Motion Graphs

Question paper 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Kinematics
Sub Topic	Motion Graphs
Paper Type	Theory
Booklet	Question paper 1

Time Allowed: **70 minutes**

Score: **/58**

Percentage: **/100**

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

1 **(a)** Define *speed* and *velocity* and use these definitions to explain why one of these quantities is a scalar and the other is a vector.

speed: .....

velocity: .....

.....

.....

[2]

(b) A ball is released from rest and falls vertically. The ball hits the ground and rebounds vertically, as shown in Fig. 2.1.

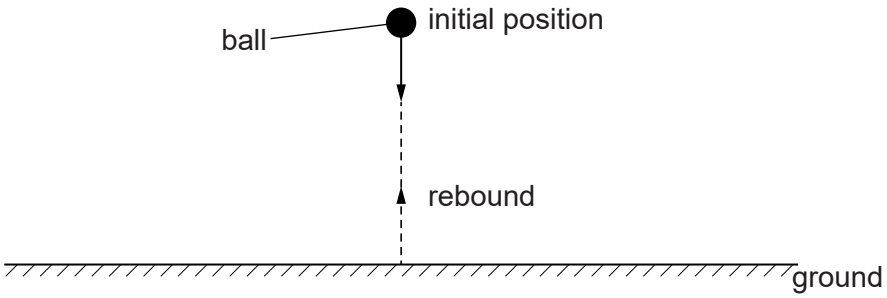

Fig. 2.1

The variation with time t of the velocity v of the ball is shown in Fig. 2.2.

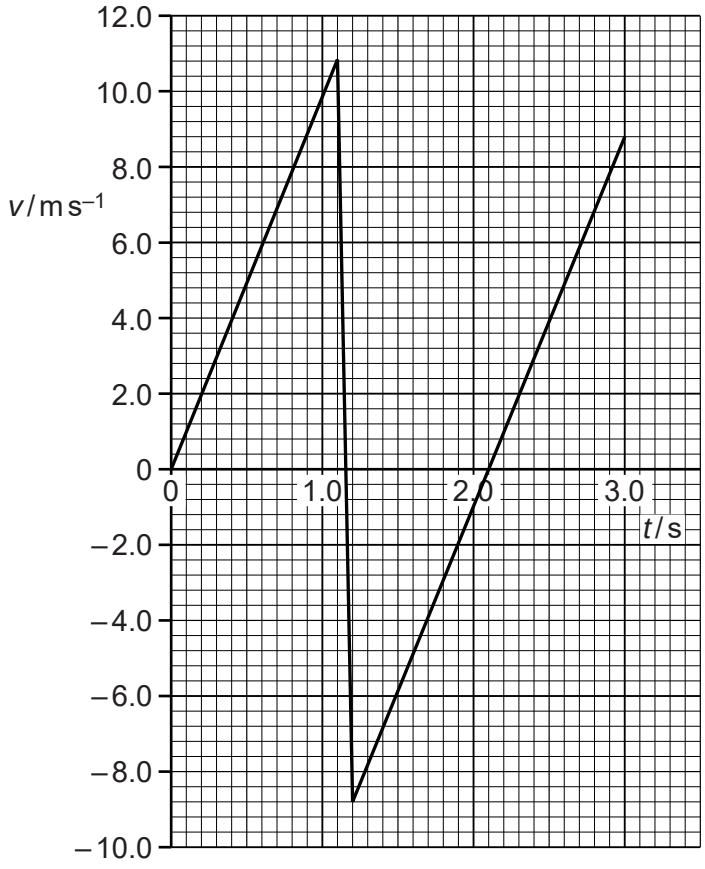

Fig. 2.2

Air resistance is negligible.

(i) Without calculation, use Fig. 2.2 to describe the variation with time t of the velocity of the ball from $t = 0$ to $t = 2.1$ s.

.....

.....

.....

.....

.....

.....[3]

(ii) Calculate the acceleration of the ball after it rebounds from the ground. Show your working.

acceleration = ... $m\,s^{-2}$ [3]

(iii) Calculate, for the ball, from $t = 0$ to $t = 2.1$ s,

1. the distance moved,

distance = ... m [3]

2. the displacement from the initial position.

displacement = ... m [2]

(iv) On Fig. 2.3, sketch the variation with t of the speed of the ball.

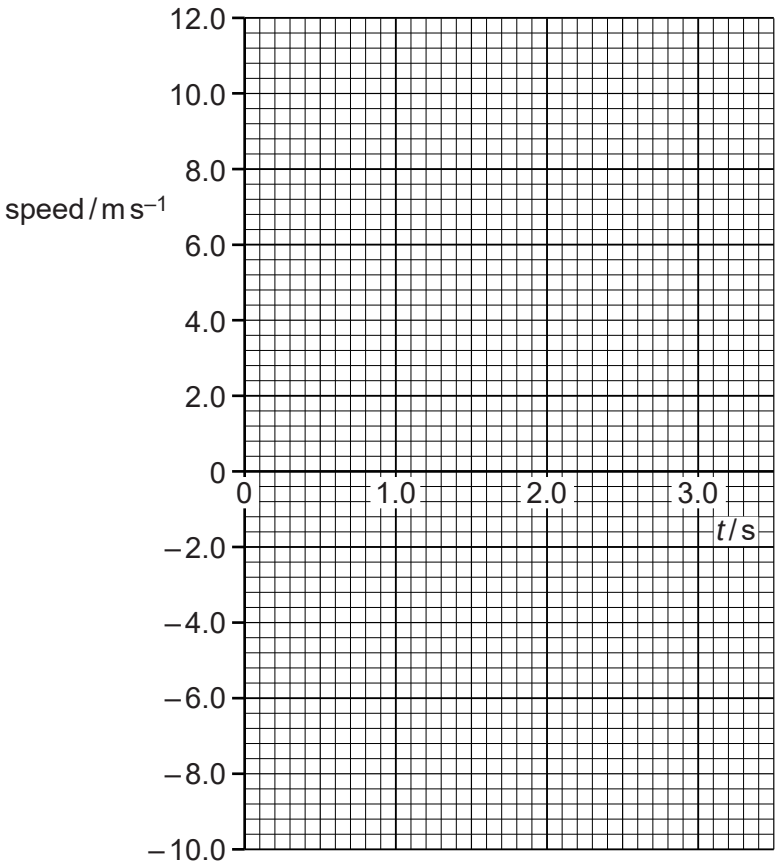

Fig. 2.3

[2]

2 A stone is thrown vertically upwards. The variation with time t of the displacement s of the stone is shown in Fig. 2.1.

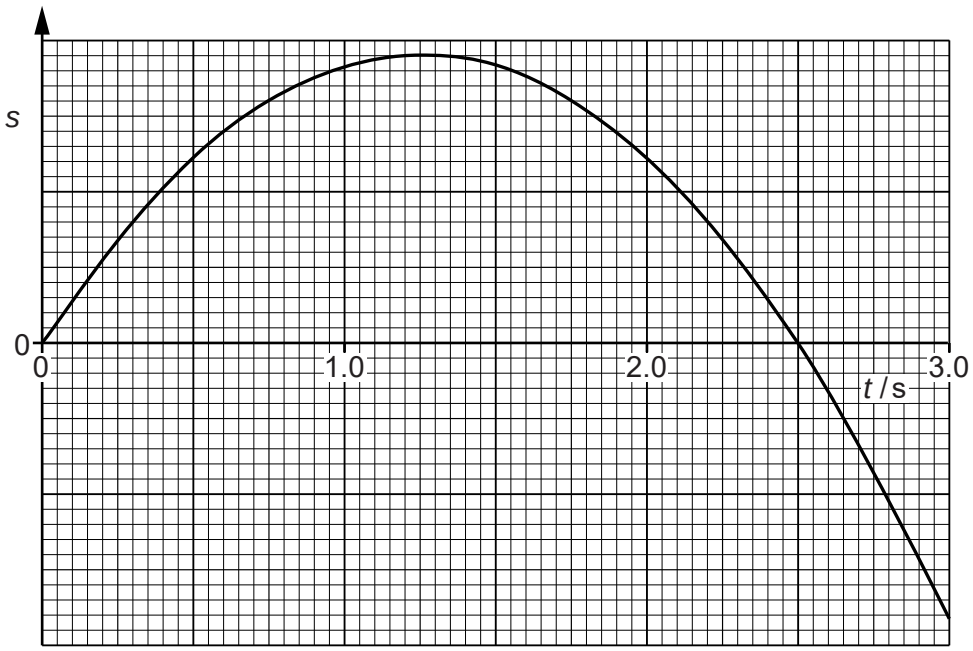

Fig. 2.1

(a) Use Fig. 2.1 to describe, without calculation, the speed of the stone from $t = 0$ to $t = 3.0$ s.

.....

.....

..... [2]

(b) Assume air resistance is negligible and therefore the stone has constant acceleration.

Calculate, for the stone,

(i) the speed at 3.0 s,

speed = ... $m\,s^{-1}$ [3]

(ii) the distance travelled from $t = 0$ to $t = 3.0\,s$,

distance = ... m [3]

(iii) the displacement from $t = 0$ to $t = 3.0\,s$.

displacement = ... m

direction .....
[2]

(c) On Fig. 2.2, draw the variation with time t of the velocity v of the stone from $t = 0$ to $t = 3.0\,s$.

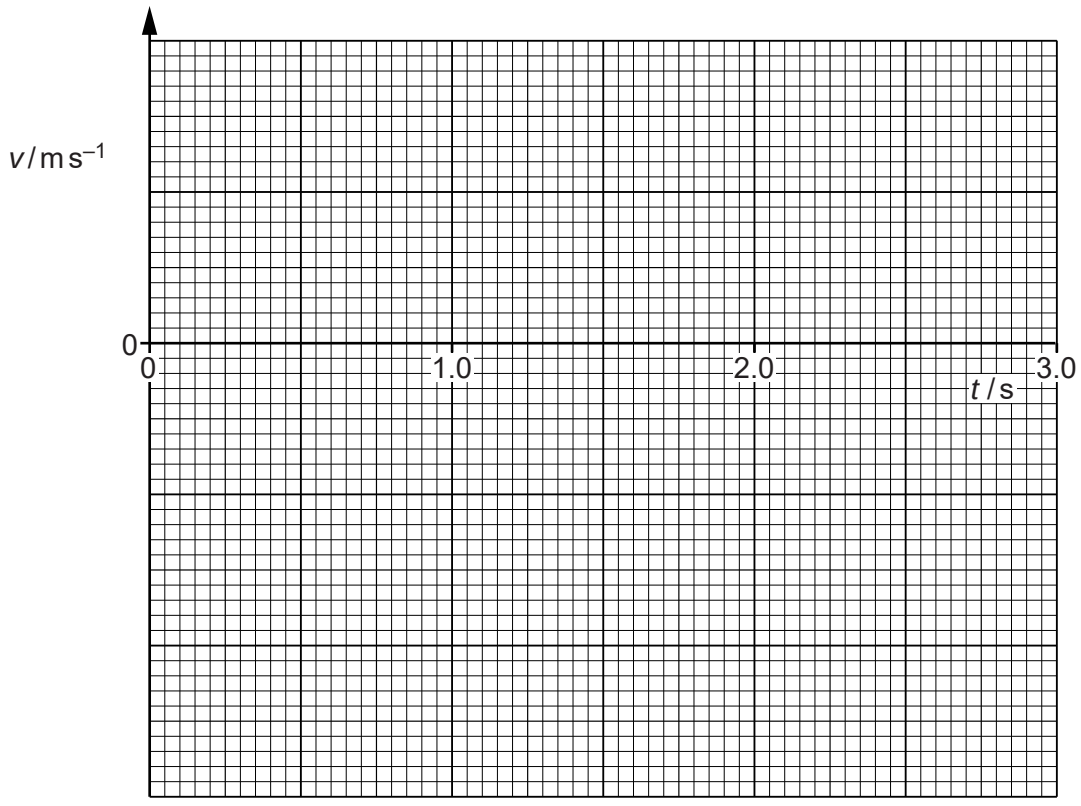

Fig. 2.2

[3]

3 The variation with time t of the velocity v of a ball is shown in Fig.

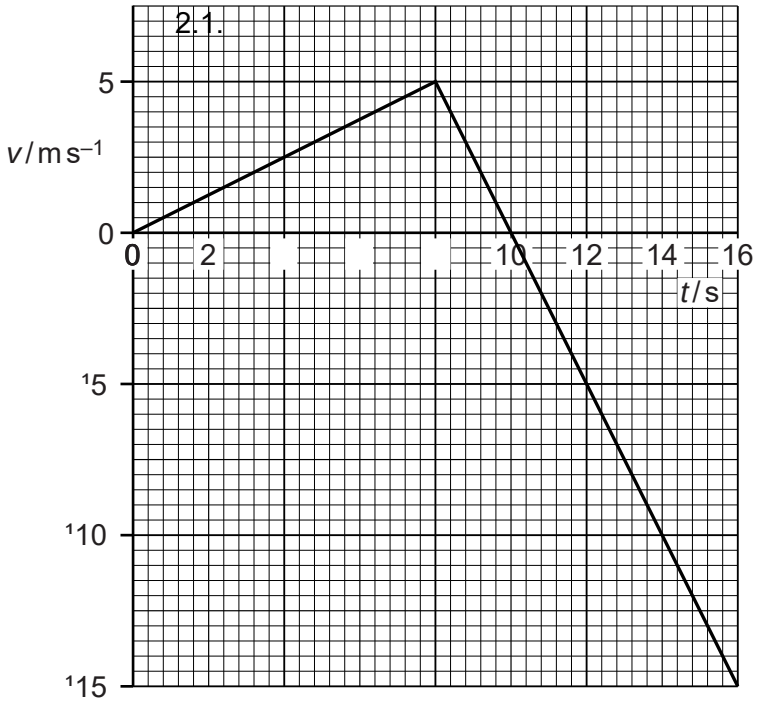

Fig. 2.1

The ball moves in a straight line from a point P at $t = 0$. The mass of the ball is 400 g.

(a) Use Fig. 2.1 to describe, without calculation, the velocity of the ball from $t = 0$ to $t = 16$ s.

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.....

.....

.....

.....[2]

(b) Use Fig. 2.1 to calculate, for the ball,

(i) the displacement from P at $t = 10\,s$,

displacement = ... m [2]

(ii) the acceleration at $t = 10\,s$,

acceleration = ... $m\,s^{-2}$ [2]

(iii) the maximum kinetic energy.

kinetic energy = ... J [2]

(c) Use your answers in **(b)(i)** and **(b)(ii)** to determine the time from $t = 0$ for the ball to return to P.

time = ... s [2]

4 **(a)** **(i)** Define *velocity*.

.....

..... [1]

(ii) Distinguish between *speed* and *velocity*.

.....

..... [2]

(b) A car of mass 1500 kg moves along a straight, horizontal road. The variation with time t of the velocity v for the car is shown in Fig. 1.1.

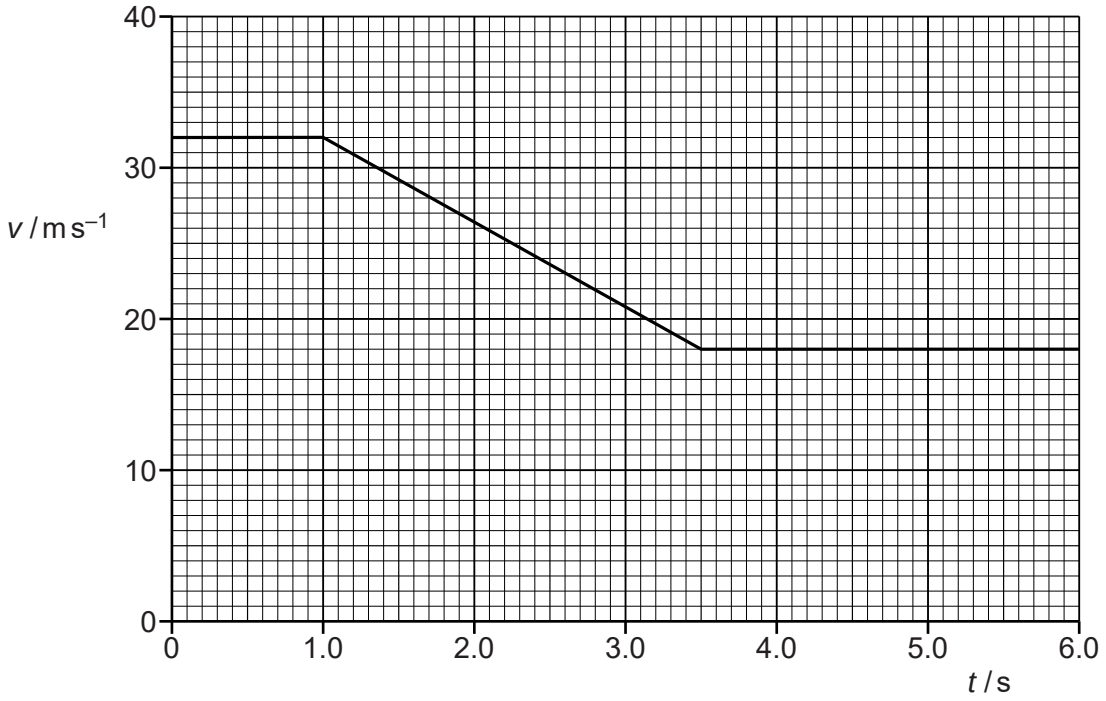

Fig. 1.1

The brakes of the car are applied from t = 1.0 s to t = 3.5 s.
For the time when the brakes are applied,

(i) calculate the distance moved by the car,

distance = ... m [3]

(ii) calculate the magnitude of the resultant force on the car.

resultant force = ... N [3]

(c) The direction of motion of the car in **(b)** at time t = 2.0 s is shown in Fig. 1.2.

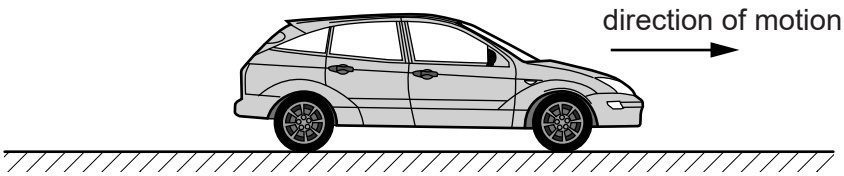

Fig. 1.2

On Fig. 1.2, show with arrows the directions of the acceleration (label this arrow A) and the resultant force (label this arrow F). [1]

5 **(a)** Define

(i) *velocity*,

.....

..... [1]

(ii) *acceleration*.

.....

..... [1]

(b) A car of mass 1500 kg travels along a straight horizontal road.
The variation with time *t* of the displacement *x* of the car is shown in Fig. 3.1.

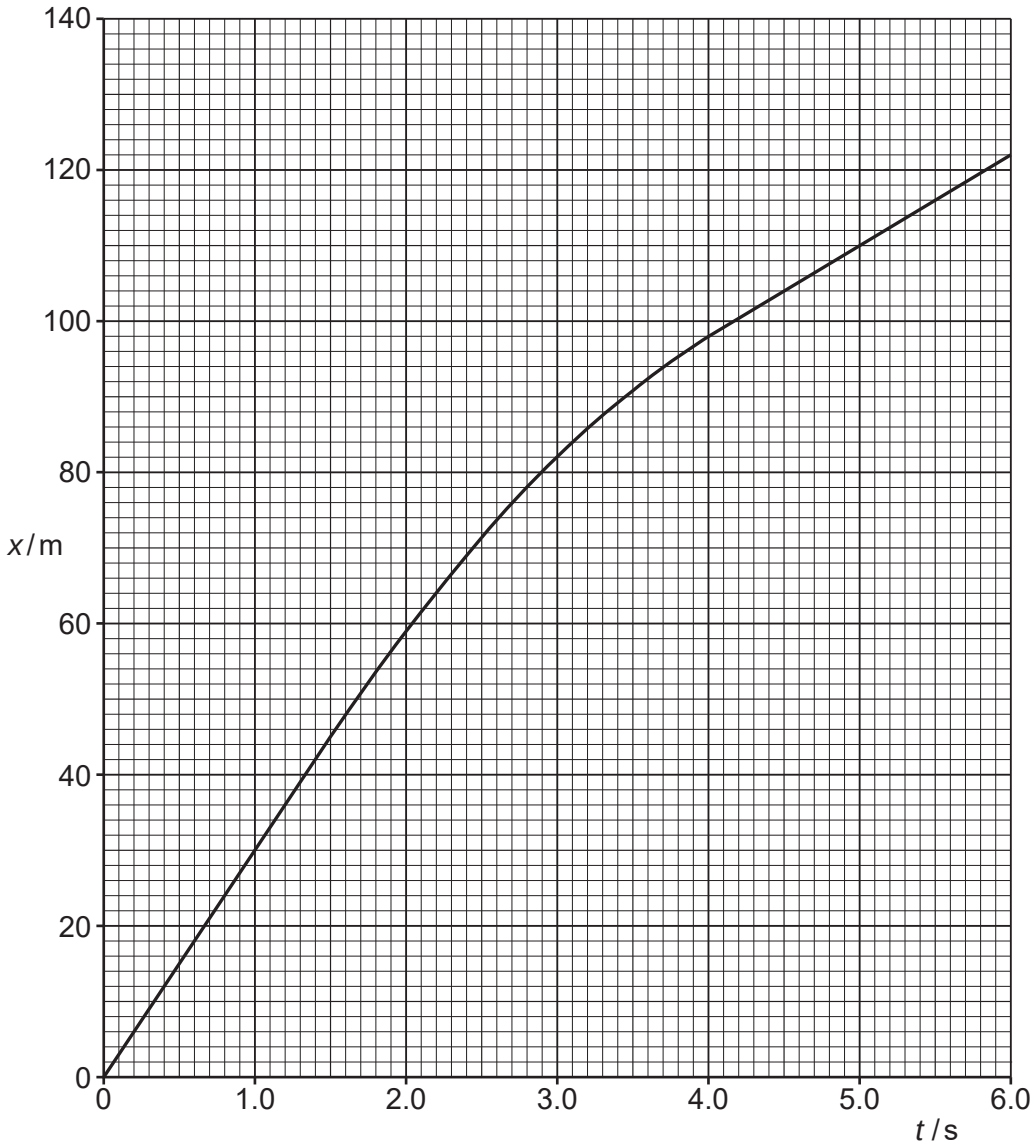

Fig. 3.1

(i) Use Fig. 3.1 to describe qualitatively the velocity of the car during the first six seconds of the motion shown.
Give reasons for your answers.

.....

.....

.....

.....

..... [3]

(ii) Calculate the average velocity during the time interval $t = 0$ to $t = 1.5\,s$.

average velocity = ... $m\,s^{-1}$ [1]

(iii) Show that the average acceleration between $t = 1.5\,s$ and $t = 4.0\,s$ is $-7.2\,m\,s^{-2}$.

[2]

(iv) Calculate the average force acting on the car between $t = 1.5\,s$ and $t = 4.0\,s$.

force = ... N [2]