Physical Science Units

The links take you to each unit bookmarked below. Or you may simply scroll down the page.

External links

Curriculum

Vocabulary Spreadsheet

Grade Level Gizmos

Requisitions

Brendan's Unit Plan: Structures and Properties of Matter

Brendan's Unit Plan: Elements, Compound, and Mixtures

Sixth Grade Science Curriculum

Unit 2: Structure and Properties of Matter

Clarification:

- Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs.
- Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.

Essential Questions, Concepts/Understandings, Competencies/Skills, and Resources

1. What is matter and how does it exist on Earth? (atom, molecule, solid, liquid, gas, Kinetic-Molecular Theory)

    - Matter is made of extremely tiny particles called atoms and molecules.
    - There are three common states of matter on Earth – solids, liquids, and gases.
    - The state of the matter (solid, liquid, gas) is a property of that substance.
    - *Add Kinetic-Molecular Theory of Matter here.*
        - Create a model to show the atom arrangement in solids, liquids, and gases.

    - Labs/Activities
        Phase Change Lab
        Physical Properties of Matter Lab
        Tim's Physical Properties Lab (adjusted)
        Phase Change Lab (adjusted by Holly)

        Density Column

2. How are liquid particles arranged?

    - The particles of a liquid are attracted to one another, are in motion, and are able to move past one another.
        - Develop an experiment to explore the attraction water molecules have for each other.

    - Labs/Activities
        Properties of Water Lab / Answer Key

Quiz study guide

3. How does heat influence the motion and attraction of a liquid? (heating, cooling, temperature, heat, expansion, contraction, kinetic energy)

- An increase in the speed of molecules (heating) competes with the attraction between molecules and causes molecules to move a little further apart.
- A decrease in the speed of molecules (cooling) allows the attractions between molecules to bring them a little closer together.
    - Water is an exception.
- Design an experiment to see if the speed of water molecules is different in hot water compared to cold water.

- Labs/Activities
    Add here

4. How are solid particles arranged and how does heating and cooling influence their arrangement?

- In a solid, the atoms are very attracted to one another. The atoms vibrate but stay in fixed positions because of their strong attractions for one another.
- Heating a solid increases the motion of the atoms moving them farther apart.
- Cooling a solid decreases the motion of the atoms moving them closer together.
    - Develop an argument as to why heating a metal causes it to expand and cooling a metal causes it to contract.

- Labs/Activities
    Add here

5. How are gas particles arranged and how does heating and cooling influence their arrangement?

- The molecules of a gas are much more spread out and have very weak attractions for one another. Molecules are able to move freely past each other with little interaction between them.
- Heating a gas increases the speed of its molecules. Cooling a gas decreases the speed of its molecules.
    - Investigate and provide an explanation for how heating and cooling affects a gas.

- Labs/Activities
    Add here

6. What is the difference between heat and temperature?

- Temperature is a measure of the average kinetic energy of the atoms or molecules of a substance. Heat is the transfer of energy from a substance at a higher temperature to a substance at a lower temperature.
    - Investigate the transfer of heat from hot water to a metal washer and hot metal washers to water.

- <u>Labs/Activities</u>
  Add here

7. What causes evaporation? (vaporization, condensation)

- Evaporation occurs when molecules in a liquid gain enough energy that they overcome attractions from other molecules and break away to become a gas. Adding energy increases the rate of evaporation.
    - Identify and control variables to design a test to see if heating water affects the rate of evaporation.

- <u>Labs/Activities</u>
  Add here

8. What happens to the molecules of liquid during freezing? (freezing)

- Freezing occurs when the molecules of a liquid slow down enough that their attractions cause them to arrange themselves into fixed positions as a solid.
    - Explain on the molecular level why a low enough temperature can cause water vapor in the air to condense to liquid water and then freeze to form ice.

- <u>Labs/Activities</u>
  Add here

9. What happens to the molecules of a solid during melting? (melting)

- Melting occurs when the molecules of a solid speed up enough that the motion overcomes the attractions so that the molecules can move past each other as a liquid.
    - Explain on the molecular level the process of heat transfer and molecular motion that causes a solid to melt to form a liquid.

- Labs/Activities
  Add here

10. *Can molecules ever “skip” a phase change? (sublimation, deposition)*
    - *Sublimation occurs when a solid changes directly into a gas.*
    - *Deposition occurs when a gas changes directly into a solid.*
      - *Need one.*

    - Labs/Activities
      Dry Ice activities

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Unit 3: Elements, Compounds, and Mixtures

Clarification:
None listed.

Essential Questions, Concepts/Understandings, Competencies/Skills, and Resources

1. What is the composition of all matter? (pure substance, mixture)

    - Matter can be classified into pure substances and mixtures.
        - Classify a sample of matter in terms of pure substances and mixtures.

2. How do elements, compounds, and mixtures differ? (element, compound, revisit mixture, element symbol, compound formula)

    - Pure substances can be elements or compounds.
    - An element is composed of only one type of atom and cannot be broken down into smaller pieces that still have properties of that element.
    - A compound is made from two or more types of atoms that are bonded together by chemical means.
    - Mixtures are made of two or more different elements or compounds physically combined.
    - Diatomic molecules are composed of two atoms of the same element and are not compounds.
        - Develop a model of atoms, elements, compounds, and mixtures using ball and stick models or drawings.

3. How are physical and chemical properties used to identify a pure substance?

    - Each pure substance has characteristic physical and chemical properties that can be used to identify it. Examples: density, thermal expansion/contraction, freezing/melting points, streak test

4. How does a substance change when it undergoes a chemical change?

    - Chemical changes cause a change in the identity and properties of the substance.
        - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical change has occurred.

5. What are the types of mixtures and how can you separate them? (homogeneous mixture, heterogeneous mixture, Tyndall effect, solution, suspension, colloid)

- Homogeneous and heterogeneous mixtures are physically, not chemically combined and can be separated into their parts by physical means using different techniques such as distillation, magnetism, using a centrifuge, filtration, chromatography, etc.
    - Distinguish between homogeneous and heterogeneous mixtures.
    - Distinguish between solutions, colloids, and suspensions.
    - Design an experiment to separate a mixture using sorting, filtering, chromatography, or magnetism.
    - Analyze and interpret a solubility graph.

Notes from 11/19 - Alex and Holly work day

To do:

- Speak with Kara about her thoughts on enriched science in 2020-21
- Speak with Kara about needs of science rooms
    - Our dept. needs to create a list of requirements for physical science classroom asap
- Create a “sequence” of content and activities for the unit and a slideshow
- Make a list of “to do” items
- Holly spoke with Wendy Martin at Science in Motion regarding authentic labs; a contact will email Holly with possibilities
- Create a Notebook File for all of the teachers

General sequence

- Unit Concept map
- Teach on elements
    - Reading assignment: Elements and Compounds
    - Notes - these correspond to the notebook file
    - Meet the Elements Song (3:15)
    - Color the three types of elements (metals, non-metals, metalloids)
        - Review properties of the three types
        - Periodic Table Link
        - Holt text p. 90-93 (Elements- goes well with coloring Periodic Table)
    - Teaching point: Capital letters indicate an element
    - Worksheet on Elements - Link
    - Teaching point: Diatomic molecules (O_2, N_2, Cl_2)(H, O, N, Cl, and O are only elements that can be diatomic in nature) are ELEMENTS, not compounds
    - Idea- provide unknown pure substances to students. Students solve the puzzle

- Teach on compounds
    - Teaching point: Elements are written as symbols, a compound is written as a formula
    - Teaching point: The chemical properties of compounds are totally different than the properties of the elements that make them up
        - NaCl (found naturally) - Na and Cl (both NOT found naturally)
    - Teaching point: Within a compound, the ratio of elements to each other is always the same
    - Teaching point: Compounds, unlike elements, CAN be broken down into simpler substances
    - Article in Science World (September 2019) on Cell Phone Chemistry - Elements that make up your smartphone
        - EdPuzzle - cell phones, metals, nonmetals, metalloids
    - Compounds Project - students choose a compound in nature or a synthetic compound and create product (polymers, resins) - 3 days
        - Compounds Research Project Directions and Structural Diagram Sheet
        - Compounds Research Project Rubric These 2 sheets would be copied back to back
        - Compounds Research Project Notes Sheet - This includes a list of possible compounds
    - Pyrotechnics Lab - can be done AFTER the test
- Teach on Mixtures
    - Reading assignment: Mixtures and Separating Mixtures refer to Holt text p. 98-105
    - Notes on Mixtures
        - Legos DEMO (or equivalent) - easy to do in notebook on smartboard
            - Video (1:11)
    - Notes on Solutions
        - Solutions can be solids, liquids and gases (see textbook)
    - Kool-aid Concentration Lab
    - Concentration
        - Borax Crystals Snowflake Activity
    - Solutions - Science Skills Station Kool Aid lab
    - Solubility curve
    - Solubility and Temperature - Gizmo (Solubility and Temperature)
    - Colloids - Sorting activator - Define colloid, then students attempt to sort common items placed around the room (marshmallow, whipped cream, mayonnaise, etc.) into 7 like-groups based on what they already know. Leads to the discussion of the different kinds of colloids - Add to this activity a light beam to demonstrate Tyndall effect
    - Need something for suspensions: (salad dressing; soil sample in water; snow globe; etc.)
    - Methods of separation (filtration, distillation, centrifuge, chromatography)

- Separating mixtures
    - Brock's Separating Mixtures Lab (found in Schoology resources)
    - Chromatography lab (easily a 2 day lab...teacher models creating procedure of one part, kids create additional procedures for other parts)
    - Particelli Chromatography Lab - Adapted from Dr. Re's
        - Evidence Sheet for Chromatography Lab
    - Centrifuge demonstration (EC Science in Motion)
        - Reserve the centrifuge from EC and take turns
    - TedTalk Video (4:24)
- Summarizer: Elements, compounds, and mixtures - Identifying diagrams (Holly's activity that could be Schoologized)
- Summarizer: Slideshow
- Summarizer: Gimkit
- Summarizer: Which Doesn't Belong
    - worksheet for this in Schoology
- Sample Questions from SAS Link
- Quizizz Unit Review
- Unit Review and Test Review Questions in Schoology Resources
- Holly will explain Taboo Review

Additional items - For 6th grade (From EC)
Renewable energy Knex kits - appropriate for 6th grade (build solar, wind, hydro cars- very cool)
Wind turbine kit ("Kid-wind")

North Museum has nanotechnology materials available for loan
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Unit 4: Simple Chemical Reactions

Essential Questions:

1. How does a physical change differ from a chemical change?
    a. Concept: A physical change, such as a state change or dissolving, does not create a new substance, but a chemical change does.
    b. Skill: Sort examples of changes into physical or chemical changes.
2. What is a chemical reaction?
    a. Concept: Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.
    b. Skill: Make a model to show that in a chemical reaction the atoms of the reactants rearrange to form the products.

3. How can particles combine to produce a substance with different properties?
    a. Concept: In a chemical reaction, the atoms and molecules that interact with each other are called reactants. The atoms and molecules produced by the reaction are called products.
    b. Skill: Identify and describe reactants and products of simple chemical reactions.
4. If a reaction occurs, does the amount of matter change?
    a. Concept: In a chemical reaction, only the atoms present in the reactants can end up in the products. No new atoms are created, and no atoms are destroyed.
    b. Skill: Count the elements in compounds by balancing a chemical reaction.
5. If a reaction occurs, does the amount of mass change?
    a. The total mass of the substances involved is conserved and does not change in a chemical reaction regardless of what reaction or change in properties occurs.
    b. Skill: Plan and carry out investigations to determine the effect on the total mass of a substance when the substance changes shape, phase, and/or is dissolved.
6. What happens when new materials are formed? What stays the same and what changes?
    a. Concept: When two or more different substances are mixed, a new substance with different properties may be formed; such occurrences depend on the substances and conditions (e.g., temperature, pressure, pH, catalysts, etc.).
    b. Skill: Investigate the interaction of two or more substances to identify the new substance formed when materials are mixed.
7. How does a catalyst influence the rate at which a reaction occurs?
    a. Concept: A catalyst is a substance that can help the reactants in a chemical reaction react with each other faster without actually becoming part of the products of the reaction.
    b. Skill: Investigate the presence of a catalyst (yeast) on a chemical reaction (decomposition of H_2O_2)
8. How does thermal energy affect particles in a chemical reaction?
    a. Concept: Reactants must be moving fast enough and hit each other hard enough for a chemical reaction to take place.
    b. Concept: Increasing the temperature increases the average speed of the reactant molecules. As more molecules move faster, the number of molecules moving fast enough to react increases, which results in faster formation of products.
    c. Skill: Develop an experiment to find out if the temperature of the reactants affects the speed of the reaction.
9. How can I use my understanding to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes?
    a. Concept: Applying temperature-changing chemical processes to the problem of making a device that can be used to achieve and maintain a particular temperature range for a very specific purpose.
    b. Skill: Undertake a design project to construct, test and modify a device that either releases or absorbs thermal energy by chemical processes.

Physical Change	a change of matter from one form to another without a change in chemical properties (e.g., tearing paper, melting ice)
Chemical Change	a change in the composition of matter; changes into a totally different substance (e.g., combustion, precipitate formed)
Mass	a measure of the amount of matter in an object
Law of Conservation of Mass	matter can change form or be rearranged, but it cannot be created nor destroyed
Chemical Equation	an equation that uses chemical formulas, numbers, symbols and arrows to show what happens during a chemical reaction
System	a set of things working together as part of a whole
Product	a substance that forms in a chemical reaction; found to the right of the arrow in a chemical equation
Reactant	a substance or molecule that participates in a chemical reaction; found to the left of the arrow in a chemical equation
Yields	produces; the arrow in a chemical equation
Precipitate	a solid that is produced in solution as a result of a chemical reaction
Endothermic	a chemical reaction in which thermal energy is absorbed
Exothermic	a chemical reaction in which heat is released into the surroundings; energy given off
Catalyst	a substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change

Unit 4 Scope & Sequence:

Unit 4 Notes - these will correspond to the notebook file that will be created and shared out (Notes & Slideshow - Sean)

- Teach Physical Changes versus Chemical Changes
    - Vocab terms: physical change, chemical change, precipitate, endothermic, exothermic
    - Main talking points: 1. Difference between physical change and chemical change, 2. Evidence of chemical changes (endothermic/exothermic reactions)
    - Video: Physical/Chemical Changes (7:40)
    - Video: Physical/Chemical Changes (5:23)
    - Reading assignment: Physical/Chemical Changes (Brendan) -- Located in shared Schoology Resources: D.R. Simple Chemical Reactions
    - Worksheet to review physical/chemical changes (Brendan) -- Worksheet
    - DEMOS: Evidence of Chemical Change
        - Alex and I did Reaction 2 in Table A and Reactions 1-3 in Table B
        - Student Sheet
    - LAB:
        - ID unknown substance lab (original version)
        - Using Chemical Change to ID an Unknown (revised version)
    - Gizmos: https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1060
    - LAB- Reptile Rescue:
        - Chemical Reactions and Engineering Design (original version)
        - Reptile Rescue
            - Enough materials for two teachers at a time (4 students/group)
            - Suggest setting out multiple buckets of water (room temp.) for students to draw from (from the tap introduces variables)
            - We did use a mortar and pestle (not in directions)
            - We used a plastic knife to level off measurements (not in directions)
            - Use 50ml beakers instead of plastic cups
            - Any residue left behind in the beakers after the reactions can be dissolved with vinegar
            - Mortar/pestles- some belong to Life Science, others to Baylor
            - I provided an extra beaker that students could pour extra ground-up CaCl2 into instead of throwing it away. Students that needed extra could use this
- Review Chemical Formulas
    - Worksheet called “Chemical Formulas and Equation” was added to Schoology Resources - This could be used or modified - It was a free download that was forwarded from Nikki Wilkinson - Days 2 & 4 on the WS apply to Chemical Formulas while Day 3 applies to the next topic on Chemical Equations

- Teach Chemical Equations/Balancing Chemical Equations
    - Vocab terms: chemical equation, product, reactant, yields, system
    - Helpful tutorial video (14:55)
    - Gizmos:
      Regular Ed. Students: (Prior Knowledge, Warm-up, Activity A&B; NOT Activity C)
      https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=461
      Higher Level Students: (Prior Knowledge, Warm-up, Activity A)
      https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=461
    - Worksheets: How To Balance Equations, Balancing Act Practice 1 & 2 (Have these already)
    - Additional worksheets to reinforce balancing equations (Brock)
    - PHET balancing equations
    - Balancing Equations Fun Online Practice
    - Hands-on Balancing Equations Activity (Directions only - do not use student sheet - see student sheets below)
        - There are enough materials for 2 teachers to use this on the same day (students working in pairs)
        - Cards for setting up equations
        - Cards for balancing equations
        - Student Sheet - Page 1
        - Student Sheet - Page 2
        - Answer key
        - Slideshow (equations and answers)
- Teach Chemical Reactions
    - Vocab term: catalyst
    - Text: 388-396
    - Video: Bill Nye Chemical Reactions - Video worksheet
      Note: This video is really 19.5 minutes long. The other 10 minutes repeat segments.
    - Video: Amazing Chemical Reactions
    - LAB: Catalysts in Chemical Reactions lab (decomposition of H_2O_2/yeast) (Tim)
- Teach Law of Conservation of Mass
    - Vocab terms: mass, Law of Conservation of Mass
    - Text: 392-397
    - Edpuzzle (6:46) - This is also posted in Schoology Resources
    - Video Link (4:36)
    - Video Link (3:47)
    - LAB: Crazy 8 Reactions Demos - from Scott Baylor - he is willing to supply materials (Sean)
    - LAB: Law of Conservation of Mass (Holly) from Internet
    - Created Lab: Law of Conservation of Mass Lab Activity - physical and chemical changes in lab
    - Revised Law of Conservation Lab
- Digital Reviews: Quizizz, Gimkit, etc. (Holly)

Possible Quizizz:

- Balancing Equations (some chem. equation review, students need to balance equations)
- Balancing Equations (good review of chem. equations, counting atoms, and poses questions like, “Is this equation balanced?” rather than having students actually balance the equation)
- Balancing Equations (need to balance equations)
- Chemical Reactions
- Physical/Chemical Changes
- Quizizz Unit 4 Review

- Study Guide (Alex)
- Unit Test (Sean)

Lab	Length (days)	Materials	Teacher	Date(s)
Substance ID Through Chemical Change	1	We have enough materials for 2, maybe 3 teachers to run the lab on the same day	Sean, Alex, Brock Brendan Holly	1/16, 1/21 1/22 1/25
Reptile Rescue (Endo/Exothermic Reactions)	2-3	Enough materials for 2 teachers concurrently	Sean, Alex Brendan Holly and Brock Tim	1/22-1/24 1/27-1/29 1/30-2/3 2/3 - 2/5
Catalysts in Chemical Reactions	1	Yeast, 3% H_2O_2, Water, Dish Soap	Tim Sean, Alex Brendan Holly	1/31 2/6 2/6 2/10
DEMO: Observing Evidence of Chemical Reactions	1	Demos of Reactions (enough for classroom demonstrations, not a lab). Enough for at least 21 class periods of demonstrations. More if we reduce volumes	Tim Sean/Alex	1/28 2/5
Hands-on Balancing Equations	1	Enough materials for 2 teachers to use on the same day (students working in pairs)	Sean/Alex	1/31
Law of	1	2 teachers per day due to using	Sean/Alex	2/4

Conservation of Mass		electronic balances	Holly Brendan	2/6 2/7
Crazy 8 Demos	1			
Pyrotechnics	2	1 teacher per day due to limited Bunsen burners	Holly Tim Alex/Sean	1/15 1/16 EOY???

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Unit 5: Forces and Motion

1. What is the effect of force on any pair of interacting objects?
    a. For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction. (1)
    b. Electric and magnetic forces can be attractive or repulsive, and size depends on the magnitude of the charges, currents, magnetic strengths, and distances involved; and can be explained by fields that extend through space. (1)
2. How is the motion of an object determined?
    a. Motion can be determined with a frame of reference. (2)
    b. The change in an object's motion depends on balanced (Newton's first law) and unbalanced forces in a system (2)
3. What is evidence of a change in motion?
    a. Evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object includes qualitative comparisons of forces, mass, and changes in motion (Newton's second law); frame of reference; and specification of units (3)
4. What are ways to stop a moving object and why do moving objects stop?
    a. Friction is the resistance encountered when an object moves over another object or surface. (4)
5. What is the relationship between mass and weight?
    a. Mass is the amount of matter in an object. Weight is the force of gravity on an object. (5)
6. What is the relationship between mass and motion?
7. What is gravity on Earth?
    a. The greater the mass of the object, the greater the force needed to achieve the same change in motion. If identical force is applied to two objects with different masses, the more massive object will accelerate less than the less massive object (F = ma). (7)
8. What is gravity like on other planets compared to Earth?
    a. Gravity is an attractive force between two objects near Earth's surface that pulls that object toward the planet's center at a rate of acceleration of 9.8 m/s^2. (8)
    b. Gravity is an attractive force between two objects that is dependent upon the mass and distance between the objects. (8)

force	a push or pull exerted on an object; have strength (magnitude) and direction; measured in Newtons (N); F = ma
unbalanced force	occurs when two forces acting on an object are not equal in size; results in a change in motion
balanced force	occurs when two forces acting in opposite directions on an object are equal in size; results in no change in

	motion; net force of 0 Newtons (N)
net force	the combined result of all forces acting on an object
Newton (N)	the metric unit for measuring force
drag	the friction between a solid object and a liquid or a gas
friction	a force that opposes motion; works in the opposite direction of a moving object; applies to solids only
static friction	no movement occurring due to high resistance force. Net force is 0 Newtons
rolling friction	force of resistance that slows down a rolling object. Minimizes friction between two surfaces; weakest type of friction
sliding friction	force of resistance between two bodies that are in sliding contact with one another
gravity	a force of attraction between objects that is due to their masses and distances from each other; the larger the mass of the objects, the larger its gravitational force
acceleration due to gravity	gravity pulls on ALL objects near the earth's surface with the same acceleration; 9.8 m/s2
mass	a measure of the amount of matter in an object
weight	a measure of the gravitational force exerted on an object; its value can change with the location of the object in the universe; measured in Newtons (N)
spring scale	instrument used to measure the weight of an object in Newtons (N)
inertia	the tendency of an object to resist a change in motion
momentum	a quality defined as the product of the mass and the velocity of an object; transferred from one body to another
Newton's Laws of Motion	three (3) laws that explain the motion of objects
Newton's First Law of Motion	An object at rest remains at rest and an object in motion remains in motion unless acted upon by an unbalanced

	force (Inertia)
Newton’s Second Law of Motion	The acceleration of an object depends on the mass of the object and the amount of force applied. (Momentum)
Newton’s Third Law of Motion	For every action there is an equal, but opposite, reaction (Net force)
motion	the movement of an object relative to a reference point
distance	the length between two points; how far an object moves or travels
displacement	change in the position of an object
position	the location where someone or something has been placed
reference point	a place or object used for comparison to see if motion has occurred
acceleration	the change in an object’s velocity over time; an object accelerates if its speed, direction, or both change
speed	the magnitude in which an object moves
time	the measured or measurable period during which an action, process, or condition exists or continues
velocity	the speed and direction of an object

Unit 5 Scope & Sequence:

Vocab: (Sean, Tim)

Update Quizlet Set: (Sean)

Teacher Notes: (Sean, Tim, Holly)

Student Notes: (Sean/Alex) - the content needs updated to what was actually taught; in addition, the order of the notes needs to be changed

Basic Slideshow: (Sean)

Reading Assignment(s): (Alex)

- Measuring Motion (ready to go)
- What is Force (ready to go)
- Friction (ready to go)
- Gravity and Mass vs. Weight (coming soon)
- Newton's Laws of Motion (coming soon)

NSTA Resource

1. How is the motion of an object determined? and What is evidence of a change in motion? (Sean/Holly)
    a. VOCAB: motion, distance, displacement, position, reference point, acceleration, speed, time, velocity
    b. I created the link below to align with the NGSS focus on Science Phenomena that crosscuts curriculum. The CER (Claim, Evidence, Reasoning) framework is designed to capture student's thoughts and help them to organize data to support their answer to a set question. The one I made is intended to be used to introduce the concept of observing motion. (TIM)
        i. CER Framework for Introducing Motion
    c. Current:
        i. Physics "Fun Day" Demos (there are enough materials for 2 teachers to do this the same day)
        ii. Example of How to Begin First Day
        iii. Video on Relative Motion
        iv. Video: Distance/Displacement (5:24)
        v. Distance and Displacement worksheet
        vi. KEY - Distance and Displacement worksheet
        vii. D.R. Measuring Motion - Alex
        viii. Edpuzzle (What Do Motion Graphs Show?) - Didn't work for me….Sean
        ix. Self-guided Lesson - Measuring Motion
            1. Activity 1: Graph Analysis
            2. Activity 2: Create a Graph (graph paper or digitally) - 5 pts.
            3. Activity 3: Create tracks that would display data shown in graphs
            4. Skills Practice - Measuring Motion
            5. Key: Skills Practice - Measuring Motion
        x. Gizmos:
            1. Distance-Time Graphs
            2. Measuring Motion
        xi. Walking Lab - (original version) https://sciencespot.net/Media/speedchall.pdf

Brendan will type - (revised version) Speed Walker Lab
(This could be 2 days with the graph option or 1 day without it.)
Graphing directions

xii. Ramp It Up Lab (2 days with data collection and follow-up)
1. Tips

xiii. Begin with GIZMO: (Fits 5E model of experiential learning)
1. Distance, Time and Velocity Graphing (metric)

2. What is the effect of **force** on any pair of interacting objects? (Sean)
   a. VOCAB: force, unbalanced force, balanced force, net force, Newton
      i. D.R. What is Force? - Alex
      ii. Forces Worksheet
      iii. PHET has some great demos
      iv. Free Body Diagrams
      - Interactive: Types of Forces (**Overview** - symbols given for free-body diagrams)
      - Practice: Drawing Free Body Diagrams
      - Interactive: Free Body Diagrams
      - Free Body Diagram worksheets -only vertical/horizontal motion...no angular motion
        - FBD worksheet #1
        - FBD worksheet #2
      - Raft Challenge (STEM Activity; buoyant force)
      - Video: Buoyant Force
3. What are ways to stop a moving object and why do moving objects stop? (Alex)
   a. VOCAB: fluid(drag), **friction**, rolling friction, static friction, sliding friction
   b. D.R. Friction - Alex
   c. CURRENT LAB:
      i. Friction Boards (use Spring Scale to measure required force) - enough boards for 2 teacher per day
         1. TPT: Friction Lab - Brendan should have materials for this lab
      ii. ~~Paper Airplane (if not already done can be used to change design and see how modifications increase/decrease drag (sliding friction)~~
      iii. ~~Block, vs. block supported by wooden dowel(wheel) (use Spring Scale to measure required force)~~

   d. GIZMO:
      i. Fan Cart Physics
4. What is **gravity** on Earth?/What is gravity like on other planets compared to Earth?(Brock)
   a. VOCAB: gravity, acceleration due to gravity
   b. D.R. Gravity - Brock
   c.
   d. EdPuzzle videos in Schoology Folder - Earth's Gravity and Gravity on Planets
   e. Video: The Gravity of the Situation: Crash Course Astronomy #7 (You could only show the first 5-6 minutes...second part gets into escape velocity)
   f. Video: Tides Explained
   g. CURRENT:

i. Video clip from NASA showing acceleration due to gravity with/without air resistance.
ii. Projectile Motion demonstration (launches a ball horizontally at the same time a ball drops vertically) {Student volunteer captures it on a cell phone in slow motion]
iii. Shoot-n-Drop (Billiard Ball example) **Have demonstration model in Tim's room (projectile motion)**

TPT: Earth's Gravity Lab - Earth's Gravity Lab
Killer Pennies?? CK12 interactive

h. GIZMO
   i. Free Fall

5. What is the relationship between **mass and weight**? (Tim)
   a. LAB: LAB Mass vs Weight use three random objects in your classroom to measure. You will need Newton Spring Scales and Beam Balances
   b. VOCAB: mass, weight, spring scale, reference gravity again
   c. Video: Mass .vs. Weight Song
   d. Mass vs. Weight Venn Diagram
   e. **Mass vs Weight Assessment (ADDED TO Schoology Forces and Motion Resource Tab ["Mass vs. Weight Exploration"]**
   f. GIZMO
      i. Weight and Mass
6. What is the relationship between mass and motion? (Brendan)
   a. Newton's Laws Projects
   b. VOCAB: inertia, momentum, **Newton's Laws of Motion**, 1st Law of Motion, 2nd Law of Motion, 3rd Law of Motion, reference net force again
   c. D. R. Newton's Laws of Motion - Alex
   d. Newton's First Law of Motion Video (5:20)
   e. Worksheet: Draw & Explain Newton's 3 Laws of Motion
   f. Newton's Laws Blended Lesson - This is a 2-day lesson
      Newton's 2nd Law of Motion Problems WS - Goes w/ Blended Lesson
      Newton's 2nd Law of Motion Problems WS KEY
   ~~g. TPT: 1st, 2nd and 3rd Laws of Motion Labs~~
   h. GIZMO:
      i. Air Track

Study Guide - Brock
Quizizz Review - Holly
Unit 5 Test - Brendan

7. POSSIBLE PROJECTS:
   a. Mouse-Trap Car Challenge (former 8th grade activity; might need permission slips?) **(SAVE FOR SIMPLE MACHINES?)**
   b. Roller Coaster? (also a Gizmo) (loosely based on Science Olympiad)
   c. Parachute design
   ~~d. Barbie Snow Sled Race (cardboard sleds)~~
      ~~i. Extension activity or whole class (race outside in retention area)~~

Study Island Topics:

Lab	Length (days)	Materials	Teacher	Date(s)
Building Track from Motion Graphs - Activity 3 **TRACK ALSO NEEDED FOR RAMP IT UP**	1	6-foot length of track/group	Alex Brendan Holly	2/25-26 2/28 3/13
Ramp it Up	1	9-foot length of track/group; enough "ramps" for **7 total groups** (1 teacher/day)	Holly Alex Sean Brendan Brock	2/27 3/2 3/10 3/13
Friction Boards	1	TWO SETS OF: Newton Spring Scales (12), Friction Boards (12), wooden blocks (12); Pb sinkers (2oz) (48)	Alex Sean Brock Brendan	3/13 3/16 3/16 3/20
Earth's Gravity	1	Baseballs(6), Aluminum Foil Balls(6), Paper Clips(6), Book(6) (about 1 pound), Meter Sticks 2, Stopwatches(6)	Brock Sean	3/18 3/19

- Horsepower Lab (Stair climbing) - fits better with Power/watts

- Marble Lab

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Unit 6: Energy and Heat

Plan for 12-15 days TOTAL

Background Information:

Upon completion of this unit of study, students will understand the relationship between energy and forces. Students develop their understanding of important qualitative ideas about energy, including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students will also begin to know the difference between energy and temperature, and the relationship between forces and energy. Students will use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence. The crosscutting concepts of scale, proportion, and quantity; systems and system models; and energy and matter will support understanding across this unit of study.

Students will come to know the difference between energy and temperature. They will understand that the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of energy and matter; scale, proportion, and quantity; and influence of science, engineering, and technology on society and the natural world are the organizing concepts for these disciplinary core ideas.

1. **What is energy and what form will it take?** *Sort and organize real life examples of energy into their forms.*
    a. Energy is the ability to do work and can be either kinetic or potential. These two categories can be in many different forms: electrical, radiant, thermal, motion and sound or chemical, stored mechanical, nuclear and gravitational.
2. **How can the relationships of kinetic energy to the mass of an object and to the speed of an object be described?** *Construct and interpret graphical displays of data to identify linear and nonlinear relationships of kinetic energy to the mass of an object and to the speed of an object.*
    a. Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of the object's speed. Kinetic energy may take different forms (e.g. energy in fields, thermal energy, energy of motion.)
3. **What happens to the amount of potential energy stored in the system when the arrangement of objects interacting at a distance changes?** *Develop a model to describe what happens to the amount of potential energy stored in the system when the arrangement of objects interacting at a distance changes.*
    a. A system of objects may contain stored (potential) energy, depending on the objects' relative positions.
4. **How is energy transferred from one object to another and conserved?** *Compare, evaluate, and design a device that improves energy transfer, and defend the selection of materials chosen to construct the device.*

    a. When the kinetic energy of an object changes, energy is transferred to or from the object. Whenever a transformation of energy occurs, some of the energy in the system appears as thermal energy.
5. **How is temperature related to kinetic energy of the particles in a sample?** *Accurately measure temperature using a Celsius thermometer and analyze the amount of energy in a sample compared to its energy.*
    a. Temperature is a measure of the average kinetic energy of particles of matter.
6. **How can scientific principles be applied to design, construct, and test a device that either minimizes or maximizes thermal energy transfer?** *Sort examples of heat transfer into conduction, convection and radiation. Design a device that either minimizes or maximizes thermal energy transfer.*
    a. Energy is transferred from hotter regions of objects and into colder ones by the processes of conduction, convection, and radiation. The amount of energy transfer needed to change the temperature of a sample depends on the nature of the matter, the size of the sample, and the environment.
7. **What are renewable and nonrenewable sources of energy?** *Research renewable and nonrenewable energy sources and Pennsylvania energy source data, and use it as evidence to explain why it is important to transition from reliance on fossil fuels to renewable energy sources.*
    a. Renewable energy sources are replenished naturally and over a relatively short period of time. Examples include solar, wind, hydro, bio, and geothermal.
    b. Nonrenewable energy sources are available in a limited supply and once used cannot be replenished. Examples include fossil fuels of coal, oil, and natural gas; as well as nuclear.

<u>Vocabulary</u>
Energy
Kinetic Energy
Potential Energy
Chemical Energy
Electrical Energy
Law of Conservation of Energy
Energy Transformation
Conduction
Convection
Radiation
Heat Transfer

Notes/Slideshow (Alex and Holly)
Energy - sort real-life examples into their forms
Kinetic and Potential Energy - important
    Relative to object's position
    Relating kinetic energy to the mass of an object and to the speed of the object
Forms of energy (electrical, thermal, etc.)

Temperature vs. Thermal energy

Analyze the amount of energy in its sample compared to its temperature

Energy transfer - Conduction, convection, radiation (Sean - lab(s) for this)

Study Island good for conduction, convection, and radiation.

Sort examples of each kind of energy transfer

Renewable/Non-renewable - review only or SKIP this spring (in 2020-21, increase the amount of instruction for 7th grade students) Brock putting together an edpuzzle

- From Nikki: NOVA: Energy Lab (seems like it ties into

Design a device that either minimizes/maximizes thermal energy transfer (Tim)

Reviews -

Study Guide -

Test -

Materials we have:

Radiation Lab -

9 spot lamps 150W

6 clamp lamps

6 support stands

6 rings 2”

6 rings 3”

24 cans

Energy Transfer -

8 battery holders

20 bulbs

10 sockets

Wires with alligator clips (more may be in room 2605)

3 rolls of electric tape

6 sand blocks

Conduction & Convection -

12 candles

15 heat-resistant gloves

Beeswax pellets

Styrofoam cups

Aluminum, brass, steel rods

LABS:

- Thermodynamics: Minimize Thermal Energy Transfer
    - From Jet Propulsion Laboratories (JPL)
        - Mars Thermos
        - Mars Thermos Student Work Sheet for Lab
- Conduction of Heat
    - We have 2 sets of materials (with directions) already in Tim's room
    - Two insulated plastic cups, thermometers, aluminum bar between two cups (each set)
-

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Unit 7: Waves: Sound and Light

- Link to Actively Learn Waves Resource (from Nikki W.)

Plan for 12-15 days TOTAL

Materials we have:
Nylon rope
9 slinkies (a few more slightly bent ones are in 2605)
Styrofoam blocks
50 small, round mirrors (more mirrors are in room 2605)
14 laser pointers
Textbooks on Sound & Light

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Unit 8: Simple Machines

- Brendan has materials for a "spoon catapult" originally meant for Forces and Motion that might work in this unit
- Brendan has simple machine kits
- Mouse-Trap Car Challenge (former 8th grade activity; might need permission slips?) **(SAVE FOR SIMPLE MACHINES?)**

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Possible End-of Year Activities:

- Fireworks Lab - Elements, Compounds, Mixtures
- Crazy 8 Reactions Demos - Simple Chemical Reactions
- Water Bottle Rocket - Forces and Motion
- Rube Goldberg Machine - Simple Machines
- Science Olympiad Based Projects: Ex: Roller Coaster, Mouse Trap Car, Balsa Wood Gliders (for time)

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