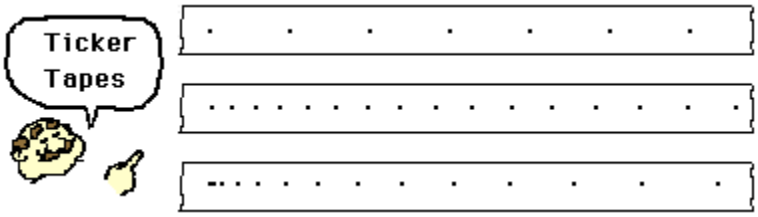
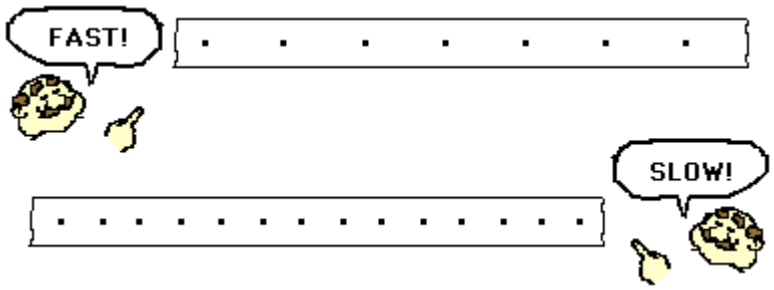
Name _____ Physics

Calculating Velocity using Ticker (Timer) Tapes

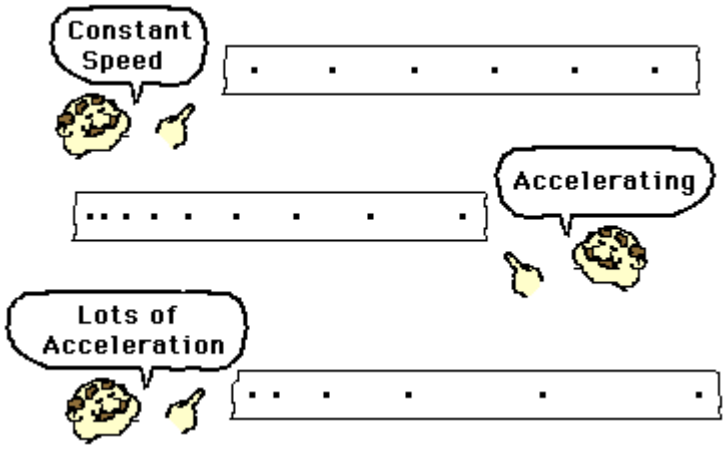
A common way of analyzing the motion of objects in physics labs is to perform a ticker tape analysis. A long tape is attached to a moving object and threaded through a device that places a tick upon the tape at regular intervals of time – say every 0.1 second. As the object moves, it drags the tape through the "ticker," thus leaving a trail of dots. The trail of dots provides a history of the object's motion and is therefore a representation of the object's motion.



The distance between dots on a ticker tape represents the object's position change during that time interval. A large distance between dots indicates that the object was moving fast during that time interval. A small distance between dots means the object was moving slow during that time interval. Ticker tapes for a fast-moving and a slow-moving object are depicted below.



The analysis of a ticker tape diagram will also reveal if the object is moving with a constant velocity or with a changing velocity (accelerating). A changing distance between dots indicates a changing velocity and thus an acceleration. A constant distance between dots represents a constant velocity and therefore no acceleration. Ticker tapes for objects moving with a constant velocity and an accelerated motion are shown below.



And so ticker tape diagrams provide one more means of representing various features of the motion of objects.

Check Your Understanding

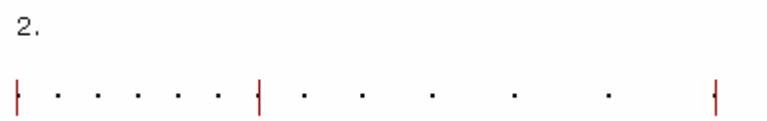
Ticker tape diagrams are sometimes referred to as oil drop diagrams. Imagine a car with a leaky engine that drips oil at a regular rate. As the car travels through town, it would leave a trace of oil on the street. That trace would reveal information about the motion of the car. Renatta Oyle owns such a car and it leaves a signature of Renatta's motion wherever she goes. Analyze the three traces of Renatta's ventures as shown below. Assume Renatta is traveling from left to right.

Describe the characteristics of Renatta's motion during each section of the diagram.

1.

What's happening? _____

2.



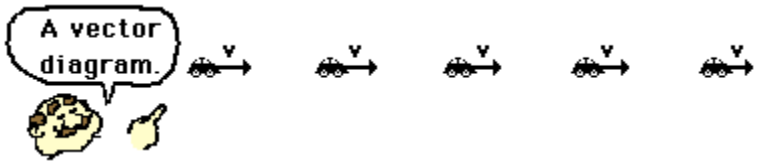
What's happening? _____

3.

What's happening? _____

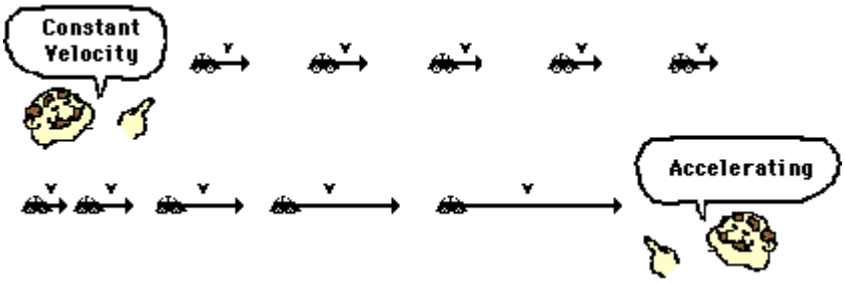
Vector Diagrams - *Revisited*

Vector diagrams are diagrams which use vector arrows to depict the direction and relative magnitude of a vector quantity. Vector diagrams can be used to describe the velocity of a moving object during its motion. For example, the velocity of a car moving down the road could be represented by a vector diagram.



In a vector diagram, the magnitude of the vector is represented by the size of the vector arrow. If the size of the arrow in each consecutive frame of the vector diagram is the same, then the magnitude of that vector is constant.

The diagrams below depict the velocity of a car during its motion. In the top diagram, the size of the velocity vector is constant, so the diagram is depicting a motion of constant velocity. In the bottom diagram, the size of the velocity vector is increasing, so the diagram is depicting a motion with increasing velocity – i.e., an acceleration.

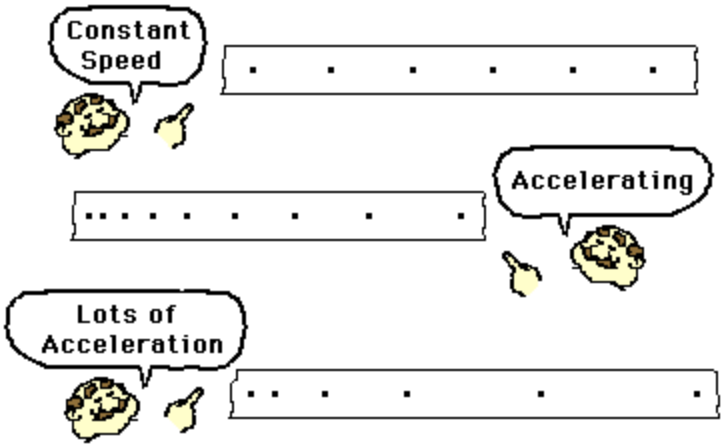


Vector diagrams can be used to represent any vector quantity. In future studies, vector diagrams will be used to represent a variety of physical quantities such as acceleration, force, and momentum. Be familiar with the concept of using a vector arrow to represent the direction and relative size of a quantity. It will become a very important representation of an object's motion as you proceed further in your studies of the physics of motion.

So How do Vector Diagram's Relate to Timer Tapes?

We use the distance between the dots and draw velocity and acceleration vectors

For Example:



How Can we calculate Velocity use Timer Tapes?

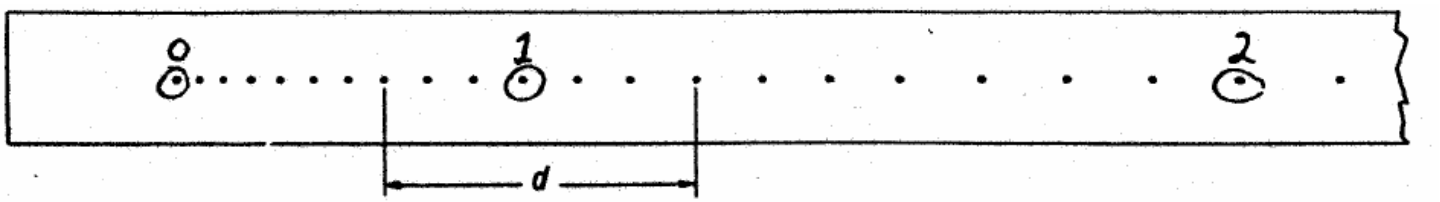


Fig. 8-3. Measuring *d* on the tape.

Practice Determining Speed on a Timer tape

Use the strip of tape timer to complete the following chart

Dot No.	Travel Time t (s)	Distance d (m)	Speed $\bar{v}$ (m/s)
0			
1			
2			
3			
4			
5			
6			