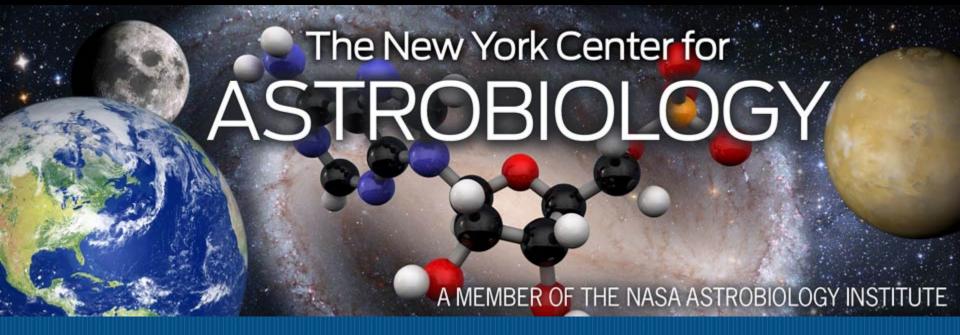


Judith Archibold, Shenendehowa High School, Clifton Park, NY John Campana, Fairport High School, Fairport, NY Paul Zachos, ACASE, Saratoga Springs, NY

KEPLER EXOPLANET VOYAGE FOR HIGH SCHOOL STUDENTS

RESOURCES



Astrobiology Teachers Academy at Rensselaer Polytechnic Institute

July 9 – 12, 2012

RESOURCES

ACASE



ASSOCIATION FOR THE COOPERATIVE ADVANCEMENT OF SCIENCE & EDUCATION

ACASE is a group of scientists and teachers who develop systematic ways to make the experience of students deeper and more creative, and to reignite the spark that inspired many teachers to take on the challenges of the classroom.

If we really believe that learners construct their own knowledge, what can we do to help?

Eleanor Duckworth







Whatever we teach children we prevent them from discovering for themselves |ean Piaget







CONCERNS OF TEACHERS:

- I. Misconceptions
- II. Engaging Students
- Role of Educational Assessment in Teaching

PURPOSE

 Create a learning module to address these three concerns

 Apply the scientific method to assess the effectiveness of teaching related to the learning module created

LEARNING GOALS

Students will be able to...

- Determine the acceleration due to gravity near the surface of a planet
- Apply Newton's Laws of Motion to the Earth and other Worlds
- Predict and sketch the path a projectile on the Earth and on other Worlds

ASSESSMENT

Published in: The Physics Teacher, Vol. 30, March 1992, 141-158

Force Concept Inventory

David Hestenes, Malcolm Wells, and Gregg Swackhamer

Every student begins physics with a well-established system of commonsense beliefs about how the physical world works derived from years of personal experience. Over the last decade, physics education research has established that these beliefs play a dominant role in introductory physics. Instruction that does not take them into account is almost totally ineffective, at least for the majority of students.

Specifically, it has been established that 1(1) commonsense beliefs about motion and force are incompatible with Newtonian concepts in most respects,

(2) conventional physics instruction produces little change in these beliefs, and (3)

ASSESSMENT

Grading Rubric

Question 1 and 2: Equal acceleration of falling objects

4	Correct answers and reasoning in both cases				
3	Correct answer both cases, partially correct reasoning				
2	Correct answer both cases, incorrect reasoning or correct in one case with correct reasoning in one case				
1	Correct answer in one case, incorrect reasoning				
0	No evidence of attainment				

Question 3 and 4: Forces in action / reaction pairs that are always equal and opposite

4	Correct answers and reasoning in both cases				
3	Correct answer both cases, partially correct reasoning				
2	Correct answer in both cases, incorrect reasoning or				
2	correct in one case with correct reasoning in one case				
4					

NASA'S KEPLER PROJECT DATA

2011 NASA DATA: Planet Candidates in or near the Habitable

	Catalog Number	T lanet I value	of planet (K)	(Earth radii)	(Earth masses)	of star (K)	of star (watts)
1	683.01	P1- Kyle A	239	4.14	12.81	5624	2.10E+26
2	1582.01	P1- Laurene B	240	4.44	15.80	5384	1.19E+26
3	1026.01	P1-Adelina C	242	1.77	5.00	3802	3.33E+25
4	1503.01	P1-Nicholas C	242	2.68	17.37	5356	8.89E+25
5	1099.01	P1-Kerian C	244	3.65	43.89	5665	1.07E+26
6	854.01	P1-Stephen D	248	1.91	6.37	3743	1.62E+25
7	433.02	P1-Caleb D	249	13.37	437.26	5237	3.02E+26
8	1486.01	P1-Seungjoo H	256	8.43	108.14	5688	2.48E+26





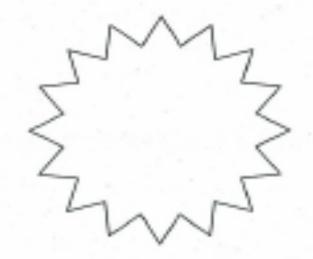
THE UNIVERSITY OF THE STATE OF NEW YORK • THE STATE EDUCATION DEPARTMENT • ALBANY, NY 12234

Reference Tables for Physical Setting/PHYSICS 2006 Edition

List of Physical Constants					
Name	Symbol	Value			
Universal gravitational constant	G	$6.67 \times 10^{-11} \mathrm{N} \cdot \mathrm{m}^2/\mathrm{kg}^2$			
Acceleration due to gravity	g	9.81 m/s ²			
Speed of light in a vacuum	c	$3.00 \times 10^{8} \text{ m/s}$			
Speed of sound in air at STP		$3.31 \times 10^{2} \text{ m/s}$			
Mass of Earth		$5.98 \times 10^{24} \mathrm{kg}$			
Mass of the Moon		$7.35 \times 10^{22} \mathrm{kg}$			
Mean radius of Earth		$6.37 \times 10^{6} \text{ m}$			
Mean radius of the Moon		$1.74 \times 10^6 \text{ m}$			
Mean distance—Earth to the Moon		$3.84 \times 10^{8} \text{ m}$			
Mean distance—Earth to the Sun		$1.50 \times 10^{11} \text{ m}$			

EXOPLANET INFORMATION

NASA Catalog Number _	174.01	Planet Name	Vulcan	
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[diagrams not to scale]



weight of 60 kg person on planet (N) = 1334.813

weight of 60 kg person on Earth (N) = _588 14

ATT		-		
Star I	hed	VACUUM.	व्यक्ति	KONTO C
1. Proposed 1		1000	***	

mass (kg): 1.59 x 10 30 VA

star class:

star color:

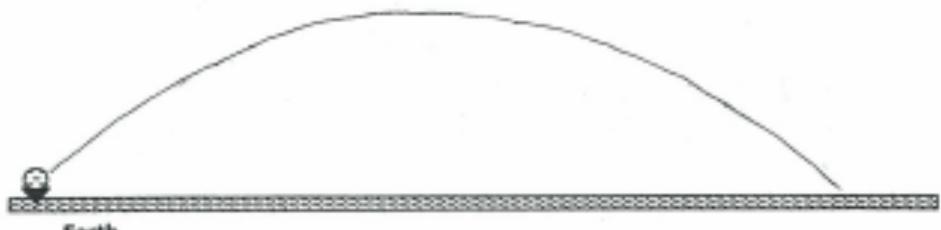
Planet Information:

mass (kg): 8,64×10⁹⁵ kg

radius (m): Last × 10 m

Fg for 60 kg person: 1534.8N

Physics Property	Earth	Planet: <u>Vulcan</u>		
acceleration due to gravity	9.8 m/s2	33.2mls.2		
distance covered in 10s free fall	490 m	mon		
time to fall 4 stories (14m)	1.695	1.125		
velocity of free falling object after 5s of free fall	49mls	111 m ls		
momentum of 8 kg bowling ball after 5s of free fall	392 kg·m/s	888 mg · m 13		
time for falling penny to reach terminal velocity of 35 m/s (neglecting friction)	3.578	1.58s		
falling distance required for penny to reach terminal velocity of 35 m/s (neglecting friction)	62.5m	27.6m		



Earth



Planet Nukono

A brief summary that compares Newton's Laws of Motion on Earth and on planet

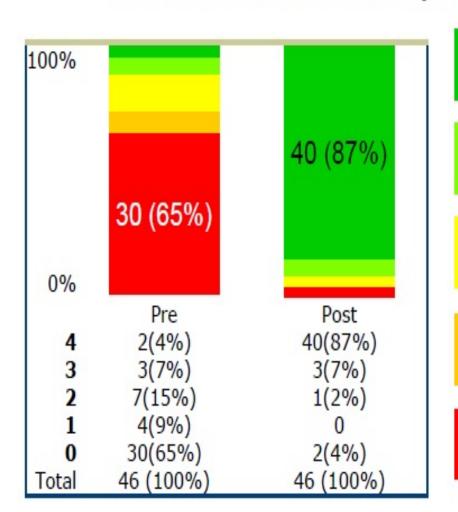
Nullan: Newton's Laws of Motion apply on Flores Yukan

just as they apply on Earth. However, a taxes much more work to
move things on Planet Villan due to the increased accellination
due to gravity.

A list any other relevant information for NASA regarding planet Nulcon, and a final recommendation to NASA regarding this planet: This planet would not be habitable, because the acculusation due to granity is more than traice what it is on Earth, This force could crush someone bring on that planet, and furthermore if it was physically possible to live on Planet Visions much more seek would be required to do simple things like aicking up a toothbrush

DATA: EQUAL ACCELERATION

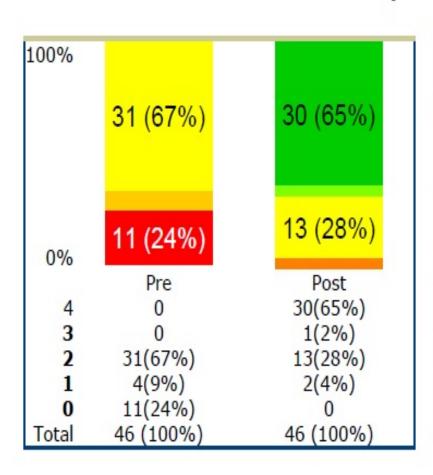
Pre & Post Results: Equal Acceleration of Falling Objects



- 4- Correct answers and reasoning in both cases
- 3- Correct answer both cases, partially correct reasoning
- 2- Correct answer both cases, incorrect reasoning OR correct in one case with correct reasoning
- Correct answer in one case, incorrect reasoning
- 0- No evidence of attainment

DATA: ACTION/REACTION PAIRS

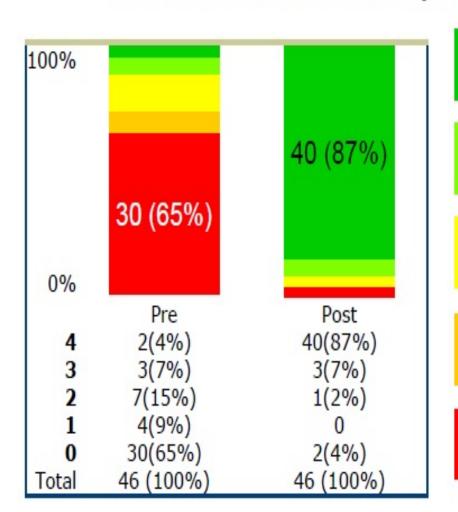
Pre & Post Results: Forces in Action/Reaction pairs that are always Equal and Opposite



- 4- Correct answers and reasoning in both cases
- 3- Correct answer both cases, partially correct reasoning
- 2- Correct answer both cases, incorrect reasoning OR correct in one case with correct reasoning
- Correct answer in one case, incorrect reasoning
- 0- No evidence of concept attainment

DATA: EQUAL ACCELERATION

Pre & Post Results: Equal Acceleration of Falling Objects



- 4- Correct answers and reasoning in both cases
- 3- Correct answer both cases, partially correct reasoning
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- Correct answer in one case, incorrect reasoning
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STUDENT QUOTES: EVIDENCE OF ENGAGING STUDENTS

- "There's no way you could live on my planet, I feel disappointed..."
- "Hey, check out my planet, you'd actually weigh less there. Can I go there now?"
- "You always show us real science."
- "Did you see the news? NASA..."
- "Can you explain what a Higgs boson is?"
- "What...? Do you, ...like..., know scientists from all over the world?"

CONCLUSIONS

- Misconceptions
- Engagement
- Role of Educational Assessment in Teaching

SOURCES

- ATA Origins Website: www.origins.rpi.edu
- Acase Website: http://www.acase.org/
- Force Concept Inventory:
 http://modeling.asu.edu/r&e/fci.pdf
- Video web site:
 http://hixby.com/image/i-enjoy-traveling-through-the-universe