Refraction and Lenses Notebook - Scoring Rubric

Your notebook will be collected at the end of class on _____, _____ _____. The following items should be in your notebook. They should be clearly organized and easy to find. *Auxilliary items* should be taped, glued or stapled into the notebook in the appropriate location; they should not be *hanging loose*. Use an organizational system and label all work. Each lab will be graded separately. Ten Refraction and Lenses lab grades will be entered into the gradebook. An overall notebook grade will be determined based on your use of the notebook as an organized and effective record-keeping tool which documents your engagement in the learning cycle during classtime and labtime.

Name: _____ Period: _____

Item		Score
RL1.	**Refraction Action Lab** ____ Included, labeled and organized all parts of the lab report. ____ Data section includes an organized documentation of observations for both parts of the lab (The Broken Pencil and the Marching Soldiers). Observations are accurate. ____ Conclusion/Discussion answers all three *questions* of the Purpose; *answers* are correct. Each *answer* includes a specific reference to an observation from the Data section as logical and empirical evidence for the statement. Conclusion/Discussion is understandable and well-written.	_____/3 (Lab score)
RL2.	**Direction of Bending Lab** ____ Included, labeled and organized all parts of the lab report. ____ Data section includes an outline of a prism with the laser light path traced into, through and out of the prism; arrowheads are included on the diagram. Normal lines are drawn and the relative direction of bending with respect to the normal line is indicated for each of the two boundaries. ____ Conclusion states the rule(s) for the direction of bending for a slow to fast and for a fast to slow situation; rules are correctly stated. ____ Discussion of Results relates the evidence of the Data section to the rules of the Conclusion. Specific references are made to the diagrams in the Data section to logically support the direction which light bends when moving from a *slow* medium to a *fast* medium. Writing is clear and thorough.	_____/5 (Lab score)
RL3.	**Least Time Principle Lab** ____ Included, labeled and organized all parts of the lab report. ____ Data section includes the provided data table; table is complete. Another table with calculated ratios is included; column headings are indicated. The calculated data lead to the development of an appropriate conclusion. ____ Conclusion states the relationship between the ratio of speeds and the ratio of the angles. An equation is reported. The statement and equation are correct.	_____/3 (Lab score)
RL4.	**How Much? Lab** ____ Included, labeled and organized all parts of the lab report. ____ Data section includes an organized table of Θ_{air} and Θ_{water} values; table headings and units are included. A plot of $\sin\Theta_{air}$ vs. $\sin\Theta_{water}$ is sketched; results of the linear regression analysis (slope, y-intercept, R value) and the equation is reported. Equation avoids y's and x's and includes the symbols of the plotted quantities. ____ Conclusion reports the experimentally-derived equation. ____ Discussion of Results accurately evaluates the reliability of the equation - commenting on the slope value and the regression constant from the linear analysis. The experimentally-derived equation is compared to the equation which would be expected based upon textbook readings.	_____/8 (Lab score)

RL5. The Unknown n Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes outline of at least two prisms. The path of laser light through the prism is shown; arrowheads are included on the light rays. An appropriate entry angle is selected - one which provides significant refraction at both boundaries. Normal lines are drawn at the entry and exit boundary and properly measured angles are indicated on the diagram. Work for the calculation of the index of refraction is clearly shown for each of the two boundaries for each prism; calculations are accurate. An average n value based on both boundaries is calculated. Work is accurate and complete. ____ Conclusion states the index of refraction value for each of the two materials; stated value is reasonably accurate.	_____/8 (Lab score)
RL6. R and R Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes observations of how the angle of incidence effects the amount of light which is reflected and the amount of light which is refracted. Observations are organized, accurate, clear and thorough. ____ Conclusion/Discussion uses complete sentences to intelligently and thoroughly describe the trend of how an increasing angle of incidence effects the amount of light reflected and refracted at a boundary. Clear and explicit reference is made to the Data section in support of the conclusion.	_____/3 (Lab score)
RL7. A Critical Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes two diagrams (one for each boundary) with an incident ray in the appropriate medium and at the critical angle; corresponding refracted ray is correctly shown. The critical angle is labeled on the diagram. ____ Conclusion states the critical angles for the two boundaries; values are reasonably accurate. ____ Discussion of Results includes an error analysis evaluating the reliability of the critical angle values. The theoretical value is calculated (work is shown) and a percent error analysis is included for both boundaries. The work is shown and organized.	_____/6 (Lab score)
RL8. Exploring Lenses Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes an organized record of observations of orientation and relative size for the two types of lenses and for the two distances (nearby and distant). Observations are clear and accurate. ____ Conclusion/Discussion describes the relative size and orientation of the images of distant and nearby objects for converging and diverging lenses.	_____/4 (Lab score)
RL9. The L•O•S•T Art of Image Description Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes an organized table with column headings which documents observations of the **l**ocation, **o**rientation, **s**ize and **t**ype of the images for the four general object locations. Observations are accurate and complete. ____ Conclusion/Discussion describes the **l**ocation, **o**rientation, **s**ize and **t**ype of the images for the four general object locations. Writing is thorough and clear. Conclusion is correct.	_____/5 (Lab score)
RL10. The Lens Equation Lab ____ Included, labeled and organized all parts of the lab report. ____ Data section includes a table of relevant measurements with column headings and units. Data appear accurate. Reciprocal values are calculated and recorded to the proper number of significant digits. Sketched a plot of $1/d_{image}$ vs. $1/d_{object}$ and included the results of the linear regression analysis. Wrote equation in slope-intercept form; did not include y's and x's in the equation; used symbols of actual quantities. ____ Conclusion states the experimentally-derived equation relating object and image	_____/8 (Lab score)

___	distance. Discussion of Results provides and error analysis discussing the reliability of the experimentally-derived equation. Equation is compared to theoretical expectation. Focal length is determined from the y-intercept; calculation is shown and explained in writing.	
RL11.	**Use of Notebook as a Record-Keeping Tool** Ideally, a student would use the notebook to record notes from class lectures, post-lab sections, textbook readings, etc. Answers and discussions of opening questions are provided. The notebook is a record of the involvement of a scientist/student in both class and lab. A blank or even sparsely-used notebook with little evidence of involvement in class is not a sign of a student who has used the notebook to document and record their involvement in class. A diligent student keeps careful records which subsequently become an effective and useful learning tool.	_____/10 (HW score)