understanding of how social factors are identified or how they shape personal experience. Scholarly ideas are cited accurately, using the ASA style sheet. Essay may have either significant organizational or proofreading errors, but not both.
<b>D</b>	The paper does not have an argument, or is missing a major component of the

	evidence requested (data, course readings, or personal experiences). Alternatively, or in addition, the paper suffers from significant organizational and proofreading errors. Scholarly ideas are cited, but without following ASA guidelines.
<b>F</b>	The paper does not provide an argument and contains only one component of the evidence requested, if any. The paper suffers from significant organizational and proofreading errors. If scholarly ideas are not cited, paper receives an automatic "F."

### Final Analytic Rubric

This is the rubric the instructor finally decided to use. It rates five major traits, each on a five-point scale. This allowed for fine but clear distinctions in evaluating the students' final papers.

<b>Argument</b>	
<b>5</b>	Argument pertains to relationship between social factors and educational opportunity and is clearly stated and defensible.
<b>4</b>	Argument pertains to relationship between social factors and educational opportunity and is defensible, but it is not clearly stated.
<b>3</b>	Argument pertains to relationship between social factors and educational opportunity but is not defensible using the evidence available.
<b>2</b>	Argument is presented, but it does not pertain to relationship between social factors and educational opportunity.
<b>1</b>	Social factors and educational opportunity are discussed, but no argument is presented.
<b>Interpretation and Use of Data</b>	
<b>5</b>	The data is accurately interpreted to identify each school's position within a larger social structure, and sufficient data is used to defend the main argument.
<b>4</b>	The data is accurately interpreted to identify each school's position within a larger social structure, and data is used to defend the main argument, but it might not be sufficient.
<b>3</b>	Data is used to defend the main argument, but it is not accurately interpreted to identify each school's position within a larger social structure, and it might not be sufficient.
<b>2</b>	Data is used to defend the main argument, but it is insufficient, and no effort is made to identify the school's position within a larger social structure.
<b>1</b>	Data is provided, but it is not used to defend the main argument.
<b>Reflection on Personal Experiences</b>	
<b>5</b>	Personal educational experiences are examined thoughtfully and critically to identify significance of external social factors and support the main argument.
<b>4</b>	Personal educational experiences are examined thoughtfully and critically to identify significance of external social factors, but relation to the main argument may not be clear.
<b>3</b>	Personal educational experiences are examined, but not in a way that reflects understanding of the external factors shaping individual opportunity. Relation to the main argument also may not be clear.
<b>2</b>	Personal educational experiences are discussed, but not in a way that reflects understanding of the external factors shaping individual opportunity. No effort is made

	to relate experiences back to the main argument.
<b>1</b>	Personal educational experiences are mentioned, but in a perfunctory way.
<b>Application of Course Readings and Materials</b>	
<b>5</b>	Demonstrates solid understanding of the major themes of the course, using course readings to accurately define sociological concepts and to place the argument within a broader discussion of the relationship between social status and individual opportunity.
<b>4</b>	Uses course readings to define sociological concepts and place the argument within a broader framework, but does not always demonstrate solid understanding of the major themes.
<b>3</b>	Uses course readings to place the argument within a broader framework, but sociological concepts are poorly defined or not defined at all. The data is not all accurately interpreted to identify each school's position within a larger social structure, and it might not be sufficient.
<b>2</b>	Course readings are used, but paper does not place the argument within a broader framework or define sociological concepts.
<b>1</b>	Course readings are only mentioned, with no clear understanding of the relationship between the paper and course themes.
<b>Organization, Writing, and Mechanics</b>	
<b>5</b>	Clear organization and natural "flow" (with an introduction, transition sentences to connect major ideas, and conclusion) with few or no grammar or spelling errors. Scholarly ideas are cited correctly using the ASA style guide.
<b>4</b>	Clear organization (introduction, transition sentences to connect major ideas, and conclusion), but writing might not always be fluid, and might contain some grammar or spelling errors. Scholarly ideas are cited correctly using the ASA style guide.
<b>3</b>	Organization unclear or the paper is marred by significant grammar or spelling errors (but not both). Scholarly ideas are cited correctly using the ASA style guide.
<b>2</b>	Organization unclear and the paper is marred by significant grammar and spelling errors. Scholarly ideas are cited correctly using the ASA style guide.
<b>1</b>	Effort to cite is made, but the scholarly ideas are not cited correctly. (Automatic "F" if ideas are not cited at all.)

[b] These materials were developed during UC Berkeley's 2005–2006 Mellon Library/Faculty Fellowship for Undergraduate Research program. Members of the instructional team who worked with Lecturer Kelsey in developing the grading rubric included Susan Haskell-Khan, a GSI Center teaching consultant and doctoral candidate in history, and Sarah McDaniel, a teaching librarian with the Doe/Moffitt Libraries.