

Motion Graphs

Question paper 4

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Kinematics
Sub Topic	Motion Graphs
Paper Type	Theory
Booklet	Question paper 4

Time Allowed: 48 minutes

Score: /40

Percentage: /100

CHEMISTRY ONLINE

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) State what is meant by *work done*.

.....
..... [1]

- (b) A trolley of mass 400 g is moving at a constant velocity of 2.5 m s^{-1} to the right as shown in Fig. 3.1.

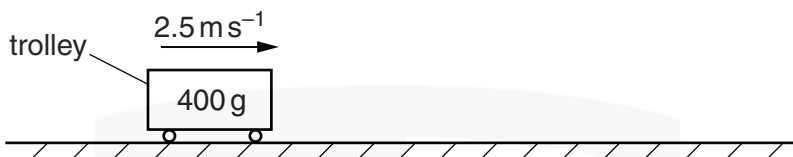


Fig. 3.1

Show that the kinetic energy of the trolley is 1.3 J.

[2]

- (c) The trolley in (b) moves to point P as shown in Fig. 3.2.

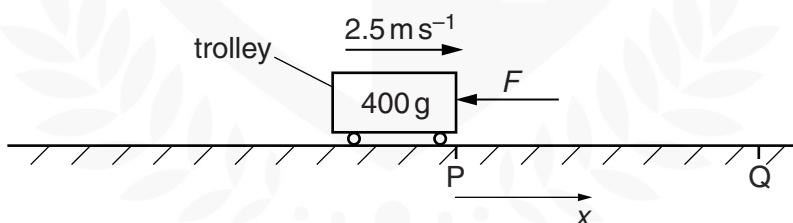
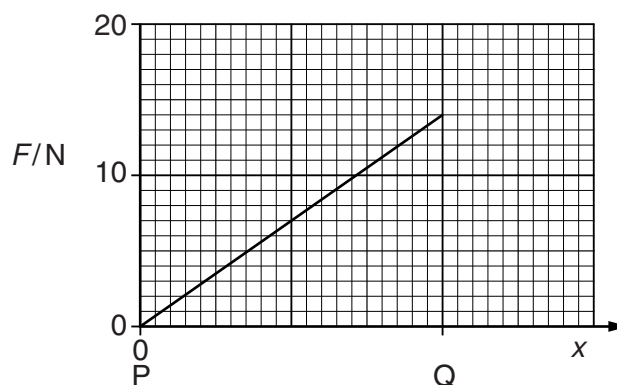


Fig. 3.2

At point P the speed of the trolley is 2.5 m s^{-1} .

A variable force F acts to the left on the trolley as it moves between points P and Q.

The variation of F with displacement x from P is shown in Fig. 3.3.



The trolley comes to rest at point Q.

- (i) Calculate the distance PQ.

distance PQ = m [3]

- (ii) On Fig. 3.4, sketch the variation with x of velocity v for the trolley moving between P and Q.

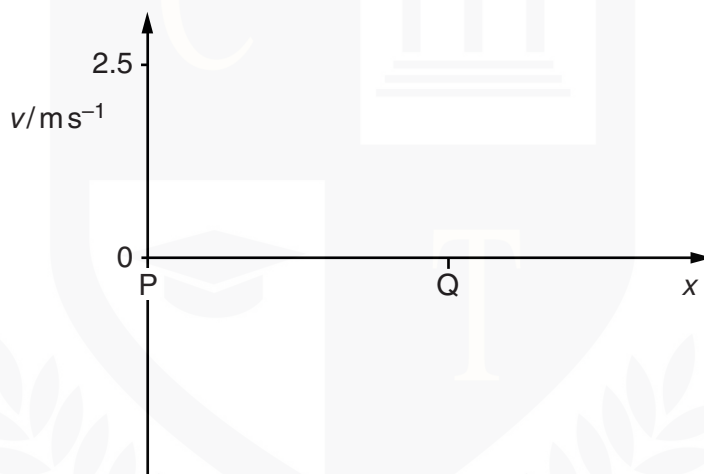


Fig. 3.4

[2]

2 (a) (i) Define *acceleration*.

.....
..... [1]

(ii) State Newton's first law of motion.

.....
..... [1]

(b) The variation with time t of vertical speed v of a parachutist falling from an aircraft is shown in Fig. 1.1.

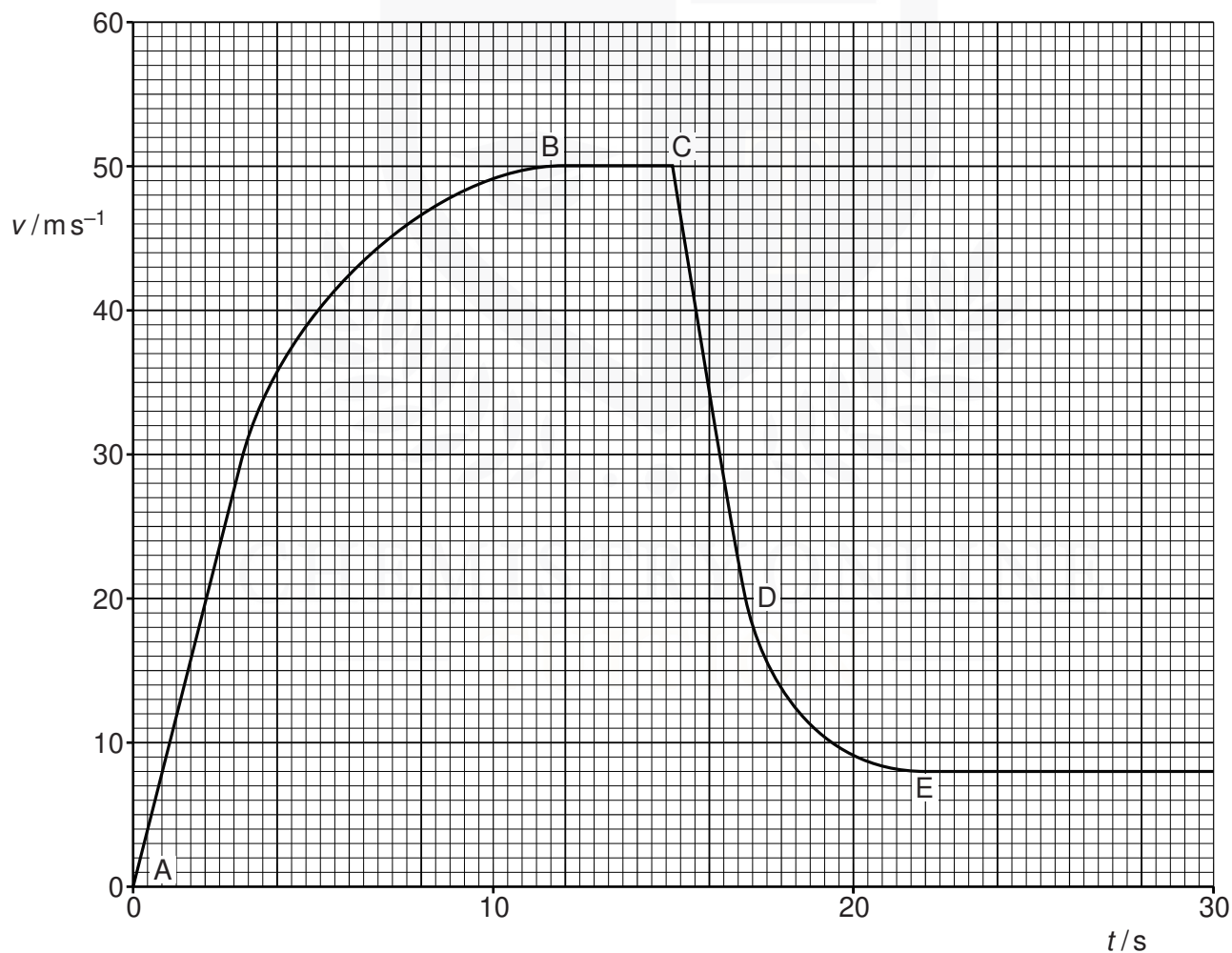


Fig. 1.1

-
- (i) Calculate the distance travelled by the parachutist in the first 3.0 s of the motion.

distance = m [2]

- (ii) Explain the variation of the resultant force acting on the parachutist from $t = 0$ (point A) to $t = 15$ s (point C).

.....
.....
.....
.....
..... [3]

- (iii) Describe the changes to the frictional force on the parachutist

1. at $t = 15$ s (point C),

.....
.....
..... [1]

2. between $t = 15$ s (point C) and $t = 22$ s (point E).

.....
.....
..... [1]

(iv) The mass of the parachutist is 95 kg.

Calculate, for the parachutist between $t = 15$ s (point C) and $t = 17$ s (point D),

1. the average acceleration,

acceleration = ms^{-2} [2]

2. the average frictional force.

frictional force = N [3]

CHEMISTRY ONLINE
— TUITION —

- 3 A motor drags a log of mass 452 kg up a slope by means of a cable, as shown in Fig.

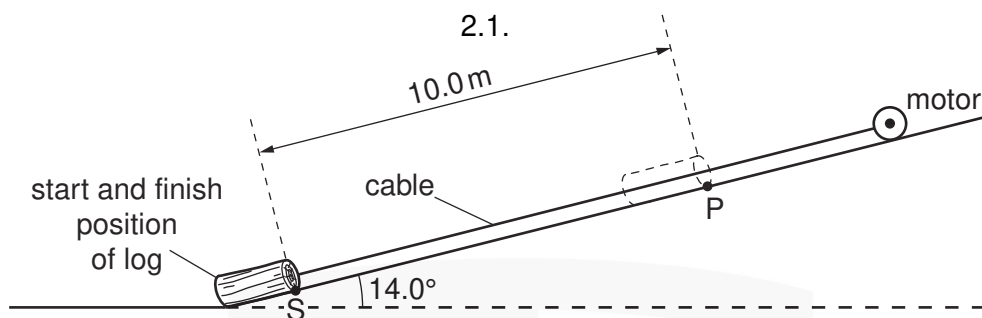


Fig. 2.1

The slope is inclined at 14.0° to the horizontal.

- (a) Show that the component of the weight of the log acting down the slope is 1070 N.

[1]

- (b) The log starts from rest. A constant frictional force of 525 N acts on the log. The log accelerates up the slope at 0.130 m s^{-2} .

- (i) Calculate the tension in the cable.

tension = N [3]

- (ii) The log is initially at rest at point S. It is pulled through a distance of 10.0 m to point P.

Calculate, for the log,

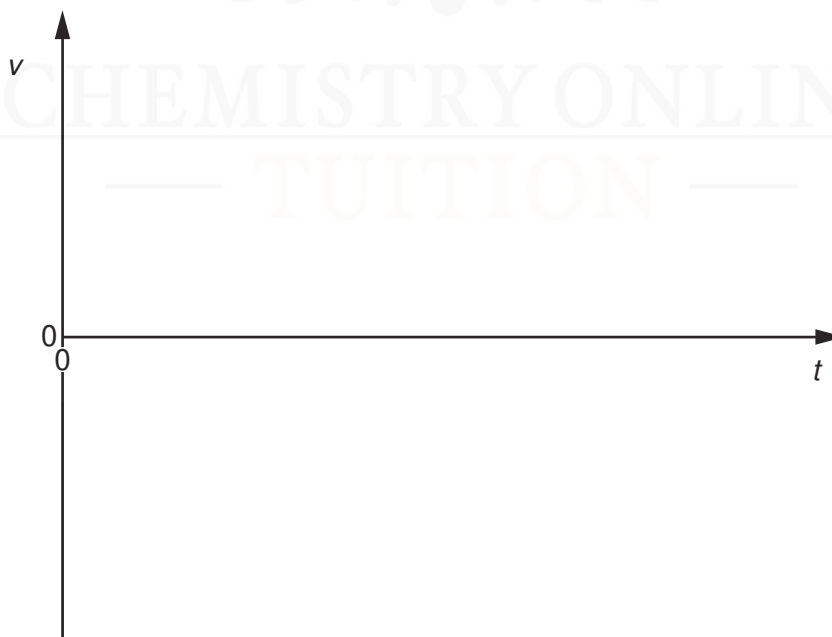
1. the time taken to move from S to P,

time = s [2]

2. the magnitude of the velocity at P.

velocity = ms^{-1} [1]

- (c) The cable breaks when the log reaches point P. On Fig. 2.2, sketch the variation with time t of the velocity v of the log. The graph should show v from the start at S until the log returns to S. [4]



- 4 A student has been asked to determine the linear acceleration of a toy car as it moves down a slope. He sets up the apparatus as shown in Fig. 3.1.

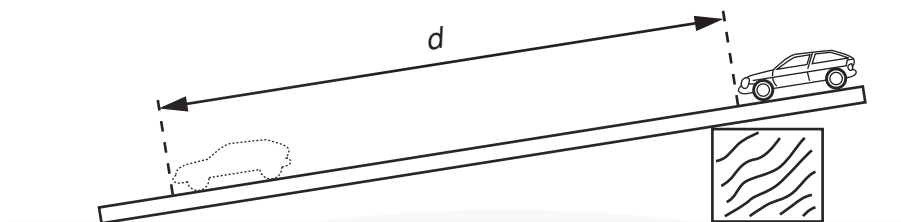


Fig. 3.1

The time t to move from rest through a distance d is found for different values of d . A graph of d (y-axis) is plotted against t^2 (x-axis) as shown in Fig. 3.2.

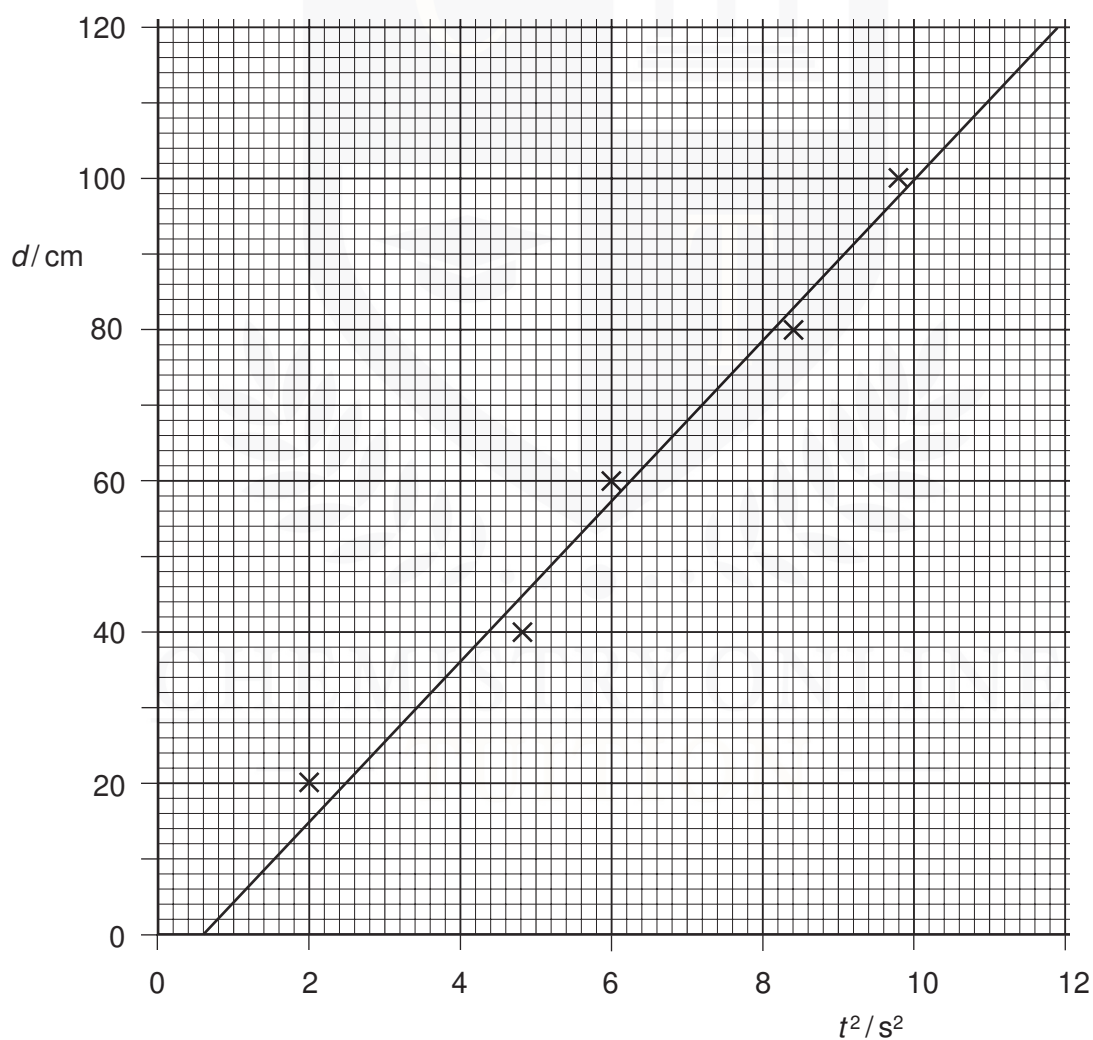


Fig. 3.2

(a) Theory suggests that the graph is a straight line through the origin.
Name the feature on Fig. 3.2 that indicates the presence of

(i) random error,

.....

(ii) systematic error.

.....

[2]

(b) (i) Determine the gradient of the line of the graph in Fig. 3.2.

gradient = [2]

(ii) Use your answer to (i) to calculate the acceleration of the toy down the slope.
Explain your working.

acceleration = ms^{-2} [3]