**Oakland Schools Science Scope (Adapted and Modified by Flint Community Schools)**

**Grade 5**

**Forces and Motion**

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**About Our Scope Unit/Lesson Template**

This template is designed to serve several teaching and learning principles considered as staples of state of the art science instruction. Here are the key principles in summary:

* It’s critical to **elicit prior knowledge** as a unit or lesson begins
* **Key questions** should drive student explorations and investigations
* **Activity Before Concept** – Student inquiry-based explorations which give personal experience with phenomena and ideas should precede a presentation of science ideas.
* **Evidence is the heart of the scientific enterprise.** Students generate evidence and analyze patterns in data that help to construct scientific explanations around key questions.
* **Concept Before Vocabulary** – attaching science vocabulary to concepts developed by student investigations yields more success than beginning a unit or lesson with a list of science vocabulary.
* **Talk, argument** **and writing** are central to scientific practice and are among the most important activities that develops understanding.
* **Application** of the ideas provides review, extends understanding and reveals relevance of important ideas.
* **Assessment** of knowledge, skill and reasoning should involve students throughout the learning process and be well aligned to the main objectives and activities of the unit.

The Scope Science template is designed to put these principles into practice through the design of the ***SCOPE LEARNING CYCLE FOR SCIENCE***. Each unit has at least one cycle. The components are listed below:

|  |  |
| --- | --- |
| The Key Question for the Unit | Each unit has one, open ended driving question that relates to all the content and skills of the unit. The Key Question is presented at the opening of the unit and revisited at the unit’s conclusion. |
| Engage and Elicit | Each unit begins with an activity designed to elicit and reveal student understanding and skill prior to instruction. Teachers are to probe students for detailed and specific information while maintaining a non-evaluative stance. They also can record and manage student understanding which may change as instruction proceeds. |
| Explore | A sequence of activities provides opportunities to explore phenomena and relationships related to the Key Question of the unit. They will develop their ideas about the topic of the unit and the Key Question as they proceed through the Explore and Investigate stage of the learning cycle.  Each of the activities may have its own Key Question or central task that will be more focused than the unit question. The heart of these activities will be scientific investigations of various sorts. The results, data and patterns will be the topic of classroom discourse and/or student writing. A key goal of the teacher is to reference the Key Question of the unit, the Engage and Elicit of the students and to build a consensus especially on the results of the investigations. |
| Explain | Each unit has at least one activity in the Explain portion of the unit when students reconcile ideas with the consensus ideas of science. Teachers ensure that students have had ample opportunity to full express their ideas and then to make sure accurate and comprehensible representations of the scientific explanations are presented. A teacher lecture, reading of science text or video would be appropriate ways to convey the consensus ideas of science. Relevant vocabulary, formal definitions and explanations are provided. It’s critical that the activity and supporting assessments develop a consensus around the Key Questions and concepts central to the unit. |
| Elaborate | Each unit cycle has at least one activity or project where students discover the power of scientific ideas. Knowledge and skill in science are put to use in a variety of types of applications. They can be used to understand other scientific concepts or in societal applications of technology, engineering or problem solving. Some units may have a modest Elaboration stage where students explore the application of ideas by studying a research project over the course of a day or two. Other units may have more robust projects that take a few weeks. |
| Evaluation. | While assessment of student learning occurs throughout the unit as formative assessment, each unit will have a summative assessment. Summative assessments are posted in a separate document. |

Forces and Motion

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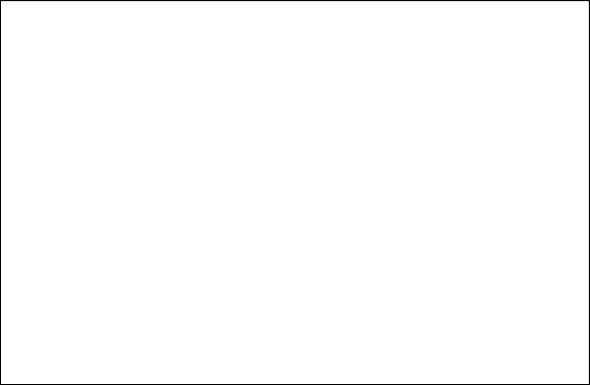
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**Administer the**

**Unit Pretest**

**prior to teaching the lessons.**

**Save results for later comparison.**

**Introduction**

This unit begins with an engaging scenario or project that all students are familiar with. This project sets the stage for all activities that follow. The lessons are selected to provide the students with the knowledge and skills needed to address the introductory challenge.

Forces exist all around us. We experience forces every time we move, play and go about our daily lives. Students will be introduced to the forces that make these things happen and how these forces can be both helpful and harmful to motion that we want to occur. Students will examine how forces are overcome and how they can be used to do work for us while doing a voice-over project covering a sporting event. A description of the project is described and attached below. It is recommended that the project idea be presented at the beginning of the unit and referred to often. A scientific journal is suggested for student ideas and reflections. Journal ideas are presented throughout the unit.

* **Learning Objectives**Distinguish between contact forces and non-contact forces.
* Demonstrate contact and non-contact forces to change the motion of an object.
* Describe what happens when two forces act on an object in the same or opposing directions.
* Describe how constant motion is the result of balanced (zero net) forces.
* Describe how changes in the motion of objects are caused by a non-zero net (unbalanced) force.
* Relate the size of change in motion to the strength of unbalanced forces and the mass of the object.
* Explain the motion of an object relative to its point of reference.
* Describe the motion of an object in terms of distance, time and direction, as the object moves, and in relationship to other objects.
* Illustrate how motion can be measured and represented on a graph.

**Key Question:**

**How can we observe and measure the effects of forces on the motion of objects?**

**Learning Cycle 1 – Newton’s First Law of Motion**

**Introduction**

The first cycle in this unit is used for students to explore aspects of Newton’s First Law of Motion. Students will explore and come to understand material as it relates to Inertia, Running Starts, and Frames of Reference. After the cycle, students should be able to apply these concepts to a sporting event. Clips of different sporting events are used throughout the cycle and students should begin to decide which event they would like to choose for their project. A list posted in the classroom for student reference and additions is a helpful reminder of the direction their focus of learning should be.

**Learning Objectives**

Distinguish between contact forces and non-contact forces.

Demonstrate contact and non-contact forces to change the motion of an object.

Describe what happens when two forces act on an object in the same or opposing directions.

Describe how constant motion is the result of balanced (zero net) forces.

**Key Question**

What is Newton’s First Law?

**Unit Project – Wanted: Physics Sportscaster**

**Purpose**

To apply aspects of physics to everyday events.

**Activity Description**

Students

**Duration**

3-4 weeks

**Focus Question**

What forces and motions are involved in different sporting events?

**Materials**

* Project Scenario for Physics Sportscaster

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Sports caster physics draft.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Sports%20caster%20physics%20draft.docx)

* Various 2-4 minute video clips of sporting events interesting to students <http://espn.go.com/espn/sportscience/index>
* Movie Maker (if computers are available)
* Video Cameras (as an option for filming students doing different events)

**Teacher Preparation**

1. Download student introduction for the project and make changes as needed.
2. Decide how many options to offer students for this project (ideas include using movie maker and computers, live commentary, videotaping sporting events in action.
3. Decide if projects will be done in groups.
4. A script should be required to go along with voice over project.
5. Select sports clips to show during the introduction of this unit to peak student interest.
6. If using video clips from the internet, it is helpful to pre select clips that might be of interest to students and let them pick from those you have chosen.
7. Have students begin to think of a sporting event they might be interested in using so they will be able to reflect on how their learning applies to the project that is coming at the end.
8. Set up a poster that can be displayed and added to throughout the unit.   
   Concepts of forces and motion should be recorded as they are discovered.
9. At the end of the unit, design a rubric with the class. Discuss requirements, point values and what the end product should look like.

**Classroom Procedure**

1. Introduce unit with sportscaster scenario
2. Play sports clips to peak student interest

**Engage**

**Activity 1 – The Penny Game**

**Purpose**

Students will begin to think about how objects can influence the behavior of other objects.

**Activity Description**

Students will flick a single and double stack of pennies at a higher stack of pennies. They will record ideas and patterns about how stationary and moving objects affect each other.

**Duration**

10 minutes

**Focus Question**

How do objects in motion or at rest affect eachother?

**Materials**

* Cup
* Small index card
* Pennies (7 per pair, one with tape to mark it)
* Penny Game Student Worksheet

<http://oaklandk12.rubiconatlas.org/links/Science_5/The%20Penny%20Game%20Inertia.docx>

**Teacher Preparation**

1. Print and copy student worksheet.
2. Prepare exit slips for student rules.
3. Gather materials and workspace.
4. Pair students up for work.

**Classroom Procedure**

1. Stack pennies to form a tower on a flat surface
2. Bottom penny should be marked with a small piece of tape
3. Aim one then two pennies at the stack.
4. Balance one penny on top of the card and remove card.
5. Record observation and make a rule for what occurred on exit slip (to be given to the teacher upon exit from the classroom)
6. After teacher has read exit slips, share class thoughts and teacher input during the next class period.

**Engage**

**Activity 2 – Running Starts**

**Purpose**Students will begin to consider what a running start provides to athletes in sporting events.

**Activity Description**

Students will view various preselected video clips of sporting events. They will look for the benefits of a running start or initial speeds in events that allow them.

**Duration**

15 minutes

**Focus Question**

What good is a running start?

**Materials**

* + - * computer and projection devise
* Student journal (notebook) or paper to record ideas
* Student worksheet- [A Running Start and Frames of Reference student directions](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20student%20directions.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/A Running Start and Frames of Reference video sites.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

* [A Running Start and Frames of Reference video sites](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/A Running Start and Frames of Reference video sites.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

**Teacher Preparation**

Teacher directions for demonstration:

1. Select video clips that are 1-2 minutes long
2. Clips should be selected based on student interest and the use of a running start to help perform the athletic event.
3. Clips may also be chosen where a running start is not allowed so that students may begin to think about how else initial speed might be gained.
4. Download the student worksheet attached with possible questions and sample sport event links

**Classroom Procedures:**

1. View video clips
2. Record ideas about the questions posed.
3. Student sharing session to discuss ideas.

**Explore**

**Activity 3 – To Run or Not to Run**

**Purpose**

Students will explore and gather data about the benefits and uses of a running start. Students will also be asked to notice how they could tell the jumper has moved (beginning to develop ideas of reference points)

**Activity Description**

Students will make predictions about the benefits of a running start to increase horizontal distance. They will test their predictions by using running starts to jump as far as they can. Student will also be introduced to the idea of reference points to describe motion.

**Duration**

1 class period

**Focus Question**

Does a running start help? How can we tell someone has moved?

**Materials** (

NOTE: if videos fail to authenticate copy URL and paste in address bar)

* Student worksheet- [A Running Start and Frames of Reference student directions](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20student%20directions.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/A Running Start and Frames of Reference video sites.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

* [A Running Start and Frames of Reference video sites](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/A Running Start and Frames of Reference video sites.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)

* Tape measure or meter sticks
* Chalk or tape to mark starting line
* Calculator

**Teacher Preparation**

1. Download student worksheet and make changes as needed
2. Secure an area where students can take running starts and land safely (an outside area works great, a long hallway, the gym are all good ideas)
3. Discuss student data recording and measuring procedures (where will they measure from, what units should they use for measuring and so on)
4. Obtain measuring devices for student use.

**Classroom Procedure**

1. Pass out student worksheet
2. Discuss where running start trials will be held
3. Discuss measuring specifics
4. Go to running start areas and perform activity
5. Answer and discuss analysis questions

**Explore**

**Activity 4 – Rolling Along**

**Purpose**

Students will explore how starting heights affect the resulting motion of objects. Students will also begin to think about forces that are at work to change an objects initial position.

**Activity Description**

Students will use a glass salad bowl, and a marble to experiment how starting the marble at different heights affects the resulting motion of the marble up the other side of the bowl. They should notice that they must let go of the marble to change its starting position (inertia).

**Duration**

1 Class Period

**Focus Question**

How does starting height affect the resulting motion of an object at rest?

**Materials**

* Student Worksheet - [Rolling Along](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Rolling%20Along.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Rolling Along.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Rolling%20Along.docx)

* Ball (marble or ball bearing work well
* Glass bowl
* Non-permanent markers
* Flexible ruler or tape measure
* Calculator

**Teacher Preparation**

1. Download student worksheet and make changes as needed.
2. Pairs of students work best for this activity. One to start the marble and one to measure the resulting distance up the other side.
3. Obtain glass bowls (a dollar store might be a good place to go). Try and get bowls with a bottom as curved as possible and those without a lip so as not to interfere with the motion of the marble.
4. Obtain markers that are erasable (overhead markers work well)
5. Obtain flexible rulers for measuring. Discuss measuring techniques (units used and so on)
6. Prepare to debrief after the lab and discuss resulting height (it should be close to the same no matter the height it was released from) and the idea of inertia)

**Classroom Procedure**

1. Discuss directions for the lab (including how to make calculations)
2. Gather materials
3. Look over the key idea and make predictions about the resulting height of the marble.
4. Perform lab
5. Discuss results as a class
6. Record teacher input and information gathered from other scientists like Newton.

**Explore**

**Activity 5 – WWI Bombing Aces**

**Purpose**

Students will explore the concepts of Inertia and Newton’s First Law of motion.

**Activity Description**

Students will attempt to drop a tennis ball or a bean bag on an intended target. They will attempt to change speed and observe changes in motion as the objects are dropped toward a target.

**Duration**

1 Class Period

**Focus Question**

How can initial motion be changed?

**Materials**

* Student Worksheet - [WWI Bombing Aces](http://oaklandk12.rubiconatlas.org/links/Science_5/WWI%20Bombing%20Aces.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/WWI Bombing Aces.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/WWI%20Bombing%20Aces.docx)

* Bean Bag (tennis ball) 1 per pair
* Prepared target (or taped X on a table or floor)

**Teacher Preparation**

1. Download student work sheet and make necessary changes
2. Obtain bean bags (they work best) or tennis balls for class
3. Divide students into pairs (or groups depending on supplies)
4. Have students make target
5. Prepare discussion for after the activity. Students should be able to look for patterns that describe how motion can be changed by “forces” such as gravity
6. The idea of reference points used to describe motion should be included in this discussion.
7. Students should also expand on their understanding of the inertia that objects have and that this must be overcome to change motion.

**Classroom Procedure**

1. Students should obtain necessary materials
2. The target should be created and placed 5 meters away from the starting point
3. Students should perform activity and collect data.
4. Classroom discussion about results and patterns should follow the activity
5. Teacher input is given after student discussion.

**Explain**

**Activity 6 – Inertia, Running Starts, and Reference Points Text in the Middle**

**Purpose**

Students will compare their current understanding of inertia, Newton’s First Law of Motion, Reference Points, and Running Starts to what other scientists think.

**Activity Description**

Students will use an informational reading technique, Text in the Middle, to further understand concepts presented this far in the unit. They will summarize what they have read and draw or write what they visualize as they are reading.

**Duration**

30 minutes

**Focus Question**

What can other scientists tell us about Newton’s First Law of Motion and Running Starts?

**Materials**

* Student Worksheet: Text in the Middle - [Running Starts Inertia Newton’s 1st Law Text in the Middle](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Running%20Starts%20Inertia%20Newtons%201st%20Law%20Text%20in%20the%20Middle.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Running Starts Inertia Newtons 1st Law Text in the Middle.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Running%20Starts%20Inertia%20Newtons%201st%20Law%20Text%20in%20the%20Middle.docx)

* Hi-lighter to enhance reading comprehension

**Teacher Preparation**

1. Download student work sheet and make changes as needed.
2. Discuss Text in the Middle reading technique (and demonstrate if needed)
3. Have quiet reading area ready for students

**Classroom Procedure**

1. Students will use the Text in the Middle to compare their own understanding to what other scientists think.
2. Students should be ready to Pair Share or share as a class after reading time has been provided.
3. Teacher guided class discussion should be held to address any questions at this point.

**Elaboration**

**Activity 7 – Illustrating Newton’s First Law of Motion**

**Purpose**

Students will demonstrate and elaborate on their understanding of Newton’s First Law of motion, Inertia, Running Starts and Reference Points. They will continue to think and practice how to apply this to the sporting event project presented at the beginning of the unit.

**Activity Description**

Students will draw or look for illustrations of sporting events and be able to express what they have learned about the physics concepts explored to this point.

**Duration**

1-2 class periods

**Focus Question**

How well do we understand Newton’s First Law of Motion?

**Materials**

* Student Worksheet- [Illustrating Newton’s First Law](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Illustrating%20Newtons%20First%20Law.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Illustrating Newtons First Law.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Illustrating%20Newtons%20First%20Law.docx)

* Paper for final work
* Magazines, computer or student generated pictures of sporting events
* Colored Pencils if desired

**Teacher Preparation**

1. Download student work sheet with check-bric and make changes if desired
2. Gather materials for work
3. Decide if class time will be given for this assignment or if part/all will be done at home.

**Classroom Procedure**

1. Obtain directions and materials for assignment
2. Perform task as directed

**Learning Cycle 2- Newton’s Second Law of Motion**

**Introduction**

Newton’s Second Law of Motion and the concepts of forces (balanced, unbalanced, contact, non-contact) are explored here. The idea of friction (although this concept was definitely a part of Learning Cycle 1) is explored in more depth. Aspects of motion like speed, acceleration and velocity are explored here as well. Students should discover what can change the motion of an object (like mass, the speed of the object and so on). Finally, students will consider other forces that affect motion like circular forces, and gravitational forces.

**Engage**

**Activity 1 – Factors that affect motion**

**Purpose**

Students should continue to think about how motion can be affected by different things. This activity helps students to organize their current understanding of how and why things move the way that they do.

**Activity Description**

Viewing short sporting video clips and using journals and class discussion, students access their current understanding of how objects can be stopped or started in motion. Ideas of how stopping and starting can be made easier or more difficult should also be considered.

Students will then be asked to consider these stopping and starting factors in terms of a “force”. They will put different activities into one of two categories “equal amounts of force needed” or “unequal amounts of force needed” to complete a task.

Finally, students will be asked to consider forces working because they touch each other or will work even without touching each other (contact and non-contact forces).

\*\*\*This activity contains engaging questions, explain opportunities and chances for evaluation.

**Duration**

1 class period (if desired may be spread out over 2-3 days)

**Focus Question**

What are some stopping or starting factors that affect motion? How can stopping or starting be made easier or more difficult?

**Materials**

* Student Worksheet - [Forces that affect motion](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Forces%20that%20affect%20motion.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Forces that affect motion.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Forces%20that%20affect%20motion.docx)

* Preselected sport video clip (1-2 minutes)
* Student journal for recording ideas

**Teacher Preparation**

1. Download student work sheet and edit as needed. There are places for students to record teacher information when you are ready to follow up their thinking with some expert information. There are also activities included for student practice after they have thought about their own ideas, record expert information and are ready to practice on their own.
2. Select a sport video clip that would be interesting to students. The questions presented are focused on a running back in football, but other activities may be substituted.
3. Decide if students will be recording observations in journal or using another form to record ideas.
4. Decide if splitting up the three parts of the engage activity would work better for the classroom.

**Classroom Procedure**

Part 1

1. View video clip
2. Consider and reflect on proposed questions

Part 2

1. View list of activities (from student worksheet) and decide which need equal or unequal amounts of force to occur.
2. Student should be able to discuss forces in terms of pairs (this will be explored when discussing Newton’s Third Law in the next cycle as well).
3. Discuss student thoughts but do not correct answers at this time
4. Consider having students make sketches of the forces they think might be acting in some of these different situations. They may give numbers representing force if desired. A free body diagram might be introduced to make sketching easier.

Part 3

1. Present a new list of events that need forces to happen.
2. Students should look over events and decide if there is a logical way to split them up into two categories.
3. Rules and patterns should be solicited from the class but not confirmed at this time.

\*\* There is room for follow up teacher information and evaluation problems for students to do in this activity.

**Explore**

**Activity 2 – Carnival of Forces**

**Purpose**

Students will discover types of forces and explore how they work.

**Activity Description**

The seven mini-experiments in this exploration will give students a chance to experience specific forces at work. This lab works well as a rotation experience.

**Duration**

One class period.

**Focus Question**

What types of forces are at work in these situations? What do they have in common? How are they different?

**Materials**

* Student Worksheet - [Carnival of Forces](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces.doc)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Carnival of Forces.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces.doc)

[Carnival of Forces key](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces%20key.doc)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Carnival of Forces key.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces%20key.doc)

* One set up for each experiment is needed if doing a rotation lab
* Station 1 – empty jar, water, large bucket
* Station 2 – empty cup/glass, paper clips, strong magnet
* Station 3 – wool sock, long plastic pieces (need to be refurbished before each rotation)
* Station 4 – pieces of paper
* Station 5 – thick rubber band, meter stick, hooked masses of different values
* Station 6 – long area (like a hallway), empty two liter bottle, newspaper, cloth, carpet, meter stick
* Station 7 – thick rubber band, paper clip, string, 2 books, drinking straws

**Teacher Preparation**

1. Download student worksheet and edit as needed
2. Gather materials and set up stations for rotation (consider copying directions for the stations and station numbers and having them at the tables before the start of the lab)
3. Consider a brief explanation of each station before students begin working.
4. Divide students into groups and develop a time and order for rotation

**Classroom Procedure**

1. Get into groups and listen to lab explanation
2. Perform experiments and record data as required
3. Answer questions as directed.

**Explore**

**Activity 3 – Friction – Friend or Foe**

**Purpose**

Students will explore ideas about a common stopping force – Friction. They will think about how to solve the problem of too much/not enough friction in everyday situations.

**Activity Description**

Students will work in groups on a given situation. The will answer questions about the situation and brainstorm ways to solve the problem.

**Duration**

½ - 1 class period

**Focus Question**

Friction – Is it a friend or a foe of motion?

**Materials**

* Friction Friend or Foe Activity Guide

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Friction Friend or Foe Activity.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Friction%20Friend%20or%20Foe%20Activity.docx)

* Situation Suggestions (teachers names can be used, as the kids find them funny):
* A person is trying to get a ring off.
* A person is trying to move large boulders from her front to backyard for landscaping.
* A person wants to do more difficult tricks on his skateboard.
* A person wants to go faster on her snowboard.
* A person keeps slipping in her high-heeled shoes.
* A person wants to move the canoe from his campsite to the river.
* A person wants to move a washing machine from the moving van to the laundry room.
* A person wants to clean behind his oven.
* A person wants to run really fast on the track.
* Poster paper/white boards for recording ideas

**Teacher Preparation**

1. Get situation to consider
2. Prepare ideas for situations students need to consider
3. Divide students into groups for activity

**Classroom Procedure**

1. Set up groups of 3 or 4
2. Reflect on situation solution and answer questions as they apply to your situation
3. Share groups proposed ideas
4. Discuss thoughts about the force of friction

**Explore**

**Activity 4 – Brick Lab**

**Purpose**

To determine:

1. If an object has a higher force of friction when it is at rest, or when it is in motion.
2. How changes in mass affect the force of friction.
3. How a change in surface affects the force of friction.

**Activity Description**

This lab is conducted in three parts. Students are investigating the difference between the force of static friction (Fstatic) and the force of moving friction (Fkinetic). In the second part of the lab, students will be investigating the effect of an increase in mass on the force of friction. They will determine if a more massive object has a greater or lesser frictional force. In the last section of the lab, students will inquire into the relationship between the surface and the force of friction. A nice extension might be a discussion of how engineers are constantly coming up with technology to increase the friction between two surfaces (think rubber, grip tape, etc.), as well as ways to reduce the friction between surfaces (think oil, ball bearings, Teflon, etc.).

**Duration**

One class period.

**Focus Question**

How do changing mass, surface and starting motion affect forces?

**Materials**

* Student Guide for [Brick lab student sheet](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Brick%20lab%20student%20sheet.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Brick lab student sheet.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Brick%20lab%20student%20sheet.docx)

* Bricks (2)
* Force meter (spring scale)
* Paper
* Carpet

(How to use a Spring Scale link <https://www.youtube.com/watch?v=FbVP9_ZCi_A> )

**Teacher Preparation**

1. Download student worksheet attached. Make any desired changes to fit classroom needs.
2. Gather materials. Fewer materials are needed if you make this a rotation lab.
3. Make sure students understand how to use a force meter and what it measures. Make sure force meters have enough Newtons (or grams) to pull the bricks.

**Classroom Procedure**

1. Divide into lab groups.
2. Complete lab rotations (all three stations) if designed for rotation
3. Answer questions as directed in lab

**Explore**

**Activity 5 – The Mu of the Shoe**

**Purpose:**

This activity will also serve the purpose of investigating the ideas of friction. It focuses on the area of sliding friction so both the Brick Lab and the Mu of the Shoe may be helpful for student understanding of friction and what affects the force of friction in different situations and for different types of motion. This activity also ties in nicely with the unit activity of the sportscaster.

**Activity Description**

Students will use different types of shoes and drag those shoes on different surfaces to measure the force of friction when sliding. Students also change the mass of the shoe to see if mass affects sliding friction for shoe surfaces.

**Duration**

1 class period

**Focus Question**

How much friction do different types of shoes provide?

**Materials**

* Student Worksheet - Mu of the Show

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Mu of shoe friction lab.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Mu%20of%20shoe%20friction%20lab.docx)

* Different types of shoes
* Access to different types of surfaces
* Spring Scales (Force Meters)
* Fillers (marbles or other objects that will aid in doubling the mass of the shoe)
* Calculator

**Teacher Preparation**

1. Download student worksheet and edit as needed
2. Divide class into teams of four
3. Gather materials for fillers
4. Obtain access to surfaces like carpet, tile floor, gym floor, concrete, dirt
5. Make sure students understand how to use a force meter and how to perform calculations (consider having stronger math students split among groups)

**Classroom Procedure**

1. Divide into groups per teacher direction
2. Select a shoe from the group members that will be used for the experiment
3. Perform experiments as directed
4. Record data and perform calculations
5. Answer analysis questions
6. Read Reflecting on the challenge information

**Explore**

**Activity 6 – Measuring Motion**

**Purpose:**

Students will use data gathered to discover how speed, distance, time, acceleration, and velocity are related. Student design and interpret speed and distance graphs to interpret motion. Students will review the use of reference points to describe motion.

**Activity Description**

Students will use groups to gather data on their speed (walking/running/skipping/hopping…) around a track. Students will calculate average speed and speed per leg. Graphs will be designed and interpreted using data collected from this lab.

**Duration**

1 class period for set up and gathering of data

1 class period for design of graphs, analysis of information and writing of summary

**Focus Question**

What are some different ways to describe motion?

**Materials**

* Student worksheet - Measuring the Motion

[http://oaklandk12.rubiconatlas.org/links/Science\_5/Measuring Motion Lab.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/Measuring%20Motion%20Lab.docx)

* Student worksheet 2 (Understanding Speed Graphs) may be assigned for additional practice. Key included below:

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Understanding speed graphs- (2).docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Understanding%20speed%20graphs-%20(2).docx)

* Understanding Speed Graphs Key

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Understanding speed graphs-Key (2).doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Understanding%20speed%20graphs-Key%20(2).doc)

* Stop Watches (4 per group if possible)
* Access to a track (or a route marked off at 100 meter intervals)
* Calculators

**Teacher Preparation**

1. Download student worksheet and edit as needed
2. Download student worksheet 2 (Understanding speed graphs with answer key) if using for additional practice. Recommended as students often have a hard time with this idea.
3. Divide groups (again splitting up stronger math students is a good idea). 5 to a group is best (one mover and four timers)
4. Secure location for motion to occur (track is ideal)
5. Secure stop watches (make sure students know how to operate them)
6. Discuss graphing (if needed)

**Classroom Procedure**

1. Divide into groups per teacher instruction
2. Dismiss to track or location for movement and timing
3. Gather data (make sure all group members have data for each leg of the mover)
4. Calculate and complete data table
5. Graph data as directed
6. Interpret graphs and answer questions
7. Write summary as directed.

**Explain**

**Activity 7 – Acceleration and Newton’s Second Law**

**Purpose**

Students will read a summary of their explorations with friction, mass and acceleration and how these things affect force and motion.

**Activity Description**

Students will read a summary of their explorations with mass, acceleration and Newton’s second law. Students will also practice applying Newton’s Second Law to sporting events.

**Duration**

30 minutes (may be assigned as a homework assignment)

**Focus Question**

How can Newton’s Second Law be applied to different sporting events?

**Materials**

* Student worksheet - Acceleration and Newton’s Second Law

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Acceleration and Newtons Second Law Reading and Practice.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Acceleration%20and%20Newtons%20Second%20Law%20Reading%20and%20Practice.docx)

* Calculator

**Teacher Preparation**

1. Download student worksheet and edit if desired
2. Decide if giving this as a homework assignment
3. Make sure students are comfortable making the calculations (if students are not ready to solve for a variable, assist them by providing the formula)

**Classroom Procedure**

1. Obtain student worksheet
2. Read and complete as directed

**Explain**

**Activity 8 – Other Ways to Move**

**Purpose:**

Student will explore other forms of motion such as circular motion, movement of a projectile. Student will also explore other things that might affect motion such as gravity and air friction.

**Activity Description**

Through a series of short activities (teacher demonstration or student experiment), students will notice movement of a penny/hex nut in a clear balloon, create and notice differences in two pencils (one is a projectile), discover how air friction acts on different sized surfaces, and see how gravity affects falling objects. These may be split up or done in succession with student/teacher discussion after each one. Movie clips may also be selected to reinforce student understanding after the activity and discussion.

**Duration**

1-2 class periods

**Focus Question**

What are some other ways that objects move?

**Materials**

* Student worksheet - Other Ways To Move

http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Other types of motion.docx

* Part 1 – Circular motion: Clear balloon, penny, hex nut
* Part 2 – Projectile motion: 2 pencils of equal size, space to launch objects
* Part 3 – Air Friction: 1 sheet flat paper, 1 piece of crumpled paper (in a ball), one large book
* Part 4 – Falling Cup: 1 heavy weight Styrofoam cup, water, wastebasket (if able to go outside, no wastebasket is needed)

**Teacher Preparation**

1. Download student worksheets and edit as needed
2. Gather materials
3. Decide if activities will be done in succession or split in more than one class period
4. Download any movie clips to be used for support of concepts after explorations
5. Decide if activities will be teacher demonstrations or student experiments

**Classroom Procedure**

1. Perform activities as directed
2. Record data and answer questions as directed
3. Prepare to discuss results with class
4. Prepare to record expert information
5. Read reflection piece and prepare to incorporate into final project

**Learning Cycle 3**

**Newton’s Third Law**

**Introduction**

Newton’s Third Law will have already been explored during the previous two cycles. This cycle will cover it as well, but if time is of the essence then it can be covered more briefly here. This cycle will also include some activities that summarize all three of Newton’s ideas of motion and can be used to assess student understanding of these concepts.

**Engage**

**Activity 1- Action-Reaction**

**Purpose**

Students will observe action and reaction pairs and identify them as another way to think about motion.

**Activity Description**

Students will blow up a balloon and release the air. They should be able to draw the forces they think are at work. Students will brainstorm other action/reaction pairs and look for a pattern.

**Duration**

15 minutes

**Focus Question**

How do forces occur?

**Materials**

* Balloons
* Large paper for brainstorming other ideas and examples of forces occurring in pairs

**Teacher Preparation**

1. Prepare journal question or questions to post for student reflection
2. Gather balloons and materials for brainstorming session

**Classroom Procedure**

1. Perform balloon experiment
2. Discuss questions as directed

**Explore**

**Activity 2 – Newton’s Third Law of Motion**

**Purpose:**

To discover and understand the meaning of Newton’s Third Law of Motion

**Activity Description**

Students explore the action reaction pairs of a balloon rocket on a string. Motion is clearly opposite of the force of air let out of the bottom of the balloon. Analysis questions follow the activity to elicit ideas and possible explanations for observations.

**Duration**

1 class period

**Focus Question**

How can Newton’s Third Law be used to describe motion?

**Materials**

* Student Worksheet - [Newton's Third Law of Motion](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Newton's%20Third%20Law%20of%20Motion.docx)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Newton's Third Law of Motion.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Newton's%20Third%20Law%20of%20Motion.docx)

* Balloons (small to medium sized long balloons work best)
* String
* Straws
* Tape

**Teacher Preparation**

1. Download student worksheet and edit as needed
2. Gather Materials
3. Divide students into groups (3 or 4 per group works best)

**Classroom Procedure**

1. Divide into groups per teacher direction
2. Make predictions when requested before performing activity
3. Record data and answer questions as directed

**Explain**

**Activity 3- Newton’s Laws Review**

**Purpose:**

Students will demonstrate their understanding of all three of Newton’s laws and should be able to relate them to the sports caster assignment at the end of the unit.

**Activity Description**

Students will answer questions about Newton’s three laws of motion. Students will then describe and illustrate how these laws fit in with their sports caster assignment.

**Duration**

1 class period

**Focus Question**

How well can you express your understanding of Newton’s Laws of Motion?

**Materials**

* Student Worksheet - [Newton's laws review](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Newton's%20laws%20review.docx)

[**Newton's laws review**](http://oaklandk12.rubiconatlas.org/links/Science_5/Newton's%20laws%20review.docx) (found on links page at end of document)

* Extra paper for drawing (if needed)

**Teacher Preparation**

1. Download and change student worksheet if desired
2. Download key if using worksheet as is
3. Develop a checkbric to use when assessing student illustrations demonstrating their understanding of Newton’s three laws.

**Classroom Procedure**

1. Answer questions from student worksheet (front)
2. Draw examples of Newton’s three laws for assessment

**Bill Nye the Science Guy ‘Motion’**

[**https://www.youtube.com/watch?v=iG-d5n9ZetM**](https://www.youtube.com/watch?v=iG-d5n9ZetM)

**Science spot Newton’s Laws**

[**http://www.sciencespot.net/Media/newtonlab.pdf**](http://www.sciencespot.net/Media/newtonlab.pdf)

**Science spot Speed Challenge**

[**http://www.sciencespot.net/Media/speedchall.pdf**](http://www.sciencespot.net/Media/speedchall.pdf)

**Activity 4 – Physics Internet Scavenger Hunt**

**Purpose:**

Students will experience physics in many different virtual situations using different on-line resources.

**Activity Description**

Students will use on-line resources to extend their understanding of the laws of motion and physics concepts explored during this unit

**Duration**

1 – 1 ½ class periods

**Focus Question**

Where else can we find and use physics?

**Materials**

* Student worksheet - [Physics Internet Scavenger Hunt](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Physics%20Internet%20Scavenger%20Hunt.doc)

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Physics Internet Scavenger Hunt.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Physics%20Internet%20Scavenger%20Hunt.doc)

* Computer access

**Teacher Preparation**

1. Download student worksheet and modify as needed
2. Check and make sure all links are working and will work on student computers
3. Obtain access to computers (if a computer lab is not available, consider doing some of the activities as a class)

**Classroom Procedure**

1. Follow directions and explore the sites
2. Answer questions as directed

**Learning Cycle 4 – Energy**

The focus of this last cycle is the concept of energy. Students will explore how is energy stored and used. Students will understand and be able to identify and apply concepts of kinetic and potential energy to their sports caster projects. After the completion of this learning cycle, student groups should be ready for the voice-over project.

**Engage**

**Activity 1 – Meep Meep – It’s the Coyote and Roadrunner!!**

**Purpose:**

Students will begin to investigate their own ideas about potential and kinetic energy. They should begin to think about where the energy that we use to do everyday things comes from. They should also realize that the position of objects has the ability to store energy as well.

**Activity Description**

Students will watch a short cartoon clip of the Coyote and Roadrunner to identify places where energy might be stored and where energy might be used.

**Duration**

10-15 minutes

**Focus Question**

How do the Coyote and Road Runner gain and release energy? Where might it come from?

**Materials**

* Coyote and Roadrunner

<http://www.youtube.com/watch?v=Jnj8mc04r9E>

* Journal to record thoughts and observations

**Teacher Preparation**

1. Download clip and make sure it is an active link. Select other links if desired
2. Prepare questions to encourage students to think about energy of moving and still objects.
3. Students should be able to find places of stored and moving energy within video clips
4. Class discussion should follow. Corrections of student ideas are not made at this time.

**Classroom Procedure**

1. View video clip
2. Answer questions as directed
3. Be prepared to share insights with class during discussion

**Explore**

**Activity 2 – Energy of a Pendulum**

**Purpose**

Pendulums are used to provide illustrations of stored energy (potential) and moving energy (kinetic).

**Activity Description**

Students will use a pendulum to notice where areas of greatest (fastest) movement occurs and where areas of slowest movement occur. Students explore the transfer from potential to kinetic energy during this activity.

**Duration**

1 class period

**Focus Question**

How do kinetic and potential energy affect the motion of the pendulum?

**Materials**

* Student Worksheet - [Energy of a Pendulum](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum.doc)
* [http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Energy of a Pendulum.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum.doc)
* Energy of a Pendulum Key

[http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Energy of a Pendulum key.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum%20key.doc)

* String
* Washers
* Meter Stick
* Ruler

**Teacher Preparation**

1. Download student worksheet and edit as needed
2. Download See What I Saw (may be used as a homework assignment to assess student understanding)
3. Divide class into groups (2 per group if possible)
4. Gather materials

**Classroom Procedure**

1. Divide into groups per teacher direction
2. Prepare pendulum as directed
3. Answer questions and provide sketches as directed

**Explain**

**Activity 3 – Types of Energy**

**Purpose:**

Students will explore the different types of energy and understand how energy is not lost, it is just converted from one form to another

**Activity Description**

Students use cooking as a background for explaining the energy conversions that occur in a series of cooking activities

**Duration**

1 class period

**Focus Question**

What are some ways that energy exists and how is it converted from one form to another?

**Materials**

* Student worksheet - [Energetic Cooking](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energetic%20Cooking.doc)
* [http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Energetic Cooking.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energetic%20Cooking.doc)
* Energetic Cooking Key
* [http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Energy of a Pendulum key.doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum%20key.doc)

**Teacher Preparation**

1. Energetic Cooking may be downloaded and used as a homework assignment.

**Classroom Procedure**

1. Pass out the worksheet on energy conversions.
2. Assign the worksheet as either a class or homework activity.

**Explain**

**Activity 4 – Egg cellent Egg Drop**

**Purpose:**

Students will express an understanding of all of Newton’s Laws of Motion and the ideas of kinetic and potential energy in this activity.

**Activity Description**

Students will design a container that will protect a raw egg from breaking when dropped from a certain height. The success of their design will be one form of evidence of their understanding of forces and how they work. The second part of this experiment is a written explanation of how their design incorporates all of the ideas of motion and energy conversion.

**Duration**

1-2 class periods

**Focus Question**

How can the force of gravity be overcome?

**Materials**

* Activity Guide - [**Eggscellent egg drop**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Eggscellent%20egg%20drop%20elaboration.docx)
* [http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Eggscellent egg drop elaboration.docx](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Eggscellent%20egg%20drop%20elaboration.docx)
* Raw Egg (one per group)
* Materials for container design (should be brought in by students)
* Place to drop egg from (a high ladder would work well and provide more of a challenge)

**Teacher Preparation**

1. Download student worksheet and make changes as needed
2. Decide on location for drop
3. Decide on how groups will be formed

**Classroom Procedure**

1. Design container with group
2. Test design (not with egg)
3. Draw final design
4. Test egg
5. Write analysis of project

**Elaboration**

**Activity 5 - Energy Project**

**Purpose:**

Students will demonstrate their understanding of energy and energy conversions

**Activity Description**

Students will select an activity of their choice and identify energy conversions going on in that activity.

**Duration**

1-2 class periods

**Focus Question**

Where can we find energy conversions in everyday activities

**Materials**

* Student activity guide - Energy Project
* [http://oaklandk12.rubiconatlas.org/links/Science\_5/5th - Forces and Motion/Energy Project (2).doc](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20Project%20(2).doc)
* Final copy paper
* Crayons/colored pencils

**Teacher Preparation**

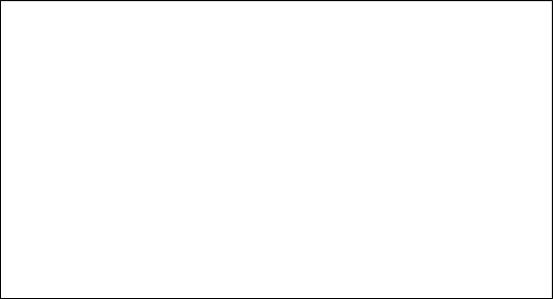
1. Download student worksheet and make changes as needed
2. Modify rubric if desired

**Classroom Procedure**

1. Review and understand expectations for the assignment
2. Complete assignment following all requirements

Students are now ready to complete the sports caster assignment. Review project goals and consider forming the rubric as a classas indicated in the opening Engage activity.

* [**A Running Start and Frames of Reference student directions**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/A%20Running%20Start%20and%20Frames%20of%20Reference%20student%20directions.docx)
* [**A Running Start and Frames of Reference student directions**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/A%20Running%20Start%20and%20Frames%20of%20Reference%20student%20directions.docx)
* [**A Running Start and Frames of Reference video sites**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)
* [**Acceleration and Newtons Second Law Reading and Practice**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Acceleration%20and%20Newtons%20Second%20Law%20Reading%20and%20Practice.docx)
* [**Brick lab student sheet**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Brick%20lab%20student%20sheet.docx)
* [**Brick lab**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Brick%20lab.docx)
* [**Carnival of Forces key**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces%20key.doc)
* [**Carnival of Forces**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Carnival%20of%20Forces.doc)
* [**Eggscellent egg drop elaboration**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Eggscellent%20egg%20drop%20elaboration.docx)
* [**Energetic Cooking- key**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energetic%20Cooking-%20key.doc)
* [**Energetic Cooking**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energetic%20Cooking.doc)
* [**Energy of a Pendulum key**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum%20key.doc)
* [**Energy of a Pendulum**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20of%20a%20Pendulum.doc)
* [**Energy Project (2)**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Energy%20Project%20(2).doc)
* [**Forces that affect motion**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Forces%20that%20affect%20motion.docx)
* [**Friction Friend or Foe Activity**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Friction%20Friend%20or%20Foe%20Activity.docx)
* [**Illustrating Newtons First Law**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Illustrating%20Newtons%20First%20Law.docx)
* [**Measuring Motion Lab**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Measuring%20Motion%20Lab.docx)
* [**Mu of shoe friction lab**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Mu%20of%20shoe%20friction%20lab.docx)
* [**Newton's laws review**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Newton's%20laws%20review.docx)
* [**Newton's Third Law of Motion**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Newton's%20Third%20Law%20of%20Motion.docx)
* [**Other types of motion**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Other%20types%20of%20motion.docx)
* [**Other ways to move worksheet**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Other%20ways%20to%20move%20worksheet.docx)
* [**Physics Internet Scavenger Hunt**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Physics%20Internet%20Scavenger%20Hunt.doc)
* [**Rolling Along**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Rolling%20Along.docx)
* [**Running Starts Inertia Newtons 1st Law Text in the Middle**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Running%20Starts%20Inertia%20Newtons%201st%20Law%20Text%20in%20the%20Middle.docx)
* [**Sports caster physics draft**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Sports%20caster%20physics%20draft.docx)
* [**The Penny Game Inertia**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/The%20Penny%20Game%20Inertia.docx)
* [**Understanding speed graphs- (2)**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Understanding%20speed%20graphs-%20(2).docx)
* [**Understanding speed graphs-Key (2)**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/Understanding%20speed%20graphs-Key%20(2).doc)
* [**WWI Bombing Aces**](http://oaklandk12.rubiconatlas.org/links/Science_5/5th%20-%20Forces%20and%20Motion/WWI%20Bombing%20Aces.docx)
* [**A Running Start and Frames of Reference student directions**](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20student%20directions.docx)
* [**A Running Start and Frames of Reference video sites**](http://oaklandk12.rubiconatlas.org/links/Science_5/A%20Running%20Start%20and%20Frames%20of%20Reference%20video%20sites.docx)
* [**Acceleration and Newtons Second Law Reading and Practice**](http://oaklandk12.rubiconatlas.org/links/Science_5/Acceleration%20and%20Newtons%20Second%20Law%20Reading%20and%20Practice.docx)
* [**Brick lab student sheet**](http://oaklandk12.rubiconatlas.org/links/Science_5/Brick%20lab%20student%20sheet.docx)
* [**Energetic Cooking- key**](http://oaklandk12.rubiconatlas.org/links/Science_5/Energetic%20Cooking-%20key.doc)
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* [**The Penny Game Inertia**](http://oaklandk12.rubiconatlas.org/links/Science_5/The%20Penny%20Game%20Inertia.docx)
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