Additional Revision questions for Section B of the exam for extended students

A student takes measurements to determine a value for the acceleration of free fall. Some of the apparatus used is illustrated in Fig. 4.1.

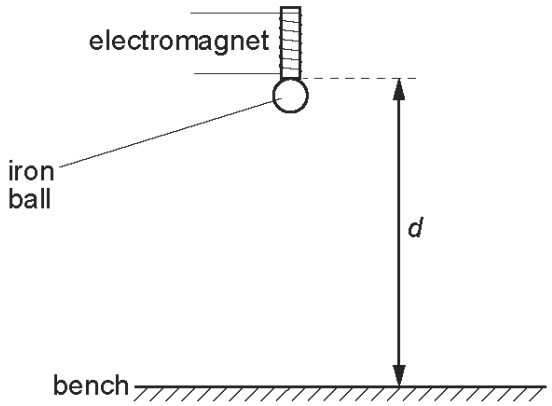


Fig. 4.1

The student measures the vertical distance d between the base of the electromagnet and the bench. The time t for an iron ball to fall from the electromagnet to the bench is also measured.
Corresponding values of t^2 and d are shown in Fig. 4.2.

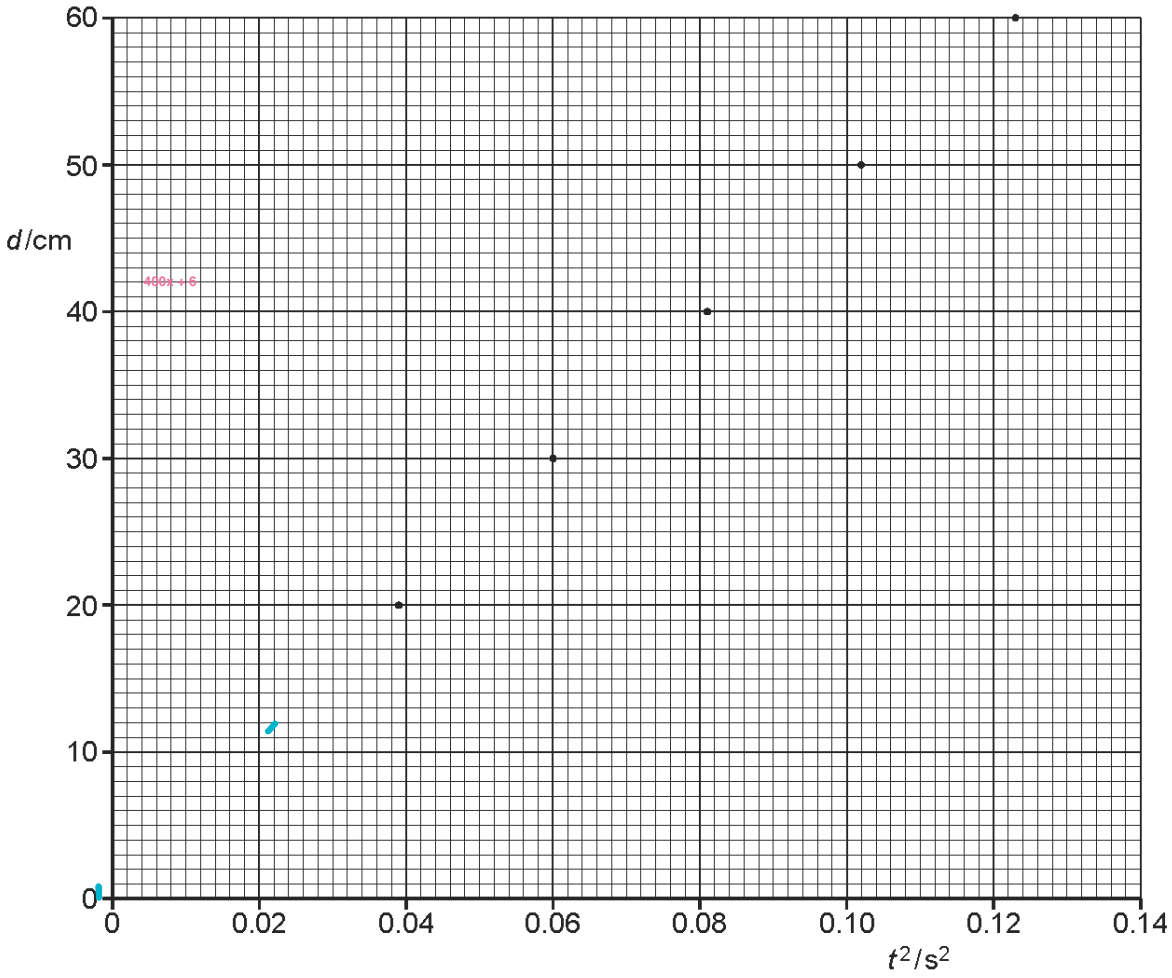


Fig. 4.2

(a) On Fig. 4.2, draw the line of best fit for the points. [1]

(b) State and explain why there is a non-zero intercept on the graph of Fig. 4.2.

.....

.....

..... [2]

(c) Determine the student's value for

(i) the diameter of the ball,

diameter = ... cm [1]

(ii) the acceleration of free fall.

acceleration = ... ms^{-2} [3]

(a) Distinguish between *scalar* quantities and *vector* quantities.

.....

.....

..... [2]

(b) In the following list, underline **all** the scalar quantities.

acceleration force kinetic energy mass power weight [1]

(c) A stone is thrown with a horizontal velocity of $20\,ms^{-1}$ from the top of a cliff 15 m high. The path of the stone is shown in Fig. 1.1.

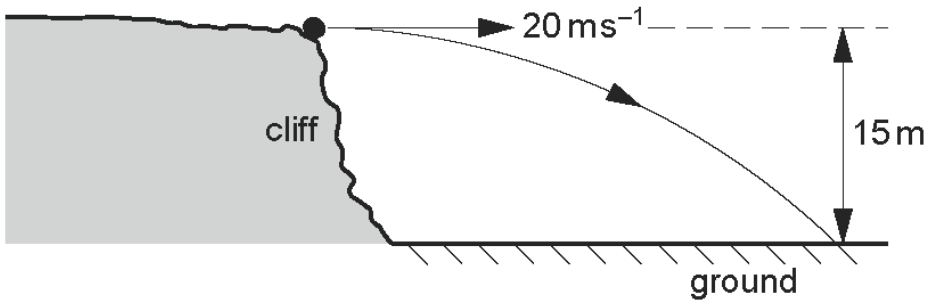


Fig. 1.1

Air resistance is negligible.

For this stone,

(i) calculate the time to fall 15 m,

time = ... s [2]

(ii) calculate the magnitude of the resultant velocity after falling 15 m,

(ii) calculate the magnitude of the resultant velocity after falling 15 m,

resultant velocity = ... ms^{-1} [3]

(iii) describe the difference between the displacement of the stone and the distance that it travels.

.....

.....

..... [2]

The variation with time t of the displacement s for a car is shown in Fig. 1.1.

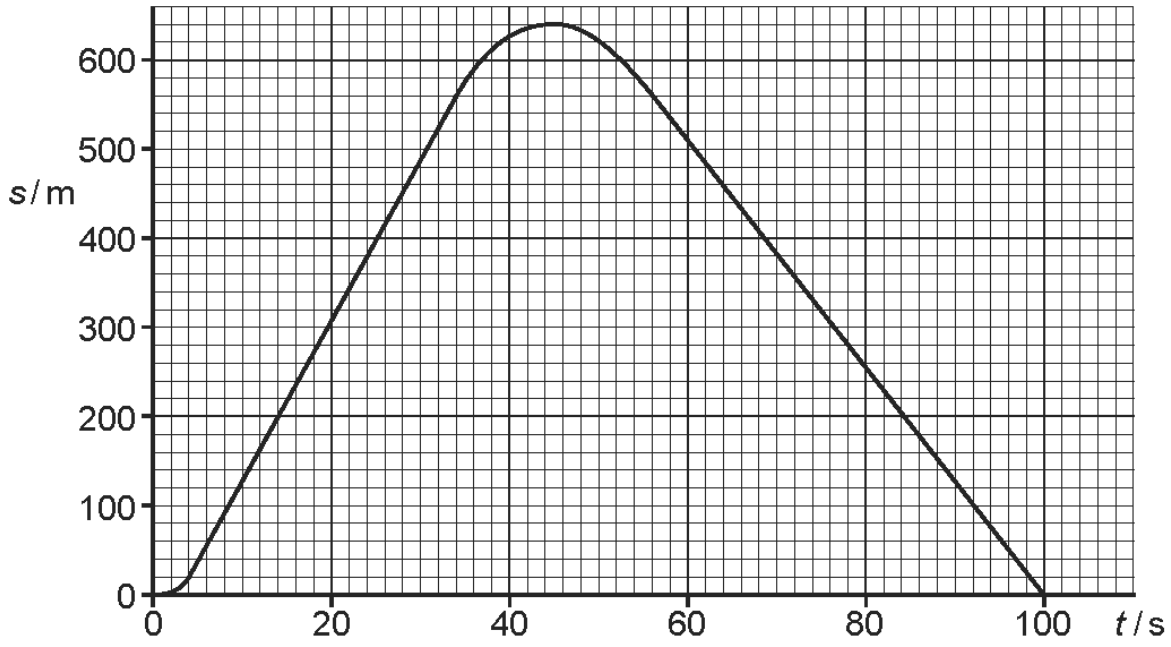
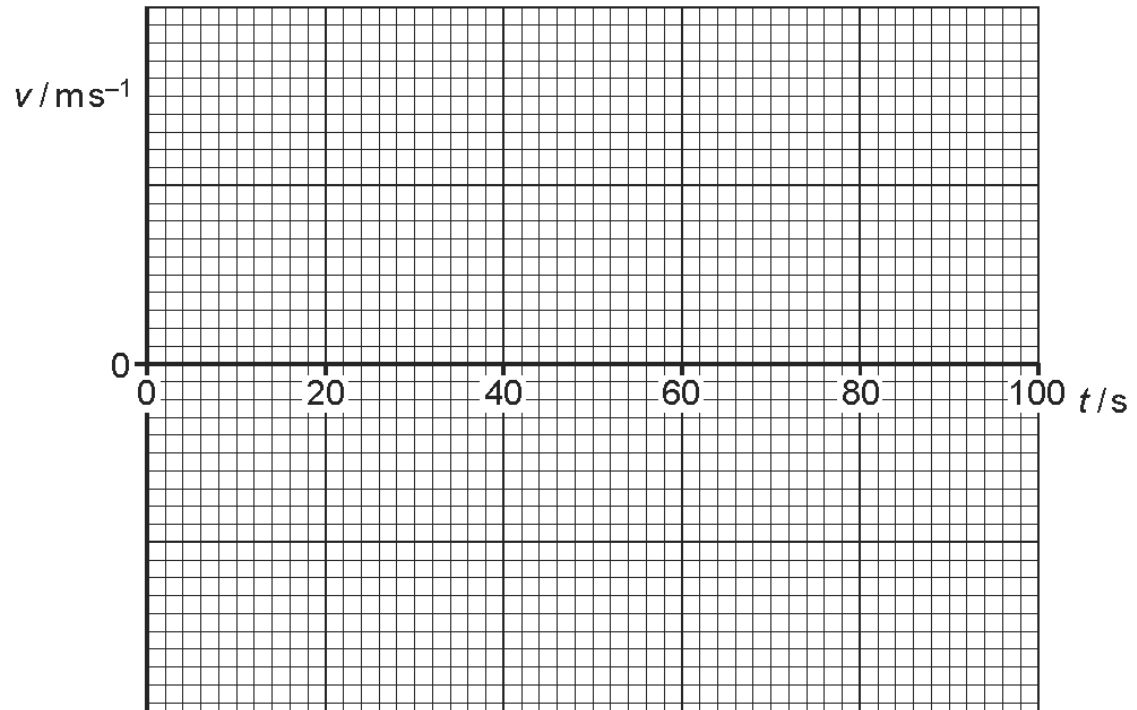


Fig. 1.1

(a) Determine the magnitude of the average velocity between the times 5.0 s and 35.0 s.

average velocity = ... ms^{-1} [2]

(b) On Fig. 1.2, sketch the variation with time t of the velocity v for the car.



(a) Explain what is meant by a *scalar* quantity and by a *vector* quantity.

scalar: .....

.....

vector: .....

.....

[2]

(b) A ball leaves point P at the top of a cliff with a horizontal velocity of $15\,ms^{-1}$, as shown in Fig. 2.1.

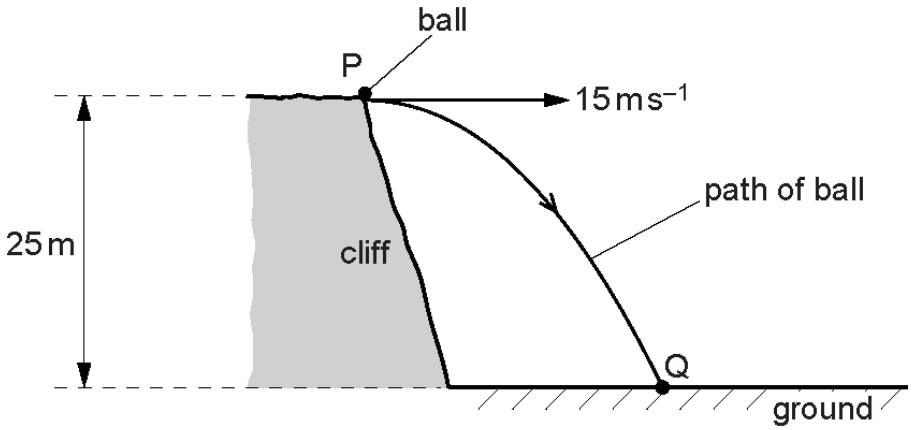


Fig. 2.1

The height of the cliff is 25 m. The ball hits the ground at point Q.
Air resistance is negligible.

(i) Calculate the vertical velocity of the ball just before it makes impact with the ground at Q.

vertical velocity = ... ms^{-1} [2]

(ii) Show that the time taken for the ball to fall to the ground is 2.3 s.

(iii) Calculate the magnitude of the displacement of the ball at point Q from point P.

displacement = ... m [4]

(iv) Explain why the distance travelled by the ball is different from the magnitude of the displacement of the ball.

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.....[2]