

State Examination Commission – Physics Higher Level, 2009

Question 1

In an experiment to measure the acceleration due to gravity, the time t for an object to fall from rest through a distance s was measured. The procedure was repeated for a series of values of the distance s . The table shows the recorded data.

s/cm	30	50	70	90	110	130	150
t/ms	247	310	377	435	473	514	540

Draw a labelled diagram of the apparatus used in the experiment.

Indicate the distance s on your diagram.

Describe how the time interval t was measured.

(15)

Calculate a value for the acceleration due to gravity by drawing a suitable graph based on the recorded data.

(21)

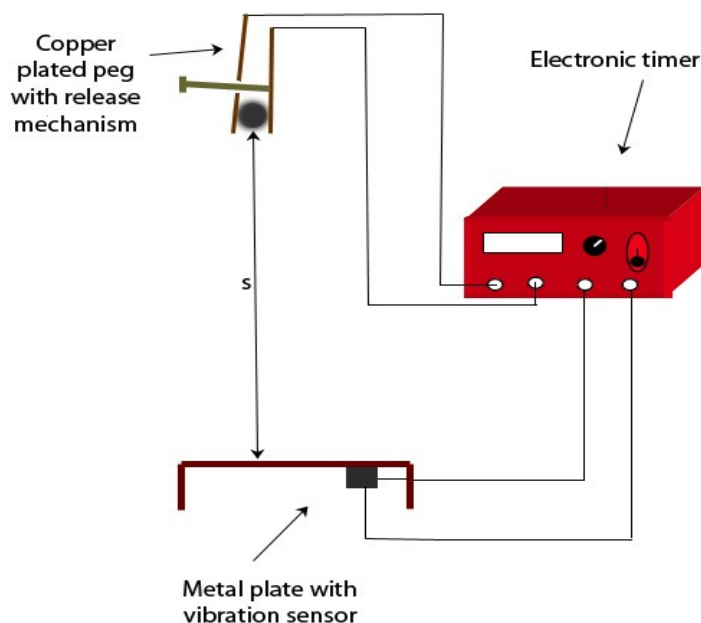
Give two ways of minimising the effect of air resistance in the experiment.

(4)

In an experiment to measure the acceleration due to gravity, the time t for an object to fall from rest through a distance s was measured. The procedure was repeated for a series of values of the distance s . The table shows the recorded data.

s/cm	30	50	70	90	110	130	150
t/ms	247	310	377	435	473	514	540
s/m	0.30	0.50	0.70	0.90	1.10	1.30	1.50
t^2/s^2	0.061	0.096	0.142	0.189	0.224	0.264	0.292

Draw a labelled diagram of the apparatus used in the experiment. Indicate the distance s on your diagram.

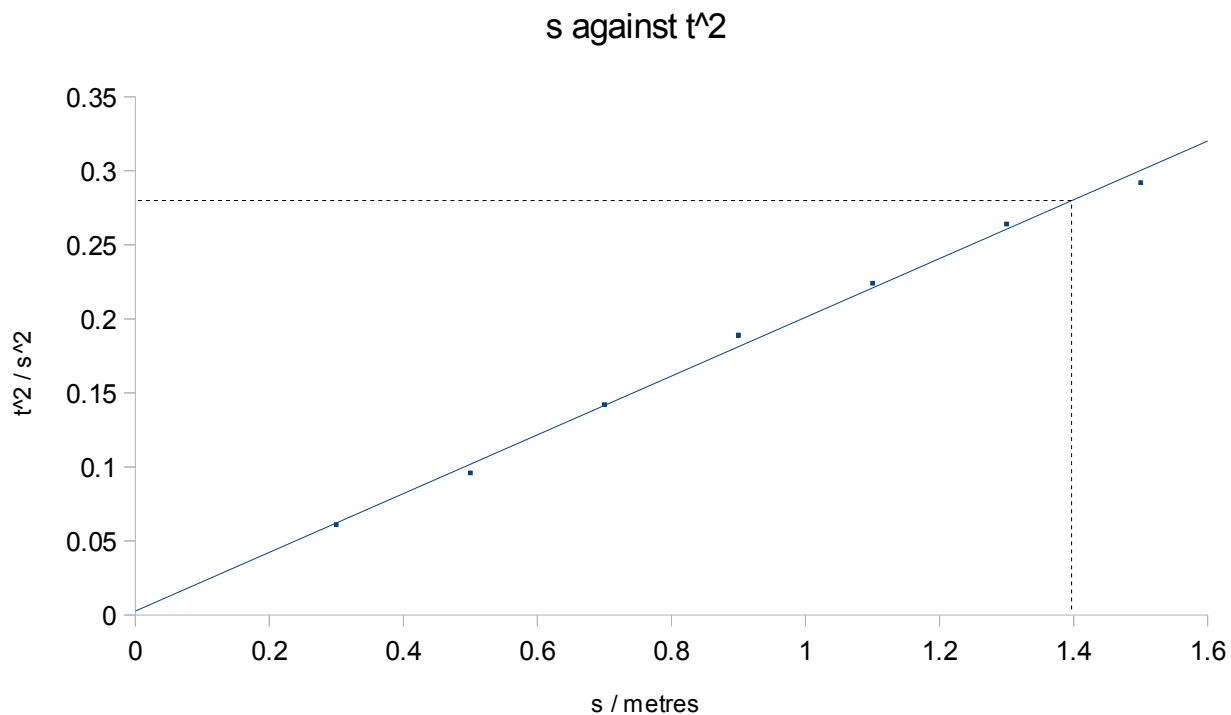


Describe how the time interval t was measured.

(15)

With the steel ball bearing inside the peg a complete circuit was formed with the electronic timer. Upon release of the ball bearing, the circuit broke and the timer began counting. When the ball struck the metal plate, the vibration triggered the counter to stop counting. For each value of s , this was repeated three times, and the lowest time value was taken.

Calculate a value for the acceleration due to gravity by drawing a suitable graph based on the recorded data. (21)



Slope of graph = $t^2/s = 0.285/1.4 = 0.204$

however, $t^2/s = 2/g \Rightarrow g = 9.8 \text{ ms}^{-2}$

Give two ways of minimising the effect of air resistance in the experiment. (4)

If possible perform experiment in a vacuum chamber and make sure the ball bearing is highly polished.