Alliance For Physics Excellence (APEX)
2015 Summer Institute Workshop – Cohort 3
Physics Teacher Institute (PTI) Activity Schedule
Alabama A & M University
July 12 – 17, 2015

Sunday July 12, 2015

5:00 - 5:15 PM	❑ Welcome ❑ Introductions ❑ Announcements	Dr. Barbara Cady Alabama A & M University Announcements/Housekeeping	AAMU Ernest L. Knight Center - VIP Room
5:15 - 5:30 PM	❑ Welcome	Dr. Mohan Aggarwal, Chairperson, AAMU Department of Physics, Chemistry and Mathematics	
5:30 - 6:00 PM	Buffet Dinner		
6:00 - 7:00 PM	❑ Kinematics & Momentum Pre Content Assessment ❑ Participants should bring a calculator	Eric Banilower and/or Keith Esch Horizon Research, Inc.	
7:00 – 7:15 PM	❑ Create a Universe Discuss (Space, Matter, & Time)	PTRAs, Dan O'Halloran and Tommi Holsenbeck	
7:15 – 7:45 PM	❑ Quantity vs. Interval (TPT – Page 22), Significant Digits (Write, Read & Calculate Measured Values– Page 23), Atlantic & Pacific Rule (Page 24). Activity #1, *Significant Times*, Page 18	PTRAs, Dan O'Halloran and Tommi Holsenbeck	
7:45 – 8:15 PM	❑ Sprinter and Jogger, Elicitation Questions	Jim Minstrell	

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Date	Topic	Activity	Time	Resource
Monday, 7/13/2015	Period vs. Length of Pendulum Appropriate For Discussion Page 28	Pass out AAPT/PTRA Teaching about Kinematic Activity #3, *Pendulums on Parade*, Page 32	8:00 - 8:30 AM	PTRA Teaching About Kinematics
	Position, Distance & Displacement Coordinate Systems, Page 49	Activity #5, *Traveling Washer 1D*, Page 40	8:30 - 9:00 AM	PTRA Teaching About Kinematics
	Position vs. Time Graph using Motion Sensor	Activity #7, *Position vs. Time (Discuss),* Page 51	9:00 - 9:15 AM	PTRA Teaching About Kinematics
	Types of Graphs (Linear, "Overachiever", "Underachiever", "Poetic"). Linearization of Data. Do this discussion before doing Activity #9		9:15 - 9:25 AM	
	Graphing Techniques Page 69 (EXCEL, Logger Pro, TI-84) Speed & Introduction to the 4-Step Analysis Process, Page 72	Activity #9, *Measurement of Speed on a Smooth and Level Surface*, Page 64. Note footnote on page 65 for the 5% rule.	9:25 - 10:20 AM	PTRA Teaching About Kinematics
	Turnpike Story page 73 Average & Instantaneous Speed (Using Photogate)	Activity #10, *Comparing Average Speed and Final Speed,* Page 75	10:20 - 11:20 AM	PTRA Teaching About Kinematics
	Circular Speed If finished, participants can work on Activity #13 Page 89 (Suggested Extensions).	Activity #11, *Comparing Linear and Circular Speed,* Page 80.	11:20 AM - Noon	PTRA Teaching About Kinematics
	Lunch Break (Lunch on your own)		Noon - 1:00 PM	
	Constant Speed (Vibration Timer). Area as Displacement	Activity #12, *Constant Speed using a Vibration Timer*, Page 84. Refer to Activity 4 page 35	1:00 - 2:00 PM	PTRA Teaching About Kinematics
	Inclined Plane. Discuss Diagram Page 99	Activity #16, *Comparing Average & Final Speed on Inclined Plane*, Page 99	2:00 – 3:00 PM	PTRA Teaching About Kinematics
	Velocity vs. Time Graph using Motion Sensor	Activity #17, *Velocity vs. Time*, Page 106, Discuss Only	3:00 - 3:15 PM	PTRA Teaching About Kinematics
	Introduction to Vectors ($V_f - V_i$), ($V_f + V_i$), Instantaneous Speed and Velocity Do before Activity #19		3:15 – 3:30 PM	Questions 1 – 6 Pages 108 - 109
	Circular Motion Activity #19, *Comparing of Speed & Velocity for Uniform Circular Motion*, Page 116. Compare Results using whiteboards. Pass out Ranking Task Books Complete APEX Daily Evaluation Form.		3:45 - 5:00 PM	PTRA Teaching About Kinematics

Suggested Extensions and/or Journal entries:

- Ranking Task(s) Velocity #1 (Velocity) and #8 (Displacement)
- Do Activities #13 (Constant Speed Problem, Page 89) and #15 (Worksheet – Constant Speed, Page 97) in PTRA Teaching about Kinematics.

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Tuesday, 7/14/2015	Questions and Comments about Suggested Extensions		8:00 – 8:15 AM	
	Building Expertise in Teaching Physics	Teacher Classroom Action Research as a Necessary Tool for Change -- PTI & PTR Activities	8:15 – 10:00 AM	Dennis Sunal
	Circular Motion	Activity #20, *Flying in Circles – Speed* (Show apparatus hanging from ceiling, but Discuss Only), Page 120	10:00 – 10:10 AM	PTRA Teaching About Kinematics
	Graphs for Position, Velocity & Acceleration versus time	Start Activity #23, *Moving Man Simulation*, Page 136. If finished, start Activity #22 Page 130 (Suggested Extensions).	10:10 – 11:30	PTRA Teaching About Kinematics
	Constant Acceleration & Free Fall	**Introduction** to Activity #24, *Relationships between Velocity and Time of Falling and Distance Fallen*, Page 141	11:30 PM - Noon	PTRA Teaching About Kinematics
	Lunch Break (Lunch on your own)		Noon - 1:00 PM	
	Constant Acceleration & Free Fall	**Complete** Activity #24, *Relationships between Velocity and Time of Falling and Distance Fallen*, Page 141	1:00 – 2:00 PM	PTRA Teaching About Kinematics
	Constant Acceleration Percent difference & Percent error, Page 153	Activity #25, *Relationships between Distance Fallen and Time of Falling*, Page 149.	2:00 – 3:00	PTRA Teaching About Kinematics
	Constant Acceleration	Activity #27 *Freely Falling Object IV, Free Fall Simulation.* – Discuss Only, Page 158	3:00 – 3:30 PM	PTRA Teaching About Kinematics
	Acceleration on Inclined Plane	Activity #31, *Acceleration on an Inclined Plane*, Page 184 If finished, start Activity #29 Page 178 (Suggested Extensions).	3:30 – 4:45 PM	PTRA Teaching About Kinematics
	Formative Assessment	Introduction to Diagnoser. Complete APEX Daily Evaluation Form.	4:45 PM – 5:30 PM	Jim Minstrell

Suggested Extensions and/or Journal entries:

- Ranking Task(s) #9 (Change of Velocity), #10 (Average Speed) & #12 (Average Velocity)
- Do Questions #2 from AP Physics B 2006 Examination
- Do Activity #22 (Worksheet - Motion with Constant Speed, Page 130)
- #29 (Worksheet – Straight line Equation and Graph, Page 178) and
- #35 (Worksheet – Graph Hopscotching, Page 201) from Teaching about Kinematics

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Wednesday, 7/15/2015	Questions and Comments about Suggested Extensions		8:00 – 8:15 AM	
	Why attend to student thinking?	Discussion	8:15-10:45 AM	J Minstrell
	Typical Stopping Problem	Stopping Problem solved two ways one with acceleration value given and one without acceleration value given.	10:45 – 11:05 PM	a > 0 & v > 0 thus speeding up, etc.
	Acceleration with Liquid Level Speed-up, Slow-down, Circular, and Simple Harmonic.	Activities #38 Page 212 (Demo); #40 Page 226 (Demo); & #41, Page 230 (Demo) *Using a Liquid Level Accelerometer*. Mention homemade Accelerometer on Page 248.	11:05– 11:50 AM	PTRA Teaching About Kinematics
	Reaction Time (Activity #32) Drop Dollar Bill, Discuss, Page 189)	**Introduction:** Activity #33, *Comparing Hand & Foot Reaction Time*, Page 191.	11:50 – Noon	PTRA Teaching About Kinematics
	Lunch Break (Lunch on your won)		Noon – 1:00PM	
	Reaction Time (Activity #32 Drop Dollar Bill, Discuss, Page 189)	**Finish:** Activity #33, *Comparing Hand & Foot Reaction Time*, Page 191.	1:00 – 1:30 PM	PTRA Teaching About Kinematics
	Review.	Review Relationships, Equations & Graph Shapes. Participants make up problem and then switch with another participant to solve.	1:30 – 2:00 PM	
	Activity #46	Activity #46, *An Acceleration Song* (First Movement!), Page 263	2:00 – 2:15 PM	PTRA Teaching About Kinematics
	Review & Naïve Ideas (If time)	Page 284 – *Naïve Ideas* (Each Participant pick one and assign an activity we have done that address the idea.) and Pages 285 – 286	2:15 – 2:30 PM	PTRA Teaching About Kinematics
	Newton's Third Law	Activity #1, *Impulse - Newton's Third Law,* Page 9 Introduce a force, generically, as a push or pull and as a simultaneous interaction between objects. More next week. Use force probe/sensors or spring type force meters.	2:30 – 3:15 PM	PTRA Momentum Supplement
	Impulse & Momentum	Define area of a force time graph and define momentum and ask how to measure them. What equipment could be used? (Force Probe, Dynamics Cart & Motion Probe)	3:15– 3:45 PM	PTRA Momentum Supplement
	Impulse: Area under a Force versus Time Graph with PASCO probes	Activity #2, *Impulse Area Under a Force Versus Time Graph,* Page 21	3:45 – 5:15 PM	PTRA Momentum Supplement
	Dinner Break – Order Pizza and have dinner in		5:15 – 6:00 PM	
	Formative Assessment	Using Diagnoser. Complete APEX Daily Evaluation Form.	6:00 PM – 7:00 PM	J Minstrell

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Thursday, 7/16/2015	Questions and Comments about Suggested Extensions		8:00 – 8:15 AM	
	Wiki/ Blog Univ. AL	Sharing Session	8:15 – 9:15 AM	Marius Schamschula
	Impulse - Momentum Using Recording Timer	Activity #3, *Impulse - Momentum Using Recording Timer,* Page 27 (Odd Tables do constant force and mass. Even Tables, constant force and time) Share data.	9:15 10:15 AM	PTRA Momentum Supplement
	Impulse - Momentum in 1-D Simulation	Activity #4A or #4B, Impulse - *Momentum in 1-D Simulation,* Page 33 or 37 Discuss as alternative to activity #3. Questions #4 to #10 on Page 34.	10:15 – 11:00 AM	PTRA Momentum Supplement
	Impulse	Activity #5, Impulse Worksheet I, Page 49	11:00- 11:30 PM	PTRA Momentum Supplement
	Impulse & Momentum	Song: Momentum, Page 106	11:30 – 11:40 AM	PTRA Momentum Supplement
	Conservation of Momentum	**Begin:** Activity #6, *Momentum Conservation Using PASCO Probes,* Page 51	11:40 - Noon	PTRA Momentum Supplement
	Lunch Break (Lunch on your own)		Noon - 1:00 PM	
	Conservation of Momentum	**Finish:** Activity #6, *Momentum Conservation Using PASCO Probes,* Page 51	1:00 - 2:40 PM	PTRA Momentum Supplement
	Momentum Simulation	Activity #7, *Momentum Simulation by Fendt* Page 57	2:40 – 4:00 PM	PTRA Momentum Supplement
	Impulse Practice Problems	Activity #8, *Impulse Practice Problems* Page 67	4:00– 4:45 PM	PTRA Momentum Supplement
	Action Research Using Diagnoser	Planning for Data Collection Complete APEX Daily Evaluation Form.	4:45 – 5:45 PM	J Minstrell

If time, do Activity *Impulsive Behavior* from Momentum Supplement also ASIM's *Horizontal Circular Motion*

Suggested Extensions & Journal entries:

- Ranking Task(s) #81 (Impulse) & #82 (Momentum)
- Do Questions #1 from AP Physics B 2008 Form B Examination
- Activity #11, Worksheet #3: *Impulse & Momentum*

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Friday, 6/17/2015	Questions and Comments about Suggested Extensions		8:00 - 8:15 AM	
	Conservation of Momentum	Activity #9, *Momentum Worksheet II*, Page 71	8:15 – 8:45 PM	PTRA Momentum Supplement
	Impulse & Momentum	Activity #12, *Impulse and Momentum Worksheet III*, Page 85 (Skip Problem #14 on Page 86).	8:45 – 9:30 PM	PTRA Momentum Supplement
	Conservation of Momentum in 2-D	Activity #11: *Momentum in 2 - Dimensions*, Page 77 and If time do problem #14 on Page 86	9:30 – 11:00 AM	PTRA Momentum Supplement
	Review	Activity #14, *Momentum Review Worksheet IV,* Page 75.	11:00 – Noon	PTRA Momentum Supplement
	Lunch Break	Lunch Provided. (Participants can start Post Content Assessment on Kinematics & Momentum as soon as everyone is done with lunch.)	Noon – 1:00 PM	
	Post Institute Assessment	Complete APEX Survey. Post Institute Content Assessment on Kinematics & Momentum	1:00 – 2:00 PM	Eric Banilower and/or Keith Esch Horizon Research, Inc.
	Pre Institute Assessment	Option to go home at 2:00 PM and return for NSL & Energy Pre Content Assessment on Sunday evening at 7:00 PM or stay and take the Pre Content Assessment on NSL and Energy today after completing the Post Institute Content Assessment on Kinematics and Momentum	2:00 – 3:00 PM	Eric Banilower and/or Keith Esch Horizon Research, Inc.

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Date	Topic	Activities	Time	Resource
Monday, July 20, 2015 (8.75 hours)	Time for Participants' Questions and Comments		8:00 – 8:15 AM	
	Force (e.g., Applied, Gravitational, Normal, etc.)	*Force Template: Types of Forces: How do you know a Force is there? What does the Force act on? Use Power Point and Smart Board* Pass out PTRA Force Supplement	8:15 - 9:15 AM	PTRA Force Supplement, Page 13
	Eliciting Student Thinking in Forces	Anticipating Student Ideas	9:15 - 10:15 AM	Jim Minstrell
	Gravitation Force & Gravitation Field Strength	Activity #1, *Weight & Mass, Why multiple by "g"?* *There is a You Tube about Inertia, Mass, Work, KE and PE.* **http://tinyurl.com/nwcfjn5** by Robert Luce	10:15 – 11:00 AM	PTRA Force Supplement, Page 15
	Vectors	**Start** Activity #2, *Forces as Vectors*	11:00 – Noon	PTRA Force Supplement, Page 25
	Lunch Break	Lunch Break on your own Video related to Galileo's use of inclined plane. **http://tinyurl.com/qd9lf76**	Noon – 1:00 PM	
	Vectors	**Finish** Activity #2, *Forces as Vectors*	1:00 – 1:30 PM	PTRA Force Supplement, Page 25
	Vectors Notes	Activities #2, *Notes on Vectors and Vector Algebra* Discussion only.	1:30 – 1:40 PM	PTRA Force Supplement, Page 31
	Vectors	Vector Song	1:40 - 1:50 PM	PTRA Force Supplement, Page 83
	Free Body Diagrams	Pre Activity #3a, Page 35, 3c, Page 37. *Free-Body Diagrams* (Set up 3e, Page 48) The Physics Teacher, *Free-Body Diagrams Revisited*, and Pages 35, 37. 48, & 41.	1:50 – 2:35 PM	PTRA Force Supplement
	Vector Components	Activity #4, *Using Vector Analysis to Determine an Unknown Force*. Do components by trig and/or by scale drawing.	2:35 – 3:30 PM	PTRA Force Supplement, Page 51
	Vectors	Activity #7A, 7B, (Stop & Whiteboard) and 7C, & 7D (Whiteboard), Pages 75, 76, 77, & 78.	3:30 – 4:30 PM	PTRA Force Supplement, Page 75
	Forces Song	Activity #16, Forces Song	4:30 – 4:40 PM	PTRA Force Supplement, Page 145
	Action Research Using Diagnoser	Planning for Data Collection Complete APEX Daily Feedback Form.	4:40– 5:45 PM	Jim Minstrell

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Tuesday, 7/21/2015 (8.58 hours)	Time for Participants' Questions and Comments		8:00 – 8:15AM	
	Newton's Second Law	Activity #8, Acce*leration versus Force Using "Force 1D"*	8:15 – 9:50 AM	PTRA Force Supplement, Page 85
	Elevator Problem	Elevator Problem	9:50 – 10:20 AM	PTRA Force Supplement, Problem, #13, Page 87
	Flipped Classroom	Activity #14: PowerPoint Worksheet on Brahe, Kepler, Newton and Cavendish	10:20 – 11:00 AM	PTRA Force Supplement, Page 127
	Newton's Second Law	**Begin:** Activity #9, *Relationship between Mass & Acceleration for a Constant Accelerating Force*	11:00 – Noon	PTRA Force Supplement, Page 93
	Lunch Break	Lunch on your own Video Galileo's thought Experiment. **http://tinyurl.com/olwzuno**	Noon – 1:00 PM	
	Making a Video	Video Making Practice	1:00 PM – 2:00 PM	Marius Schamschula
	Newton's Second Law	**Finish:** Activity #9, *Relationship between Mass & Acceleration for a Constant Accelerating Force*	2:00 – 2:35 PM	PTRA Force Supplement, Page 93
	Force	Pass out PTRA Teaching About Newton's Second Law Activity #8, *What Connects Motion & Force*	2:35 – 3:30 PM	PTRA Teaching About Newton's Second Law, Page 41
	Intro to Newton's Second Law	Activity #9, *Acceleration-Force & Velocity-Force Graphs* "Wiggle Graphs"	3:30 – 4:30 PM	PTRA Teaching About Newton's Second Law, Page 44
	Song	Song about Newton's Second Law, "*The Most Famous Concept of All* " Pass out Ranking Task books.	4:30 – 4:35 PM	PTRA Force Supplement, Page 110
	Monitoring Changes in Student Thinking	Diagnoser for Data Collection Complete APEX Daily Feedback Form.	4:35 PM – 5:35 PM	Jim Minstrell

Suggested Extensions & Journal entries:

- Ranking Task(s) #19 (Acceleration) & #20 (Net Force)
- Do Question #1 from AP Physics B 2006 Form B Examination

Observe a Twu's YouTube video and comment on use in a "Flipped Classroom" See https://sites.google.com/site/twuphysicslessons

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Wednesday, 7/22/2015 (8 hours)	Time for Participants' Questions and Comments		8:00 – 8:15 AM	
	Intro to Newton's Second Law	Activity #10, *Additional Acceleration vs. Force* Problems in Activity #8 and #10 look the same but are not.	8:15 – 9:00 AM	PTRA Force Supplement, Page 107
	Intro to Newton's Second Law	Activity #11, *Sample Braking Problems*	9:00 –9:30 AM	PTRA Force Supplement, Page 115 Also page 98
	Constant Net Force	Activity #10, *Motion with Constant Force*	9:30 - 10:15 AM	PTRA Teaching About Newton's Second Law, Page 47
	Constant Net Force	Fan cart blowing opposite direction of velocity, or Tilted track with cart pushed up inclined plane.	10:15 – 10:45 AM	PTRA Teaching About Newton's Second Law. Motion sensor at bottom.
	Centripetal Force	**Begin:** Activity #15, *Uniform Circular Motion.* Perhaps tables can share data.	10:45 AM – Noon	PTRA Force Supplement, Page 131
	Lunch Break	Lunch on your own	Noon - 1:00 PM	
	Centripetal Force	**Finish:** Activity #15, *Uniform Circular Motion.* Activity #13, *Flying in Circles.* Demo and discussion only.	1:00 – 1:30 PM	PTRA Force Supplement, Page 119
	Work & Energy Charts	Activity #1 *Work done by a Constant Force,* Page 15 & Do energy chart on Page 9 & 10 in PTRA Energy Supplement	1:30 – 2:25 PM	PTRA Energy Supplement
	Work and Gravitation Potential Energy & Energy Chart	Activity #1, *Designing a Roller Coaster,* Page 17 & Do energy chart on Page 10 in PTRA Energy Supplement. Questions for Activity 1, Page 75 in PTRA Energy Supplement	2:25 – 3:55 PM	PTRA Teaching about Energy and PTRA Energy Supplement
	Kinetic Energy & Energy Chart	Activity #2, *What happens as Roller Coaster rolls down hill?* Page 22 & Do energy chart on Page 11 in PTRA Energy Supplement. Questions for Activity 2, Page 77 in PTRA Energy Supplement. Complete APEX Daily Feedback form.	3:55 – 5:00 PM	PTRA Teaching about Energy, and PTRA Energy Supplement

Suggested Extensions & Journal entries:

- Ranking Task(s) #57 (Stopping Force) & #59 Work and Change in Velocity)
- Do Questions #1 from AP Physics B 2010 Form B Examination

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Date	Topic	Activities	Time	Resource
Thursday, 6/23/2015 (8 Hours)	Time for Participants' Questions and Comments		8:00 - 8:15 AM	
	Hooke's Law & Potential Energy for Spring & Energy Chart	Activity #3E, *Dependence of Elastic Energy on Position,* Page 58 & Do energy chart on Page 12 in PTRA Energy Supplement Questions for Activity 3, Page 79 in PTRA Energy Supplement	8:15 – 9:45 AM	PTRA Teaching about Energy, and PTRA Energy Supplement
	Power	Activity #5, *Power of a Student.* Discuss, Page 79. Questions (5 & 6) from Activity 5 & 7, Page 82 in PTRA Energy Supplement	9:45 – 10:45 AM	PTRA Teaching about Energy, and PTRA Energy Supplement
	Electrical Energy	**BEGIN:** Activity #6a, Converting *Electrical to Thermal Energy,* Page 91 Questions (3, 4) for Activities 4 & 6, Page 81 in PTRA Energy Supplement Do energy chart on Page 12 in PTRA Energy Supplement. On energy chart you need to add Electrical Energy.	10:45 AM – Noon	PTRA Teaching about Energy, and PTRA Energy Supplement
	Lunch Break	Lunch on your own	Noon - 1:00 PM	
	Electrical Energy	**FINISH:** Activity #6a, Converting *Electrical to Thermal Energy,* Page 91 Questions (3, 4) for Activities 4 & 6, Page 81 in PTRA Energy Supplement Do energy chart on Page 12 in PTRA Energy Supplement. On energy chart you need to add Electrical Energy.	1:00 – 1:45 PM	PTRA Teaching about Energy, and PTRA Energy Supplement
	Chemical Energy	Activity #7, Energy *from Chemical Fuels,* Page 97 Question (7) for Activity 5 & 7, Page 82 in PTRA Energy Supplement	1:45 – 3:30 PM	PTRA Teaching about Energy, and PTRA Energy Supplement
	Kinetic Energy	Activity #4, *Kinetic Energy - Simulation,* Page 35. Collect and analyze data for Activity #4. Complete APEX Daily Feedback form.	3:30 – 4:50 PM	PTRA Energy Supplement
	Song: Joules	Joules, Activity #8, Page 52	4:50 – 5:00 PM	PTRA Energy Supplement

Suggested Extensions & Journal entries:

- Ranking Task(s) #65 (Potential Energy) & #68 (Work)
- Do Questions #1 from AP Physics B 2010 Examination

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Friday, 7/24/2015 (5 Hours)	Time for Participants' Questions and Comments		8:00 – 8:15	
	Light Energy	Activity #10, *Energy Levels in Atomic Systems,* Description on Page 142 PTRA Teaching about Energy Direction on Page 53 PTRA Energy Supplement	8:15 - 9:30 AM	PTRA Teaching about Energy PTRA Energy Supplement
	Simple Machine	Set up a pulley system. See example on front desk Activity #2, *Efficiency of Pulley System,* Page 23	9:30 – 10:55 AM	PTRA Energy Supplement
	Work & Energy	Activity #5, *Penguin - Work & Energy,* Page 43	10:55 AM – Noon	PTRA Energy Supplement
	Song: Work & Energy	Erging in the Classroom, Page 51, and Post institute Survey	Noon – 12:10 PM	PTRA Energy Supplement
	Lunch Provided. After all participants have finished lunch, the post institute assessment can be done.		12:10 - 1:00 PM	
	Institute Assessment on Energy and Dynamics	Post Institute Content Energy and Dynamics Assessment	1:00 – 2:00 PM	Eric Banilower and/or Keith Esch Horizon Research, Inc.