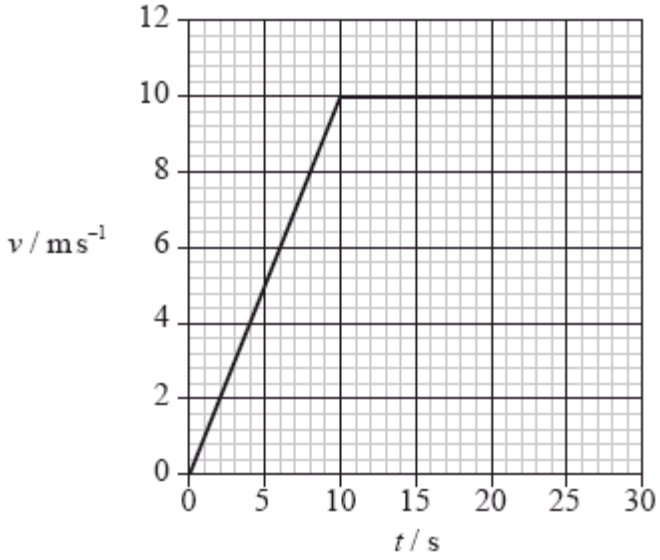
1. Joseph runs along a long straight track. The variation of his speed v with time t is shown below.

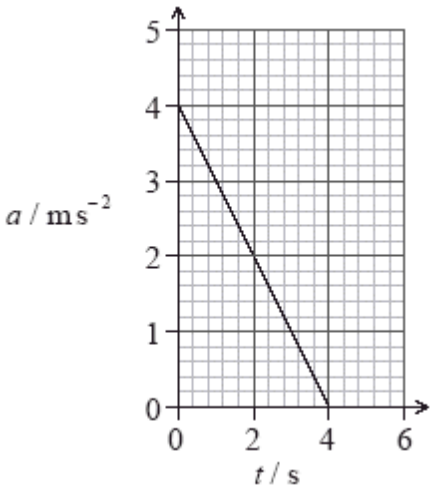


After 25 seconds Joseph has run 200 m. Which of the following is correct at 25 seconds?

	Instantaneous speed / m s^{-1}	**Average speed / m s^{-1}**
A.	8 m s^{-1}	8 m s^{-1}
B.	8 m s^{-1}	10 m s^{-1}
C.	10 m s^{-1}	8 m s^{-1}
D.	10 m s^{-1}	10 m s^{-1}

(Total 1 mark)

2. The graph shows the variation with time t of the acceleration a of an object.



Which of the following is the change in velocity of the object in the time interval 0 to 4 s?

A. $-8\ \text{m s}^{-1}$

B. $-4\ \text{m s}^{-1}$

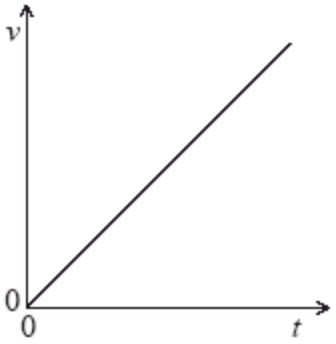
C. $+4\ \text{m s}^{-1}$

D. $+8\ \text{m s}^{-1}$

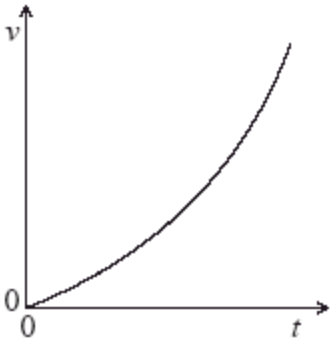
(Total 1 mark)

3. A car accelerates from rest. The acceleration increases with time. Which graph shows the variation with time *t* of the speed *v* of the car?

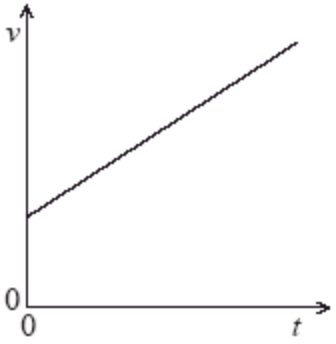
A.



B.



C.



D.

(Total 1 mark)

4. Which of the following quantities can be determined from a speed-time graph of a particle travelling in a straight line?

A. Only the magnitude of the acceleration at a given instant

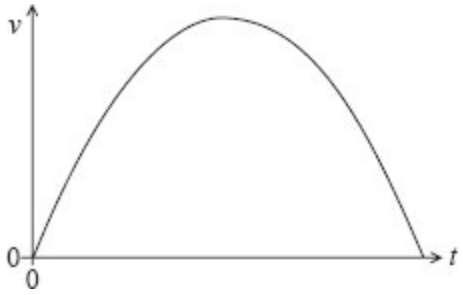
B. Both the velocity and the acceleration at a given instant

C. Only the distance travelled in a given time

D. Both the distance travelled in a given time and the magnitude of the acceleration at a given instant

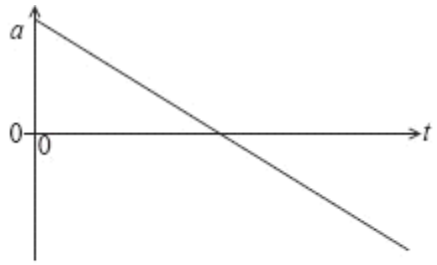
(Total 1 mark)

5. The graph below shows the variation with time *t* of the velocity *v* of an object moving on a straight-line.

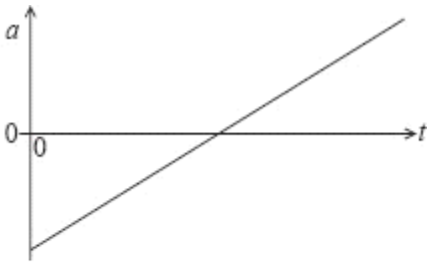


Which of the graphs below best represents the variation with time *t* of the acceleration *a* of the object?

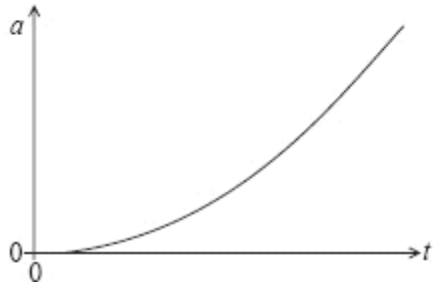
A.



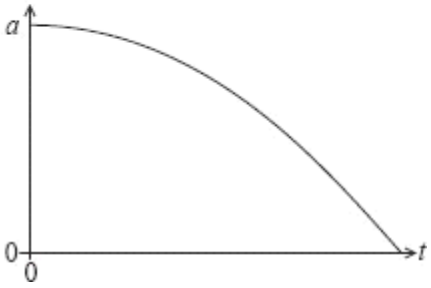
B.



C.



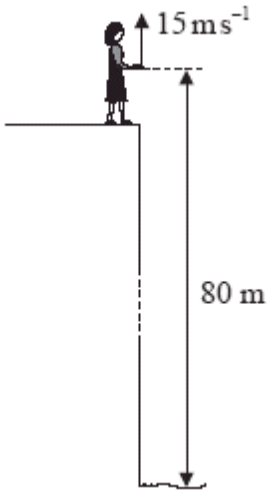
D.



(Total 1 mark)

6. This question is about kinematics.

Lucy stands on the edge of a vertical cliff and throws a stone vertically upwards.



The stone leaves her hand with a speed of 15 m s^{-1} at the instant her hand is 80 m above the surface of the sea. Air resistance is negligible and the acceleration of free fall is 10 m s^{-2}.

(a) Calculate the maximum height reached by the stone as measured from the point where it is thrown.

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(2)

(b) Determine the time for the stone to reach the surface of the sea after leaving Lucy's hand.

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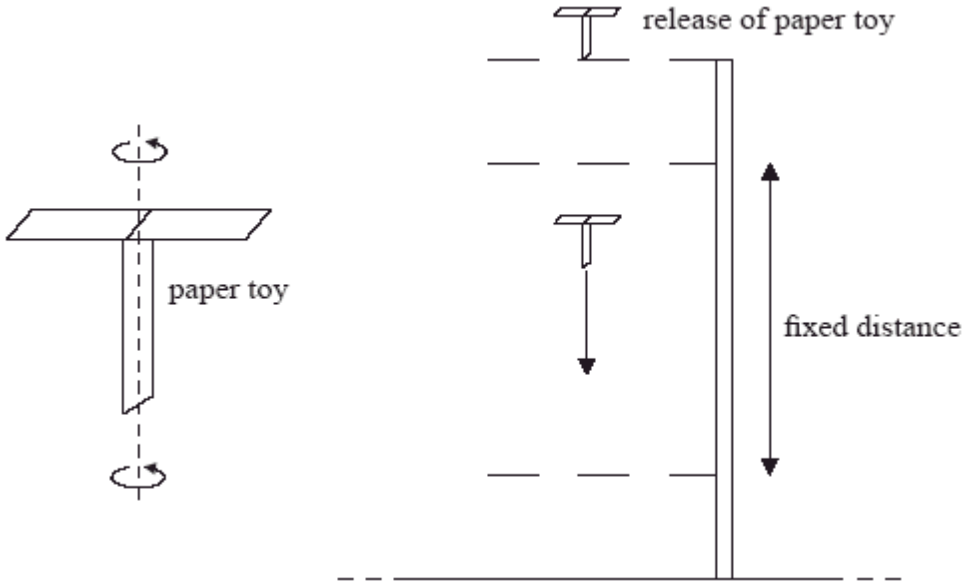
(3)
(Total 5 marks)

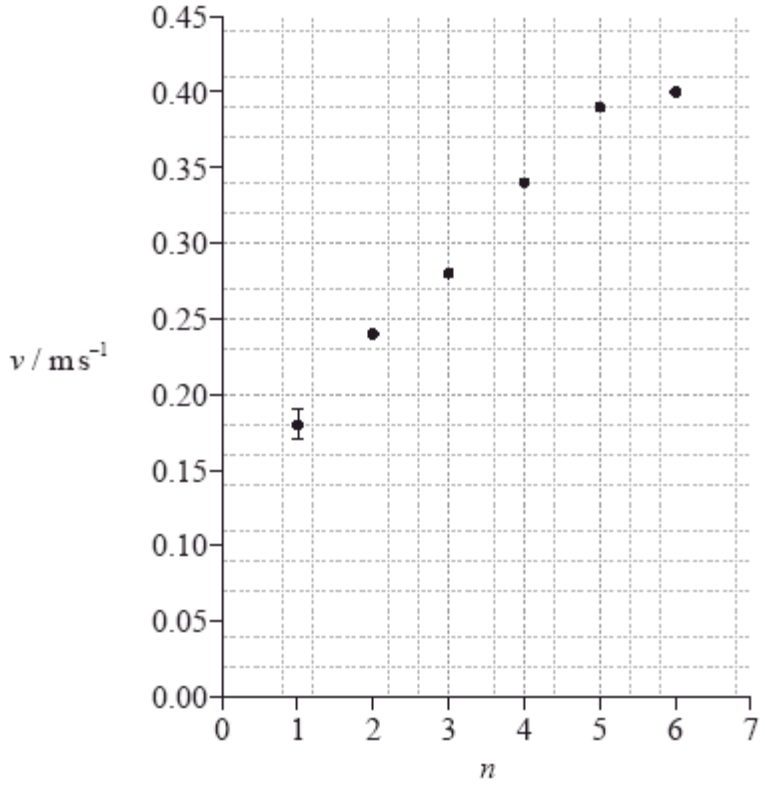
7. Data analysis question.

A student performs an experiment with a paper toy that rotates as it falls slowly through the air. After release, the paper toy quickly attains a constant vertical speed as measured over a fixed vertical distance.



The aim of the experiment was to find how the terminal speed of the paper toy varies with its weight. The weight of the paper toy was changed by using different numbers of paper sheets in its construction.

The graph shows a plot of the terminal speed v of the paper toy (calculated from the raw data) and the number of paper sheets n used to construct the toy. The uncertainty in v for $n = 1$ is shown by the error bar.



(a) The fixed distance is 0.75 m and has an absolute uncertainty of 0.01 m. The percentage uncertainty in the time taken to fall through the fixed distance is 5 %.

(i) Calculate the absolute uncertainty in the terminal speed of the paper toy for $n = 6$.

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(3)

(ii) On the graph, draw an error bar on the point corresponding to $n = 6$.

(1)

(b) On the graph, draw a line of best-fit for the data points.

(1)

(c) The student hypothesizes that v is proportional to n. Use the data points for $n = 2$ and $n = 4$ from the graph above to show that this hypothesis is incorrect.

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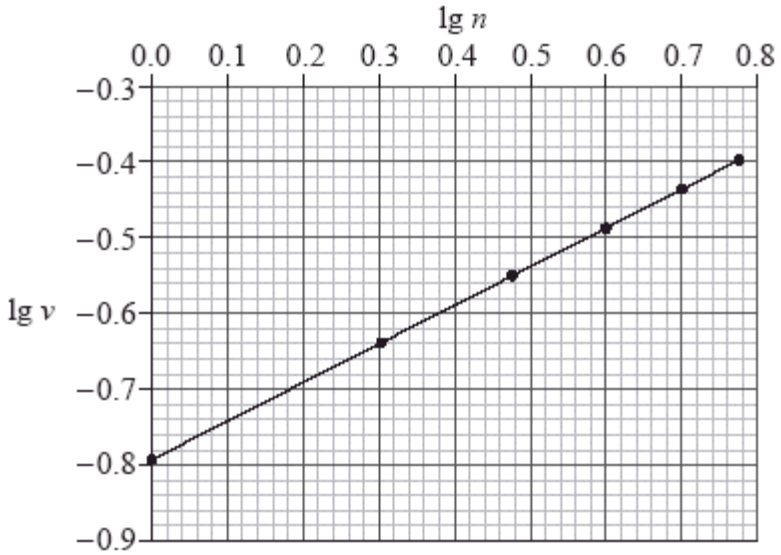
(3)

(d) Another student hypothesized that v might be proportional to $\sqrt{n}$. To verify this hypothesis he plotted a graph of lg v against lg n as shown below.



Show that the graph verifies the hypothesis that v is proportional to $\sqrt{n}$.

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(4)

(Total 12 marks)