Subject: Conceptual Physics Grade: 8 Unit #: 2 Title: Motion & Forces

UNIT OVERVIEW

<table>
<tr><th colspan="3">STAGE ONE: Identify Desired Results</th></tr>
<tr><td rowspan="5">Established Goals/ Standards

5.1 Describe different patterns of motion of objects</td><td colspan="2">Long-Term Transfer Goal</td></tr>
<tr><td colspan="2">At the end of this unit, students will use what they have learned to independently…
Using explicit language (accelerating, moving at constant speed), describe and measure the movement of cars on a nearby street. They will develop their own investigation to determine if there is a speeding problem and create a model to demonstrate the forces involved in a car collision in terms of Newton’s three laws to argue for the importance of car safety. Is there a speeding problem around East and why should we care?</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Enduring Understandings
Students will understand that…
Energy and matter interact through forces that result in changes in motion.

The motion of an object can be represented and predicted by its position and speed. Speed is the rate of change.

Newton’s First law says an object at rest or in motion will remain that way unless a force acts upon it
· Newton’s second law says that when an object fells an unbalanced net force its motion changes· Newton’s third law state that for every applied force there is an equal and opposite force.</td><td>Essential Questions
Students will consider such questions as…
Is there a speeding problem around East and why should we care?
How can the motion of an object be represented?

How can we develop and use mathematical models and diagrams to describe and predict the motion of an object in one dimension?
How do forces affect the way our world moves?
How do forces affect an object’s energy?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>What knowledge will students learn as part of this unit?

key terms - distance, average speed, and acceleration.

5.1a The motion of an object is always judged with respect to some other object or point. The idea of absolute motion or rest is misleading.

5.1b The motion of an object can be described by its position, direction of motion, and speed (rate of change).

Energy and matter interact through forces that result in changes in motion.

4.1e Energy can be considered to be either kinetic energy, which is the energy of motion, or potential energy, which depends</td><td>What skills will students learn as part of this unit?
Use meter sticks to appropriately measure distance or length in meters and centimeters.
Use a stopwatch to measure time of travel in minutes and seconds.
Interpret constant speed vs. time graphs.
Describe acceleration using a speed vs. time graph.
Describe motion in terms of distance, time, speed, and acceleration.
Solve simple kinematics problems using the formula v = d/t
determine the speed and acceleration of a moving object.
Describe different patterns of motion of objects.
Develop scientific procedures.
collect, organize, and analyze data
Report findings.</td></tr>
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	on relative position · 5.1c An object's motion is the result of the combined effect of all forces acting on the object. · A moving object that is not subjected to a force will continue to move at a constant speed in a straight line. An object at rest will remain at rest. · 5.1e For every action there is an equal and opposite reaction.	· Identify situations as "explainable" by newton's laws · Identify different situations as examples of Newton's laws and how those laws are applied · Make force diagrams that show all forces acting on an object

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria to assess understanding: *(This is used to build the scoring tool.)* · Report must include ○ Clearly Stated question ○ Clearly Stated hypothesis that relates distance time and speed ○ Procedures are clearly written as a step by step process ○ All average speed calculations are correct with clearly labeled variables ○ Data is represented in tables and/or graphs Force diagram accurately depicts the direction and relative sizes of all forces involved in a collision. Explanation includes how each of Newton's laws applies to the forces in	Performance Task focused on Transfer: Students develop and run an investigation in which they investigate whether or not there is a speeding problem on East Main Street / Culver Road. Students must decide which variables to measure, what instruments they will use and how they will go about performing their investigation. Students create a model demonstrating the forces involved in a collision in order to explain the importance of car safety. Other Assessment Evidence: Unit ILS style quiz Daily Bridge Daily Summary/Closure Questions Daily Extended learning Activities Lab Reports Teacher observations

the diagram. Conclusions and recommendations are backed up by data	

T, M, A *(Code for Transfer, Meaning Making and Acquisition)*	**STAGE THREE: Plan Learning Experiences**
A: Acquisition M: Meaning Making T: Transfer	Evidence of learning: *(formative assessment)* Summary + Closure at end of each lesson utilizing the "Workshop Model". Investigation reports if applicable.
1. A, M 2. A, M 3. M, T 4. A, M 5. A, M 6. M, T 7. A, M 8. A, M 9. A, M 10. A, M 11. M, T 12. T 13. T 14. T 15. T 16. T	Learning Events: 1. Day 1: How can we describe motion? (**defining position, time, and speed)** a. Motion in sports video. b. Students move through stations that depict different ways to describe motion. 2. Day 2: How can we represent motion? (**graphing distance vs. time)** a. Students complete an investigation looking at how we can represent distance and time graphically and how it relates to an object's speed. 3. Day 3: What can mathematical models tell us about motion? **(interpreting distance v. time graphs)** a. Students interpret distance vs. time graphs to write a story about the motion of an object. 4. Day 4: What is speed? **(calculating speed of objects)** a. Students apply knowledge of the relationship between distance and time to find the speed of objects. 5. Day 5: Do moving things have energy? **(potential & kinetic energy)** a. Investigation crashing objects into playdough to determine how mass, speed, and drop height affect an object's energy. 6. Day 6: What makes a good balloon rocket? **(applying speed, kinetic, & potential)** a. Students investigate the variables that affect the speed of balloon rockets by measuring their distance traveled over time. 7. Day 7: Why do things move / What causes changes in energy? (**intro to forces as push/pull)** a. Students brainstorm and diagram instances of push and pulls in their everyday life. 8. Day 8: When will an object gain/lose energy? **(Newton's 1st Law)** a. Students predict, observe, and explain a series of demonstrations of newton's first law. 9. Day 9: Do all objects gain/lose energy equally? **(Newton's 2nd Law)** a. Students investigate how changing the mass of an object changes how it responds to a force. 10. Day 10: How do rockets move? (**Newton's 3rd Law**) a. Students investigate the relationship between action and reaction forces. 11. Day 11: Where do we experience forces? **(Application of forces & laws)**

	a. Students work in pairs to create a charade demonstrating one or more of Newton's laws in everyday life. 12. Day 12-16: Answering essential question (Is there a speeding problem around East and why should we care?) (**Creating and running own investigation, revising based on feedback/experiences, scientific argumentation)** a. Create investigation document in small groups (question, hypothesis, procedure, etc). b. Practice investigation with toy cars and revise investigation document based on feedback. c. Conduct investigation and analyze results to determine if there is a speeding problem. d. Create force diagram demonstrating forces involved in a car collision. (may switch with previous days depending on weather). e. Write report on the importance of car safety using evidence from investigation and force diagram.