

Structure and Properties of Matter: Ion Propulsion

Developer: John Ristvey, McREL

Audience: Grades 9-13

Format: Website

I. Final Recommendation: Minor Revisions.

The panelists praised this Website and labeled it ‘one of the best we’ve seen recently.’ They also noted that the student assessment is fantastic. Since it is relatively easy to edit a Web site, they noted a few items that would be very quick fixes and urge the developers to incorporate them right away. This product may be resubmitted for final approval at any time.

- On page 4 of “How Do We Get There”, the sentence “Since this small thrust changes the spacecraft’s velocity only 10^{-5} m/s every second, it will require 100 days to achieve an acceleration of 1000 m/s/s.” there is something wrong with the units and result. After 100 days, the final *velocity* would be about 86.4 m/s. You would not have a greater acceleration if the acceleration of 10^{-5} m/s² is constant (as stated above). In the next line, the same 1000 m/s² is cited - this may need to be a velocity as well. The actual average orbital speed of Vesta is 19,340 m/s (Wikipedia.org article). Will it actually take the spacecraft 22,384 days (61 years) to match the velocity of Vesta? The numbers given do not seem to work. The units for 1000 m/s/s would actually be 1000m. If the state acceleration is correct, it should be typed as 1000 m/s*s or 1000 m/s².
- Include a notice with each exercise stating the time needed for completion and its intended use.
- Label *plasma* the 4th state of matter (not the latter state).

II. Individual Review Summary (prior to panel telecon)

Following is the summary of the individual reviews that was distributed to the reviewers prior to the panel discussion by telecon. This information was used to guide the panel discussion; it is included here to provide a complete report of the review process.

Reviewer	Overall Rating	Recommendation
Education Reviewer	Outstanding	Recommended
Education Reviewer	Outstanding	Recommended
Education Reviewer	Outstanding	Recommended
Science Reviewer	Very Good	Minor Revisions
Science Reviewer	Outstanding	Recommended

Strengths:

- The activity is engaging and inspiring to students; the content is age-appropriate.
- The students are engaged in the use of many process skills.

- Good information is provided for teachers, and the instructions are easy to follow.
- The standards are clearly identified and addressed.
- Good suggestions for assessment are provided.
- The site is visually stimulating, well organized, easy to navigate, and stays mostly within the 2-click rule.
- The material is highly relevant to NASA and well connected to the Dawn Mission.
- The material makes links to several science disciplines and provides a historical perspective.

Weaknesses:

- The units should all be metric; some places were identified where English units are used. See specific listings on page 6.
- The science reviewers found some inaccuracies or areas where more explanation could be provided. Some examples include (For additional suggestions, see individual review pg. 6-8):
 - Ceres and Vesta should be referred to as dwarf planets not asteroids. [*IGES Note: Ceres as a dwarf planet was an IAU decision August 2006, Vesta remains an asteroid.*]
 - On “Pushing with Plasma” page 2, it should state that plasma is the “fourth” state of matter instead of the “latter” state of matter.
 - On “Pushing with Plasma” page 4, examples are given for collisional outcomes of inelastic vs. elastic.
 - In the How Do We Get There power point, the diagram of the spacecraft trajectory is confusing and the terms coasting vs. thrusting are not defined.
 - Explain what change of velocity means and why it is important.

Suggestions for Improvement:

- The site contains so much information that it might be helpful to provide suggestions for teachers on how to use activities and the amount of time to allow for each.