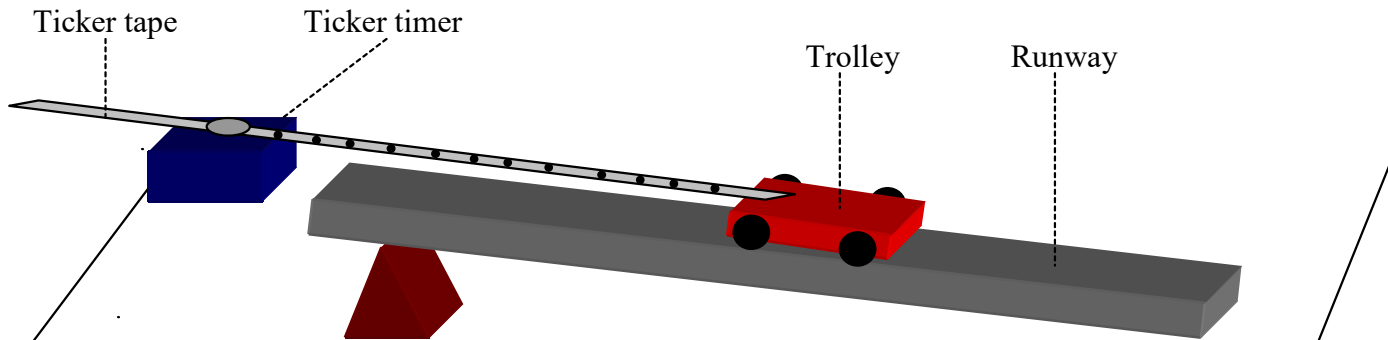# MEASUREMENT OF ACCELERATION
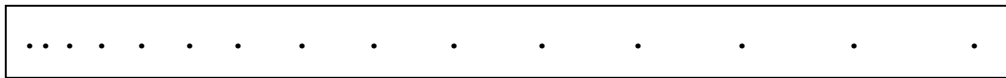
Apparatus

Ticker timer and tape, suitable low-voltage a.c. power supply, dynamics trolley, runway and laboratory jack or stand.

Ticker tape   Ticker timer   Trolley   Runway

Procedure

1. Set up the apparatus as in the diagram.
2. Connect the ticker timer to a suitable low-voltage power supply.
3. Allow the trolley to roll down the runway.
4. The trolley is accelerating as the distance between the spots is increasing.

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5. The time interval between two adjacent dots is 0.02 s, assuming the ticker timer marks fifty dots per second.
6. Mark out five adjacent spaces near the beginning of the tape. Measure the length s_1.
7. The time t_1 is $5 \times 0.02 = 0.1$ s.
8. We can assume that the trolley was travelling at constant velocity for a small time interval. Thus

$$\text{Initial velocity} = \frac{\text{distance}}{\text{time}} = \frac{s_1}{t_1} = u \ .$$

9. Similarly mark out five adjacent spaces near the end of the tape and find the final velocity v.
10. Measure the distance s in metres from the centre point of u to the centre point of v.
11. The acceleration is found using the formula $a = \dfrac{v^2 - u^2}{2s}$.
12. By changing the tilt of the runway different values of acceleration are obtained. Repeat a number of times.
13. Tabulate results as shown.

s_1/m	t_1/s	u/m s^{-1}	s_2/m	t_2/s	v/m s^{-1}	t/s	a/m s^{-2}

Results

Notes

Ignore the initial five or six dots on the tape since the trolley may not be moving with constant acceleration during this time interval.

Ticker timers that use precarbonated tape are recommended because the friction due to paper drag is reduced.

Ensure that the voltage rating of the timer is not exceeded.

Some timers make one hundred dots in one second.