**Mission to Titan**



[*Saturn's largest moon, Titan*](http://www.space.com/12638-amazing-photos-titan-saturn-moon.html)*. There are no jolly elves at Titan's north pole; liquid methane and ethane seas appear as splotchy features near the moon's poles. At the south pole, a high-altitude vortex swirls. The hazy orange atmosphere of Titan is thought to resemble the atmosphere of early Earth. The goal of the Huygens probe — named after Titan's discoverer, the Dutch astronomer Christiaan Huygens — is to learn more about Titan's atmosphere and surface.*

*http://www.space.com/24108-amazing-saturn-photos-cassini-spacecraft-2013.html*

**Project Based STEM Unit**

Scientists and engineers are teaming up to plan a mission to Titan. Your Team will be charged with designing a sphere (containing sensors) that can both navigate the gas clouds of Titan and roll along the surface for a long enough period to gather needed data.

**Easy Rollers**

|  |
| --- |
|    I.   Introduction to the problem.                   |
|   II.   Teams assign roles and begin Part I (prediction) of the activity. |
|  III.   Teams begin "lab" trials with rolling and falling balls.                 |
|  IV.   Teams engage in discussing and writing lab results.       |
|   V.   Teams self assess their participation (See Checklist) |
|  VI.   Whole Group reconvenes for presentations and processing of their collaborative        achievements   |
|  VII.  Whole group discussion of their responses to engagement in the constructivist         learning activity  |
| VIII. Teams return to discuss how they will "engineer" a ball for a specific surface to         reduce friction or air resistance. (Create a visual to describe and explain ideas). |
|  IX.  Teams report out to Whole Group followed by Summary and Assessment     |

See the accompanying sheets to learn of your individual role and responsibility in this exciting new venture!  **Double-T Chart on Attentive Listening**

|  |  |  |
| --- | --- | --- |
| **LOOKS LIKE** | **SOUNDS LIKE** | **FEELS LIKE** |
|  |  |  |

CHARACTERISTICS OF INTELLIGENT BEHAVIOR

*Reflect on your team’s engagement in and use of the following intelligent behaviors:*

 [ ] Persistence

 [ ] Decreasing impulsivity

 [ ] Empathic listening

 [ ] Flexibility in thinking

 [ ] Metacognitive awareness

 [ ] Checking for accuracy

 [ ] Questioning

 [ ] Problem posing

 [ ] Drawing on past knowledge

 [ ] Application to new situations

 [ ] Precision of language and thought

 [ ] Using all the senses

 [ ] Ingenuity, originality, insightfulness and creativity

 [ ] Inquisitiveness, curiosity

 [ ] Enjoyment of problem solving

Reuven Feuerstein

Arthur Costa

**CONSTRUCTIVIST LEARNING PRACTICES**

***Check those items that were observed during the activity and processing***

🞏 Encourage and accept student autonomy, initiative and leadership.

🞏 Whenever possible, use raw data and primary sources along with manipulative, interactive and physical materials.

🞏 When framing tasks, use cognitive terminology like classify, analyze,

predict, and so on.

🞏 Allow student thinking to drive lessons. Shift instructional strategies of

alternative content based on student responses.

🞏 Ask students for their theories about the concepts before sharing the

facts or background of these concepts.

🞏 Encourage students to engage in dialogue both with the teacher and

with one another.

🞏 Seek elaboration of students’ initial responses.

🞏 Pose contradictions to students’ hypotheses (in diplomatic ways) and

then encourage alternative responses.

🞏 Encourage student inquiry by asking thoughtful, open-ended questions

and encouraging them to ask questions of others.

🞏 Allow wait time after posing questions.

🞏 Provide time for students to discover relationships and to create

metaphors about the topics of their learning experiences.

🞏 Encourage students to reflect on experiences and actions, and then

participate in deciding future activities or predicting future outcomes.

**CONSTRUCTIVIST TEACHING PRACTICES**

1. Design curriculum around active or hands-on learning tasks.

2. When designing curriculum, organize information and conceptual

clusters of problems, questions, and discrepant situations.

3. Both before and during activities, adapt curricula so that their cognitive

demands match the cognitive schemes of students.

4. Look for students’ alternative conceptions, and design subsequent

activities to address any misconceptions. (Problem-based learning)

5. For selected tasks, group students according to their demonstrated

cognitive complexity.

6. Design lessons or units by applying Tyler’s four questions on curricular

 alignment.

7. Structure lessons so that the direct instruction is embedded in the

introduction and that students are quickly engaged in exploration, prediction testing and construction.

8. Include higher order thinking through the use of graphic organizers and

student self assessment and goal setting.

**SOURCE INFORMATION REGARDING THE EASY ROLLERS PBL ACTIVITY**

**FIRST LAW OF FALLING BODIES (GALILEO - 1590)**

 Under the influence of gravity alone, air bodies fall with equal acceleration. All resistance affects velocity (to determine velocity multiply 32.16 per second times the number of seconds the body falls. The bodies descend at the same rate regardless of horizontal motion when their fall is caused by gravity alone. A body’s horizontal motion caused by a chute does not affect it’s vertical speed.

**INERTIA**

 The tendency of an object that is not moving to remain motionless and a moving object to continue moving at a constant speed in the same direction.

**MASS**

 The amount of matter in an object; Mass and weight are not the same.

**MECHANICS**

 *Dynamics* - bodies in motion; *Static*s- objects at rest

**MOMENTUM**

 The quantity of motion of a moving body depends on mass and acceleration, and the force exerted on it. Calculate the momentum of a moving object by multiplying its mass (quantity of matter) by its velocity. (P equals its mass (m) multiplied by velocity (v) p=mv).

**KINETIC ENERGY**

 Energy is equal to 1/2 mass squared ( E = 1/2 m2 )

**PRINCIPLE OF INERTIA (NEWTON’S LAW OF MOTION)**

 An object moves in a straight line unless acted on by an outside force.

**SECOND LAW OF MOTION (NEWTON)**

 Force (f) equals mass times acceleration.

**WEIGHT** The force on an object due to the pull of earth’s gravity.

**Checker**: Has your group . . .

[ ] Reviewed Physics Source Sheet and Discussed Group
 Results? Identified key math and science questions arising
 from this activity?

[ ] Completed the Galileo’s Log

[ ] Created a Graphic Organizer for Group Presentation on crafting a sphere that will roll the furthest on a rough surface/smooth surface?

[ ] Reviewed Constructivist Learning Characteristics

[ ] Reviewed Intelligent Behaviors

[ ] Created a Team Name and Slogan

SELF-ASSESSMENT FORM

Use this form to assess your participation and learning outcomes in the constructivist activity by responding to the following items:

Name of Activity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Circle the rating (5 is the highest) for each item below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1. Energy expended in planning, conducting

and processing activity | 1 | 2 | 3 | 4 | 5 |
| 2. Success in task completion within timelines | 1 | 2 | 3 | 4 | 5 |
| 3. Quality of the new learning experience: in terms of gaining new or expanded knowledgein content, or process of teaching and learning | 1 | 2 | 3 | 4 | 5 |
| 4. Overall effort and enthusiasm expended during the activity | 1 | 2 | 3 | 4 | 5 |
| 5. Quality of presentation to the whole group(when applicable)   | 1 | 2 | 3 | 4 | 5 |

What did you like best about this activity? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What did you like least? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What would you ***change*** if anything? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If applicable, what letter grade you believe you have earned? \_\_\_\_\_\_

Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_/\_\_\_\_/\_\_\_\_\_

Instructor Comments: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*“The unexamined life is not worth living,”*

*Socrates*

 **Collaborative Research Project Peer Assessment
*Rate your mates!***

***Team Member Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **1****Bench Warmer** | **2****RolePlayer** | **3****Team Captain** | **4****SuperStar** |
| **Work** | **Did very little during work period** | **Did most of the work assigned to the team** | **Did all work assigned to him/her well** | **Graciously accepted extra work** |
| **Organization** | **Did their own thing** | **Followed directions** | **Helped organize the group** | **Took charge & organized the group** |
| **Contribution** | **Held our group back** | **Helped our group succeed** | **Our group was better because of him/her** | **Group was much better because of him/her** |
| **Motivation** | **He/she prevented me from doing my best** | **He/she expected too much from me** | **He/she pushed me to be better** | **He/she brought out the best in me** |
| **Group members** | **Overall Performance** | **Total from above** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **1 2 3 4**  | **\_\_\_\_\_\_\_/16**  |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **1 2 3 4**  | **\_\_\_\_\_\_\_/16**  |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **1 2 3 4**  | **\_\_\_\_\_\_\_/16**  |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **1 2 3 4**  | **\_\_\_\_\_\_\_/16**  |