**Characterizing KBO’s**

*The Kuiper Belt Catch and Return Mission (KatcheM) has returned a number of intact Kuiper Belt Objects for your study. Your team has been assigned one of the objects for study. Develop a detailed report that describes the physical characterization of this new world. Include tables of its physical characteristics and images along with written descriptions of each type of surface feature observed. Report all measurements in SI units such as grams and cm.*

*Create a Google doc or PowerPoint suitable for presentation to the other teams. You will share your studies at the KatcheM colloquium to identify commonalities and proposed topics for research.*

Directions for teacher:

Brainstorm ahead of time with the class a list of physical characteristics that each team will investigate in common. Here are some examples: surface color(s), shape, diameter or circumference (maybe along more than one axis, if not very spherical), mass, density, volume, presence of an atmosphere.

If you can smell “potato”, you have detected an atmosphere. If yes, what is the farthest distance away from your nose the smell can be detected? This will indicate the thickness of the atmosphere.

What types of surface features are on your KBO?
Show students new images from Pluto and Charon for inspiration. Explain that this is a necessary first step for understanding the physical processes that formed the surface and perhaps are still at work today. Just as on earth, if the planet has an atmosphere there will be weather that will also alter and form the surface features.

Sample timeline

Period 1: Introduce the problem, form teams, develop characteristics for study (all teams agree to a common list). Each group should come up with a team name.

Period 2-3: Allow teams to collect data, take images, develop the list of features, and assemble the report/presentation. Teams should also designate spokespersons or roles for multiple speakers.

Period 4: Colloquium. Each team presents, and audience records data on spreadsheets in order to compare the KBOs. They should calculate averages for numerical parameters. They also should write about common features observed, or differences they notice between their object and others.

Period 5: After the presentations, each team should develop a future research direction and describe it in a report. It can be about their KBO, or another group’s specimen, or KBO’s in general. They may need to spend time in conversation with other teams to look more closely at data or to ask questions that perhaps were not covered in the presentation. The team should vet their idea through the research director (teacher) to make sure that has not already been used by another team.

The team prepares a written report of what research question they would like to answer, then proposes the next steps: what further data needs to be collected in order to answer the question, and how will that be accomplished (propose a mission or way of collecting the data)? Two teams may work together to investigate two different aspects of the same question.

Sample Assessment rubric : Each ranked 1-5 scale with 5 as the best

\*Teamwork
 Does each person have a role? Are all contributing? Is the team working well together?

\*Physical parameters measured
 All measurements taken and recorded, correct units used, correct calculations of volume& density

\*Surface features characterization
 All features imaged and described, numbers of each type of feature, patterns in locations of features?

\*Report
 All data and observations recorded and organized, correct spelling, format

\*Colloquium presentation
 Organization, clarity, oral presentation, thoroughness

\*Colloquium data recorded
 Complete data set collected, analyzed for averages and patterns, and also for unique features

\*Future research report
 Unique research question developed, description of what data will need to be collected and how it happens. Quality of report evaluated on thoroughness, completeness, grammar and spelling, format.