Motion Unit Introduction

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Title: Accelerated Motion

Overview: This 50-minute unit introduction is designed to get students started working in the area of rectilinear (straight-line) accelerated motion. It is assumed that the students have a working knowledge of the following:

- constant velocity motion
- *Graphical Analysis*
- graphical methods
- dimensional analysis

Performance Objectives: Students will:

- describe real-world situations where rectilinear accelerated motion is taking place
- orally provide an operational definition of rectilinear accelerated motion, and contrast this with constant velocity (non-accelerated) motion
- predict the nature of a position-time graph for an accelerated object starting from rest
- predict the nature of a velocity-time graph for an accelerated object starting from rest
- experimentally but qualitatively determine what factors affect the distance of an accelerating object (rate of acceleration and time)
- use the above information and the process of dimensional analysis to predict the form of the relationship $d = f(a,t)$ to show that $d = kat^2$
- students will design an experiment for a given acceleration (a fixed inclined plane – using a video demonstration in this case) to determine the relationship between distance, acceleration, and time

Anticipatory Set: This lesson will be linked to constant velocity motion by conducting a quick review of what students know and then asking how things would change for things not moving at a constant velocity. I would ask for a number of examples of accelerated motion. I'd also attempt to solicit known misconceptions about accelerated motion (see below).

Process: Once the students are engaged in the project through the activities of the anticipatory set, I'll pursue the following steps:

1. students operationally define accelerated motion
2. predict the nature of a position-time graph for an accelerated object
3. predict the nature of a velocity-time graph for an accelerated object
4. determine which factors affect the distance of an accelerating object
5. conduct dimensional analysis to predict the form of the relationship $d = f(a,t)$
6. design and conduct an experiment for determine the function $d = f(a,t)$
7. find $d = f(a,t)$

Closure: Summarized findings from discussion and experiment for relating distance to acceleration and time.

Assessment: This will only be information and will consist of a constant flow of questions to the students to get them to think about physical phenomena and make their thinking transparent.

Preconceptions: I'll attempt to elicit the following alternative conceptions during the anticipatory set:

- Acceleration always means that an object is speeding up.
- Acceleration always occurs in the same direction that an object is moving.
- If an object has a speed of zero (even instantaneously), it has no acceleration.

Materials: investigation video (or inclined plane, ball bearing, 6 stopwatches, meter stick, masking tape, etc.)