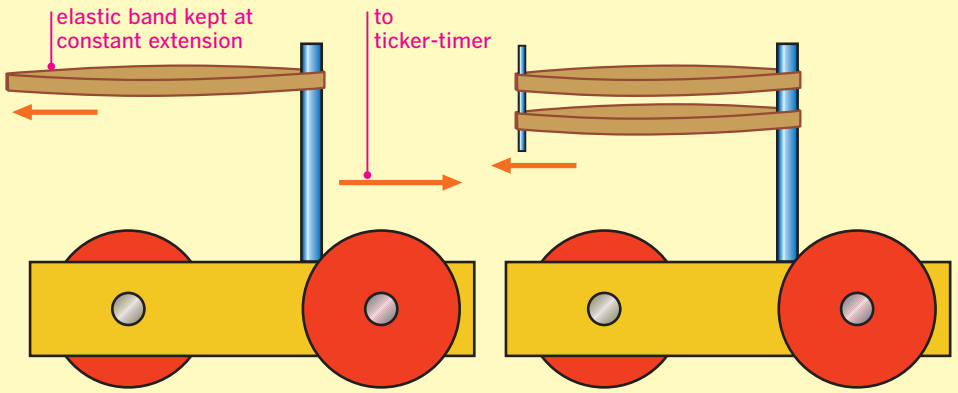
Newton's second law of motion

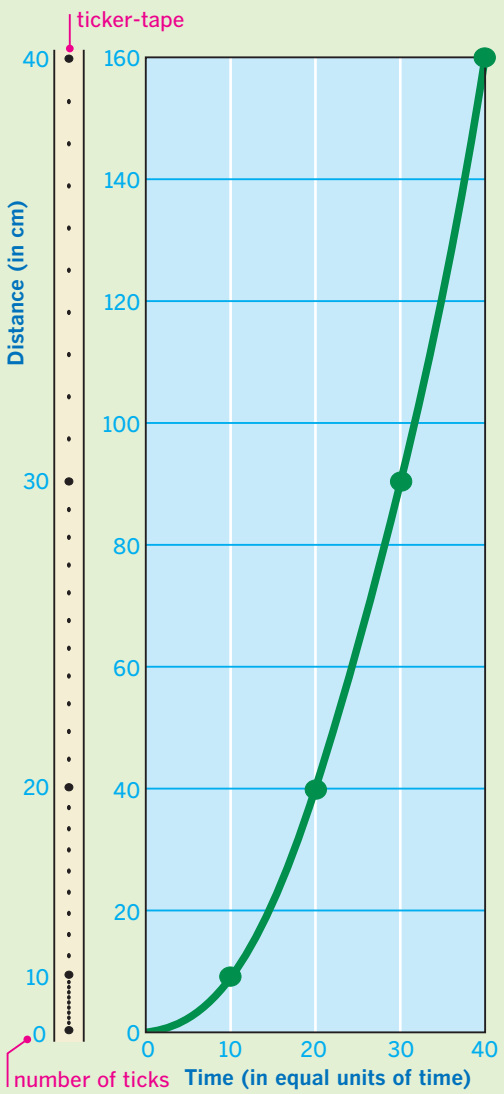
Key words

acceleration
momentum
velocity

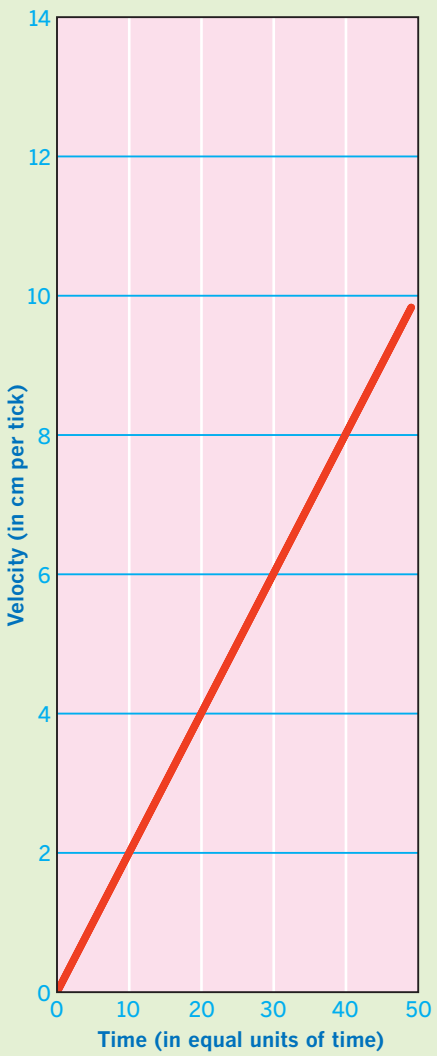
1 Equipment and method



2 Typical result



3 Velocity/time graph



Newton's second law

- Newton's second law of motion states that an external resultant force changes the motion of an object in such a way that the rate of change of the object's *momentum* is proportional to the force, and in the same direction.
- This law may be expressed mathematically in two ways:
  force = mass x acceleration (F = ma)
  impulse = change of momentum

1 Equipment and method

- The paper strip attached to the trolley passes through a ticker-timer which places a dot on the paper at regular time intervals.
- Exert a steady force on the elastic band in the direction shown.

2 Typical result

- As the trolley accelerates, the distance between adjacent dots on the tape increases. The distance traveled by the trolley can be plotted on a graph.

3 Velocity/time graph

- The trolley's *velocity* (v) equals the distance traveled (d) divided by the time (t). v=d/t
- As the ticker-timer places dots on the paper at regular time intervals, the trolley's velocity at any point equals the distance traveled per dot.
- The *acceleration* (a) of the trolley equals its velocity divided by time.
  a=v/t
- The velocity time graph is a straight line indicating that acceleration is uniform. The trolley's acceleration is given by the gradient of the graph.
- Study the effect of increased force by increasing the number of elastic bands used in the experiment. With increased force, the gradient of the graph increases, showing that the force is proportional to the acceleration.