

# Kinematics

## Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Newtonian Mechanics
Topic	Kinematics
Booklet	Question Paper

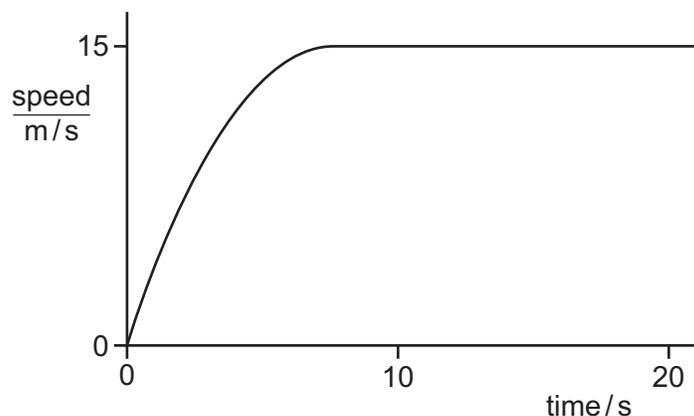
**Time Allowed:** 66 minutes

**Score:** /55

**Percentage:** /100

**Grade Boundaries:**

- 1 The graph shows how the speed of a car varies with time.



Which statement about the acceleration of the car between 10s and 20s is correct?

- A The acceleration decreases.
  - B The acceleration increases.
  - C The acceleration is constant, but not zero.
  - D The acceleration is zero.
- 2 A student walks at a constant speed. He takes 100 s to walk 160 paces. The length of each pace is 0.80 m.

How far does the student walk in 50 s?

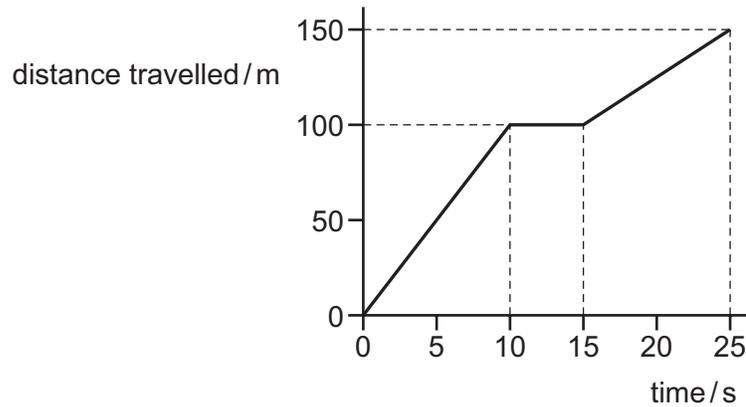
- A 64 m
  - B 80 m
  - C 128 m
  - D 256 m
- 3 A student drops, from rest, a table-tennis ball in air.

What happens to the velocity and to the acceleration of the ball during the first few seconds after release?

	velocity	acceleration
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 4 A cyclist takes a ride lasting 25 s.

The diagram shows how her distance travelled from the starting position varies with time.



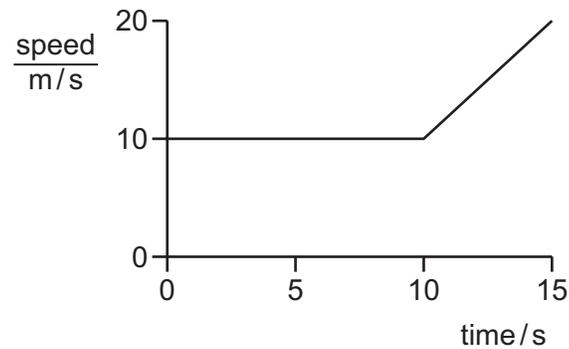
What is her average speed for the whole ride?

- A** 6.0 m/s      **B** 7.5 m/s      **C** 10.0 m/s      **D** 11.0 m/s
- 5 A car begins to move. It speeds up until it reaches a constant speed. It continues to travel at this constant speed for the rest of the journey.

What happens to the acceleration and what happens to the velocity of the car during the journey?

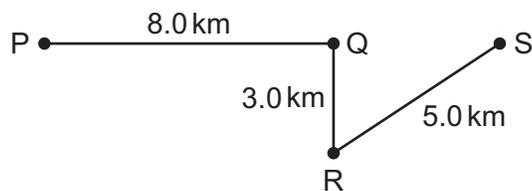
- A** Both the acceleration and the velocity change.  
**B** Only the acceleration changes.  
**C** Only the velocity changes.  
**D** Neither the acceleration nor the velocity changes.

- 6 An object travels at a constant speed of 10 m/s for 10 s. During the next 5 s, it accelerates uniformly to 20 m/s.



What is the total distance travelled by the object?

- A** 150 m      **B** 175 m      **C** 200 m      **D** 300 m
- 7 A lorry takes 15 minutes to travel along the path PQRS.



What is the average speed of the lorry?

- A** 4.0 km/h      **B** 22 km/h      **C** 48 km/h      **D** 64 km/h

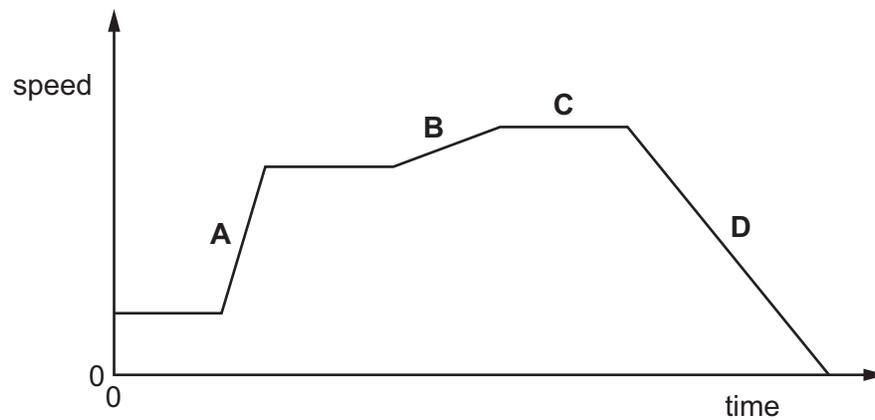
- 8 At time  $t_1$ , a stone is dropped from a stationary balloon. The stone reaches terminal velocity at time  $t_2$ .

Which row gives the acceleration of the stone at time  $t_1$  and at time  $t_2$ ?

	<u>acceleration at <math>t_1</math></u> $\text{m/s}^2$	<u>acceleration at <math>t_2</math></u> $\text{m/s}^2$
<b>A</b>	0	0
<b>B</b>	10	0
<b>C</b>	0	10
<b>D</b>	10	10

- 9 The graph shows how the speed of a car travelling in a straight line changes with time.

Which section shows the largest acceleration?



10

An object falls from rest through the air and the air resistance on it increases. The object reaches terminal velocity.

Which quantity **decreases** until its terminal velocity is reached?

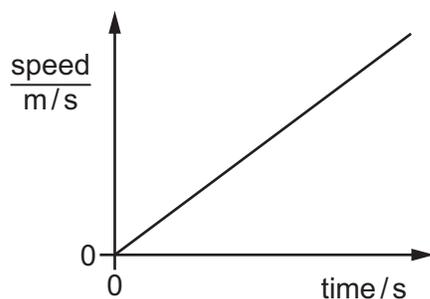
- A acceleration
- B kinetic energy
- C speed
- D weight

11 An object falls from rest through the air. Its velocity increases until it reaches terminal velocity.

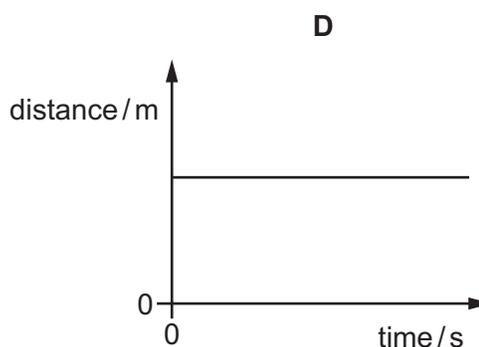
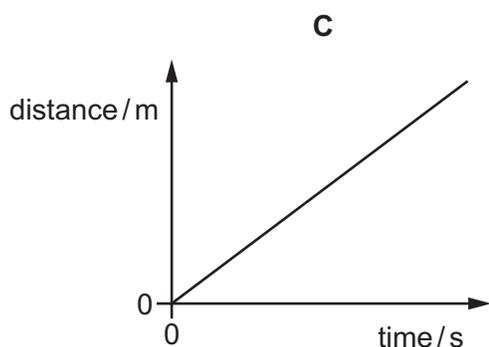
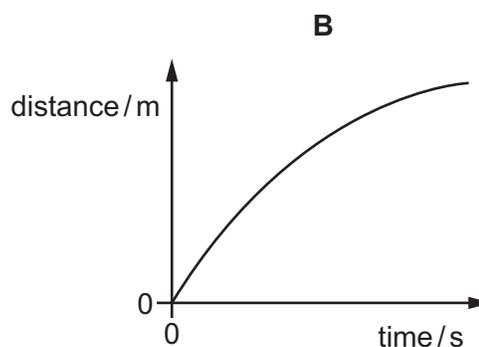
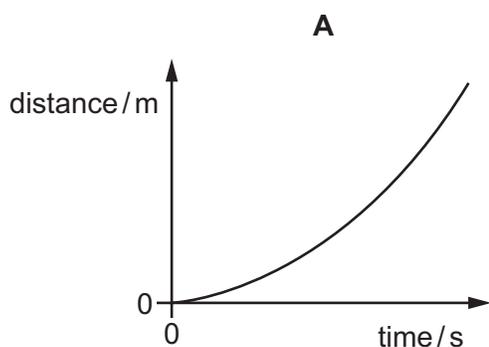
Which quantity **increases** until its terminal velocity is reached?

- A acceleration
- B air resistance
- C resultant force
- D weight

12 The speed-time graph represents a short journey.



Which distance-time graph represents the same journey?



13 When a heavy coin falls a short distance towards the ground it does **not** reach terminal velocity.

Why is this?

- A The coin has not hit the ground.
- B The weight of the coin equals the air resistance.
- C The weight of the coin increases as air resistance increases.
- D The weight of the coin is always more than air resistance.

14 A car travels along a road at 50 km/h.

The driver applies the same braking force at the same place on a day when the surface is dry and then on a day when the road is wet.

On the **wet** surface, how many of these distances are greater than on the dry surface?

braking distance

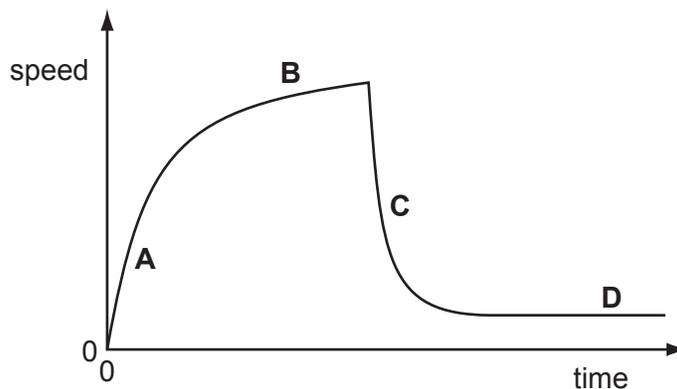
stopping distance

thinking distance

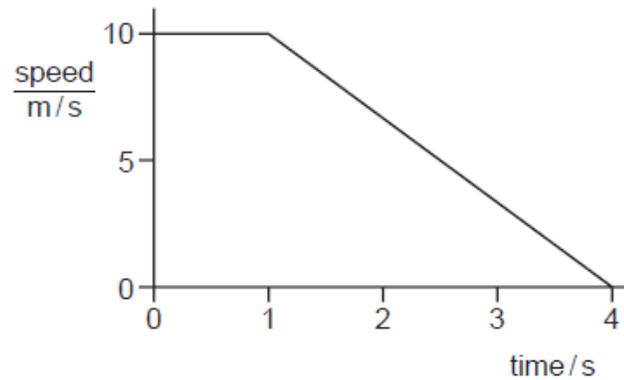
- A 0                      B 1                      C 2                      D 3

15 The speed-time graph for a falling skydiver is shown below. As he falls, the skydiver spreads out his arms and legs and then opens his parachute.

Which part of the graph shows the skydiver falling with terminal velocity?



16 The diagram shows the speed-time graph of the motion of a car for four seconds.



What is the distance travelled by the car in the four seconds?

- A** 15 m            **B** 25 m            **C** 30 m            **D** 40 m

17 An object moves from P to Q in 10s with uniform acceleration.

velocity at P = 5 m/s

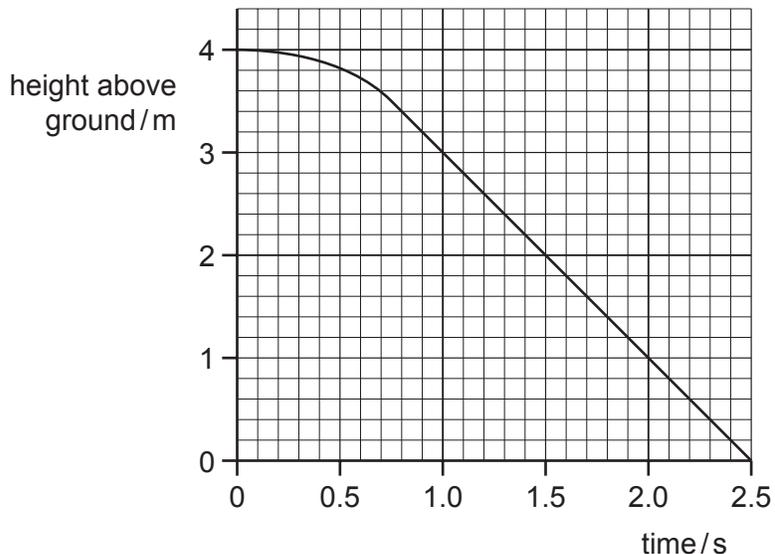
velocity at Q = 12 m/s

What is the acceleration?

- A**  $0.5\text{ m/s}^2$       **B**  $0.7\text{ m/s}^2$       **C**  $1.2\text{ m/s}^2$       **D**  $1.7\text{ m/s}^2$

3

18 The graph shows how the height of an object above the ground changes with time.

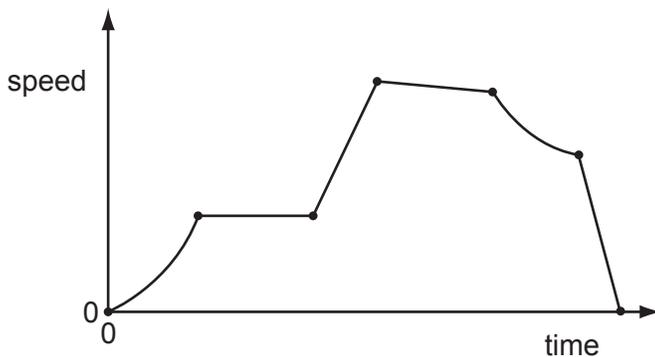


What is the terminal velocity?

- A** 1.0 m/s      **B** 1.3 m/s      **C** 1.6 m/s      **D** 2.0 m/s

19 The speed-time graph represents the journey of a car.

The dots separate different sections of the journey. There are six different sections.



How many sections represent the car moving with non-uniform acceleration?

- A** 0      **B** 1      **C** 2      **D** 3

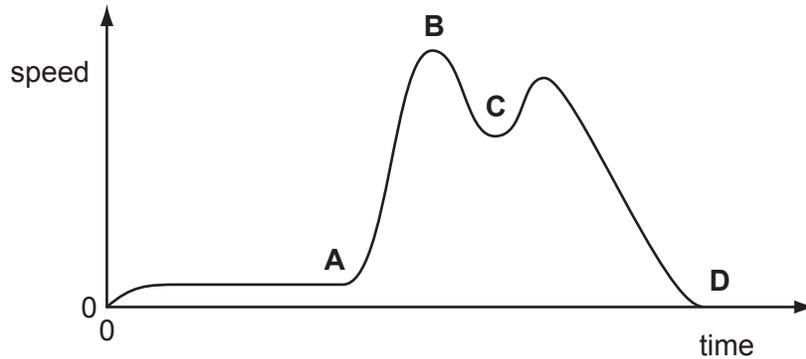
20 A steel ball is released just below the surface of thick oil in a cylinder.

During the first few centimetres of travel, what is the acceleration of the ball?

- A constant and equal to  $10 \text{ m/s}^2$
- B constant but less than  $10 \text{ m/s}^2$
- C decreasing
- D increasing

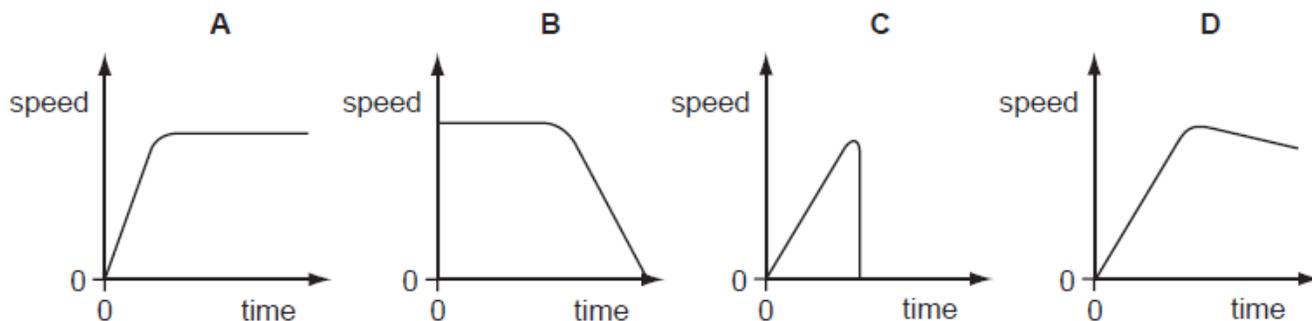
21 A cyclist travels along a hilly road without using the pedals or brakes. Air resistance and friction are negligible. The speed/time graph of the cyclist is shown.

At which point did he reach the bottom of the first hill?



22 A ball starts to roll down a steep slope and then along rough horizontal ground.

Which graph best shows the **speed** of the ball?



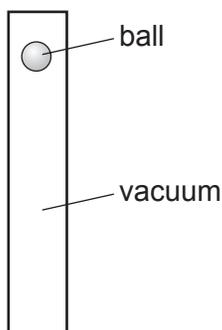
23 A car is stationary at a set of traffic lights.

When the lights turn green, the car begins to move and continues to speed up until it reaches the maximum speed allowed. It continues to travel at this constant speed for the rest of the journey.

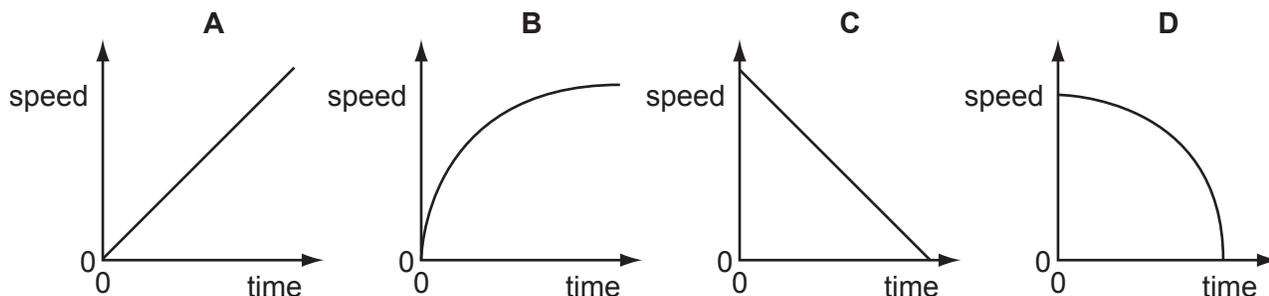
What happens to the acceleration and to the velocity of the car during this journey?

- A Both the acceleration and the velocity change.
- B Only the acceleration changes.
- C Only the velocity changes.
- D Neither the acceleration nor the velocity changes.

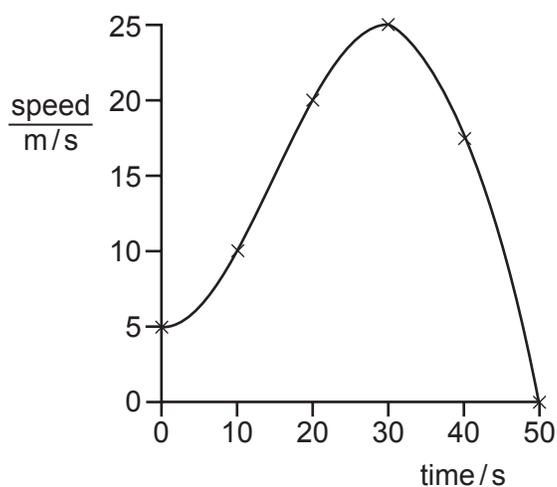
24 A table-tennis ball is released from the top of an evacuated tube.



Which graph shows how the speed of the ball changes with time as it falls to the bottom of the tube?



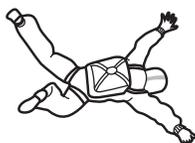
25 The speed-time graph for a car is shown.



What is the acceleration of the car at 30 s?

- A** 0                      **B**  $\frac{25-5}{30} \text{ m/s}^2$                       **C**  $\frac{25}{30} \text{ m/s}^2$                       **D**  $\frac{25}{50} \text{ m/s}^2$

26 A skydiver falls from rest through the air and reaches terminal velocity.

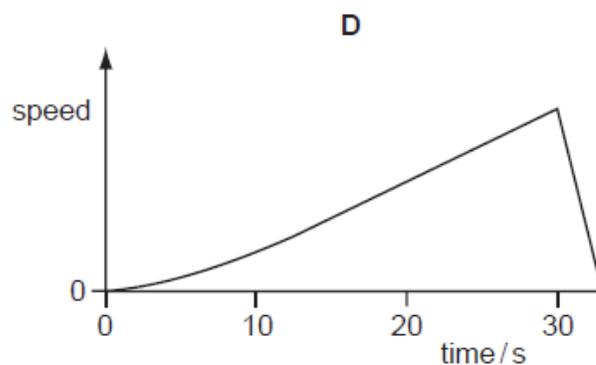
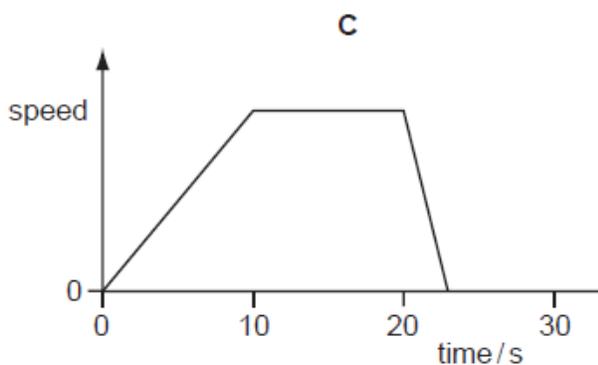
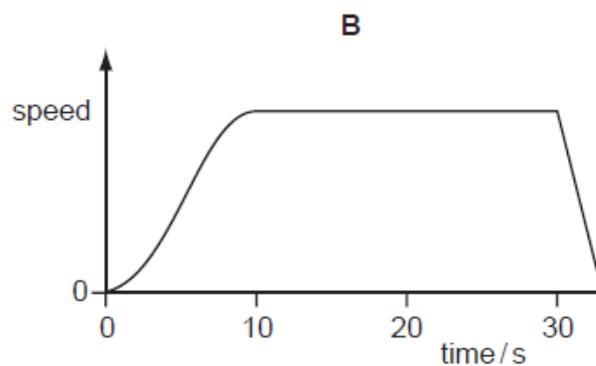
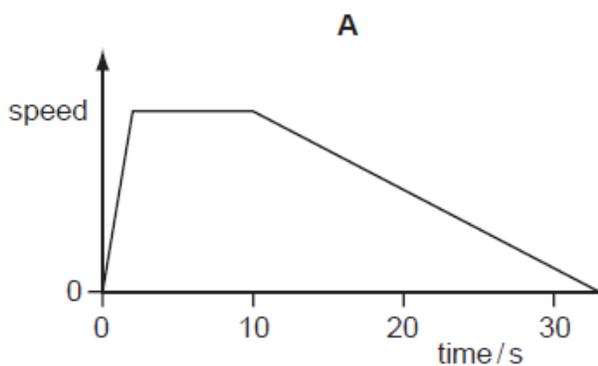


What is the acceleration of the skydiver during his fall?

- A constant at  $0 \text{ m/s}^2$
- B constant at  $10 \text{ m/s}^2$
- C starting at  $0 \text{ m/s}^2$  and increasing to  $10 \text{ m/s}^2$
- D starting at  $10 \text{ m/s}^2$  and decreasing to  $0 \text{ m/s}^2$

27 A car accelerates from traffic lights for 10 s. It stays at a steady speed for 20 s and then brakes to a stop in 3 s.

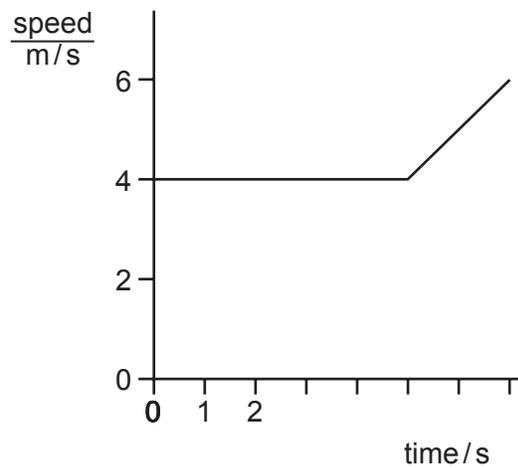
Which graph shows the journey?



28 Which vehicle has an acceleration of  $5 \text{ m/s}^2$ ?

- A a bicycle, when its speed changes from rest to  $2.5 \text{ m/s}$  in  $2 \text{ s}$
- B a car, when its speed changes from rest to  $15 \text{ m/s}$  in  $5 \text{ s}$
- C a lorry, when its speed changes from rest to  $20 \text{ m/s}$  in  $15 \text{ s}$
- D a motorbike, when its speed changes from rest to  $50 \text{ m/s}$  in  $10 \text{ s}$

29 The graph shows part of a journey made by a cyclist.



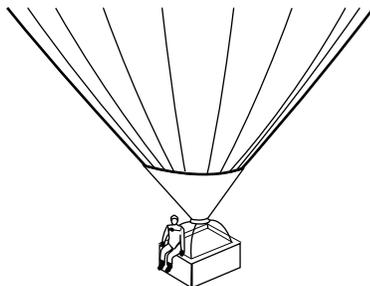
How far did the cyclist travel in  $7 \text{ s}$ ?

- A 28 m
- B 30 m
- C 32 m
- D 42 m

30 The diagrams show a parachutist in four positions after she jumps from a high balloon.

At which position does she have terminal velocity?

A not yet moving



B accelerating



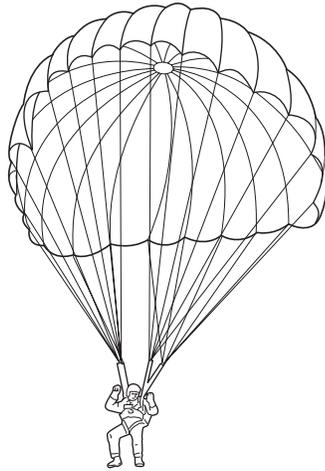
C not accelerating



D not moving



- 31 Two men jump out of an aeroplane at the same time. One of the men opens his parachute and the other man remains in free-fall.



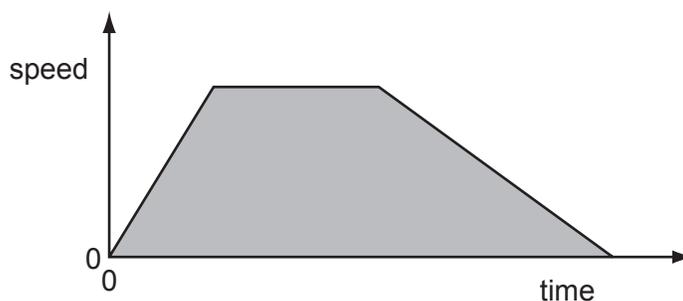
Why is the man in free-fall moving faster than the parachutist?

- A The man in free-fall experiences greater air resistance.
  - B The man in free-fall has a greater mass.
  - C The parachutist experiences greater air resistance.
  - D The parachutist has not reached terminal velocity.
- 32 A student measures the speed of a trolley. At one instant, the speed of the trolley is 1.0 m/s and two seconds later the speed is 4.0 m/s.

What is the acceleration of the trolley?

- A 1.5 m/s<sup>2</sup>      B 2.0 m/s<sup>2</sup>      C 2.5 m/s<sup>2</sup>      D 5.0 m/s<sup>2</sup>

33 The speed-time graph shows the movement of a car.

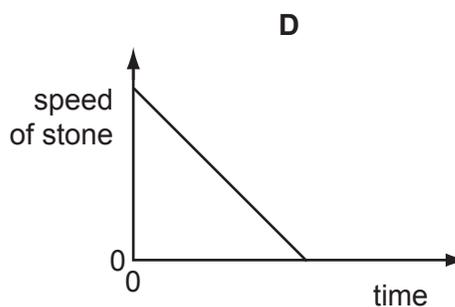
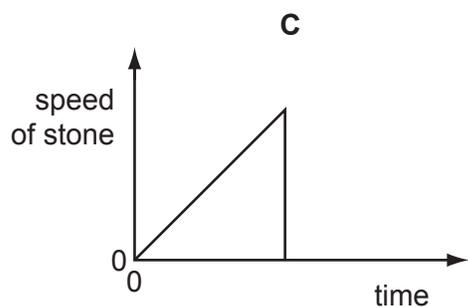
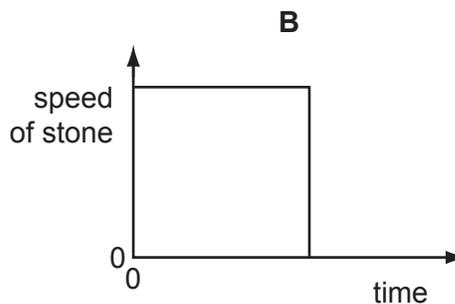
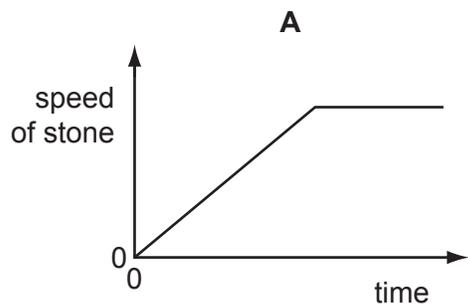


What does the shaded area of the graph represent?

- A the average acceleration of the car
- B the average speed of the car
- C the total distance travelled by the car
- D the total travelling time of the car

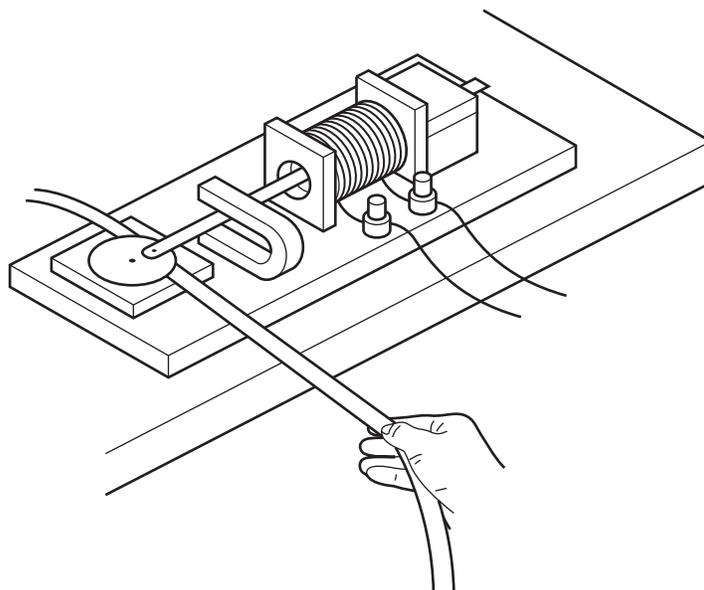
34 A small stone is dropped from the top of a ladder, falls and hits the ground. It does not rebound.

Which speed-time graph is correct?



- 35 A student pulls a piece of tape through a ticker-tape timer. Every 0.02 s, the timer prints a dot on the tape.

First the tape is pulled quickly, then slowly, then quickly again.

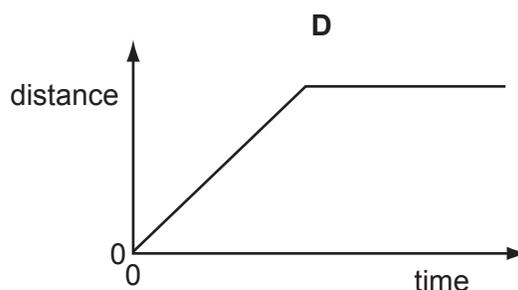
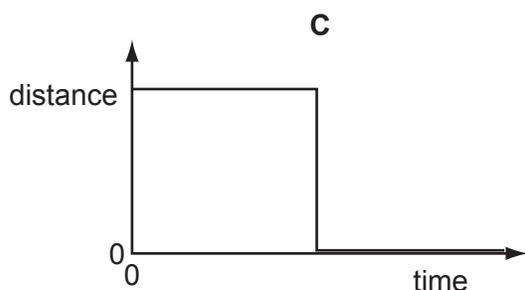
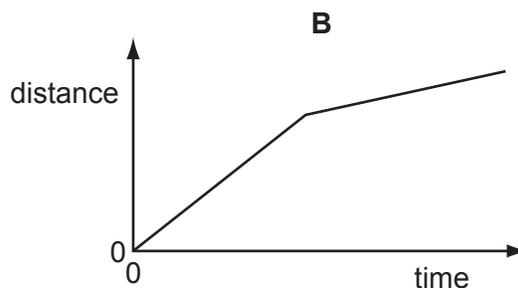
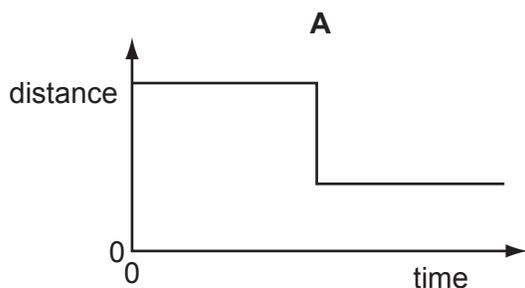


Which piece of tape does the student obtain?

- A
- B
- C
- D

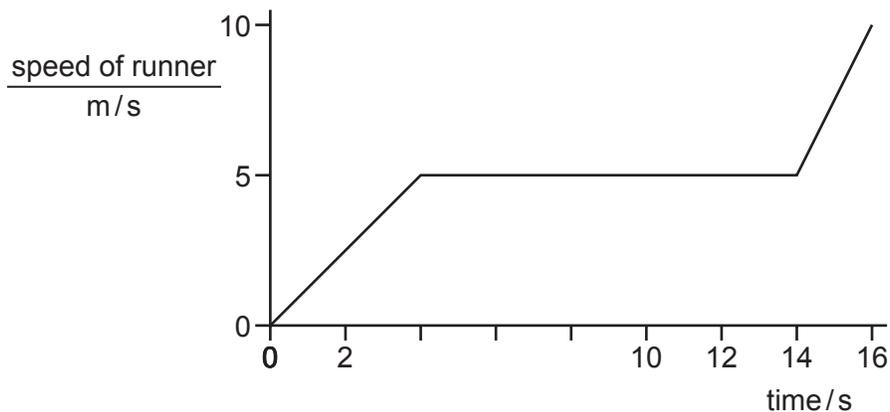
- 36 A free-fall parachutist falls at a constant speed. He then opens his parachute and continues to fall to Earth at a lower, constant speed.

Which diagram shows how the distance fallen by the parachutist varies with time?



3

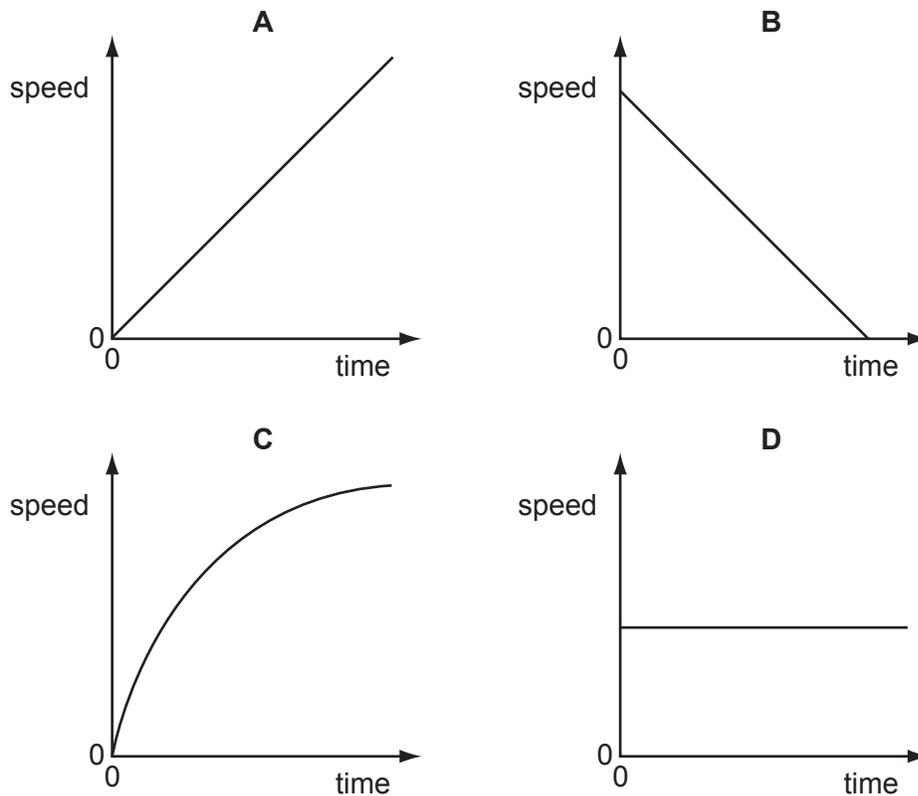
- 37 The graph shows the speed of a runner during a race.



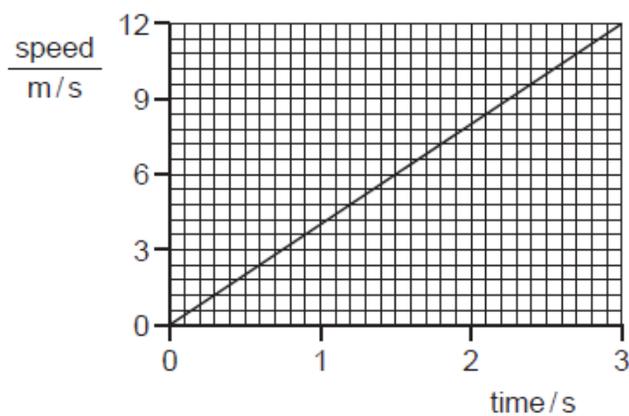
What is the distance travelled by the runner during the race?

- A** 50 m      **B** 65 m      **C** 75 m      **D** 90 m

38 Which speed-time graph shows an object moving with non-uniform acceleration?



39 The graph shows the speed of a car as it moves from rest.

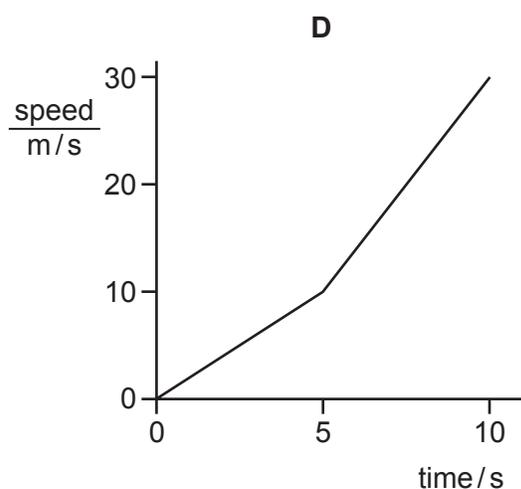
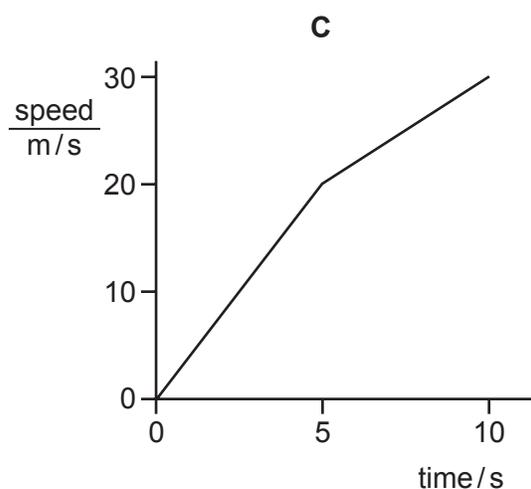
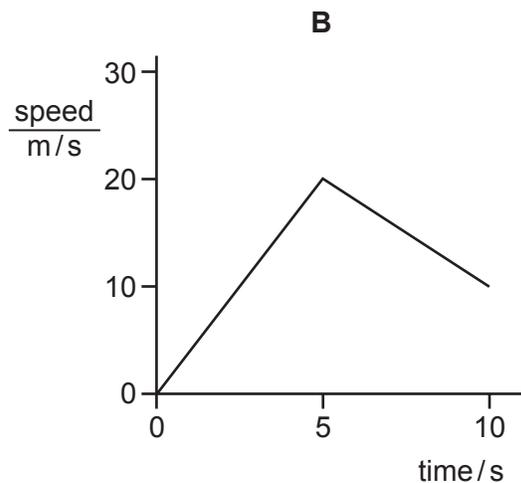
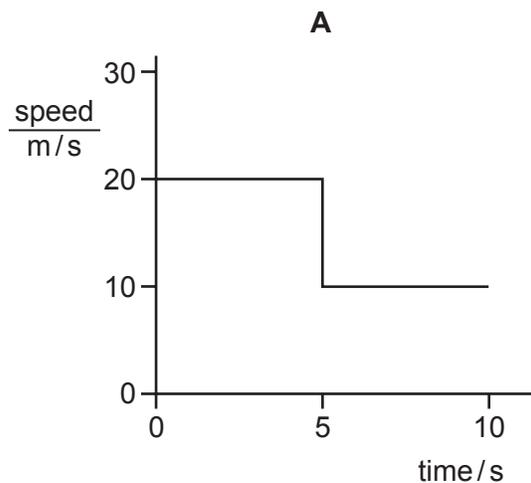


What is the average speed of the car during the first 3 s?

- A** 4 m/s      **B** 6 m/s      **C** 18 m/s      **D** 36 m/s

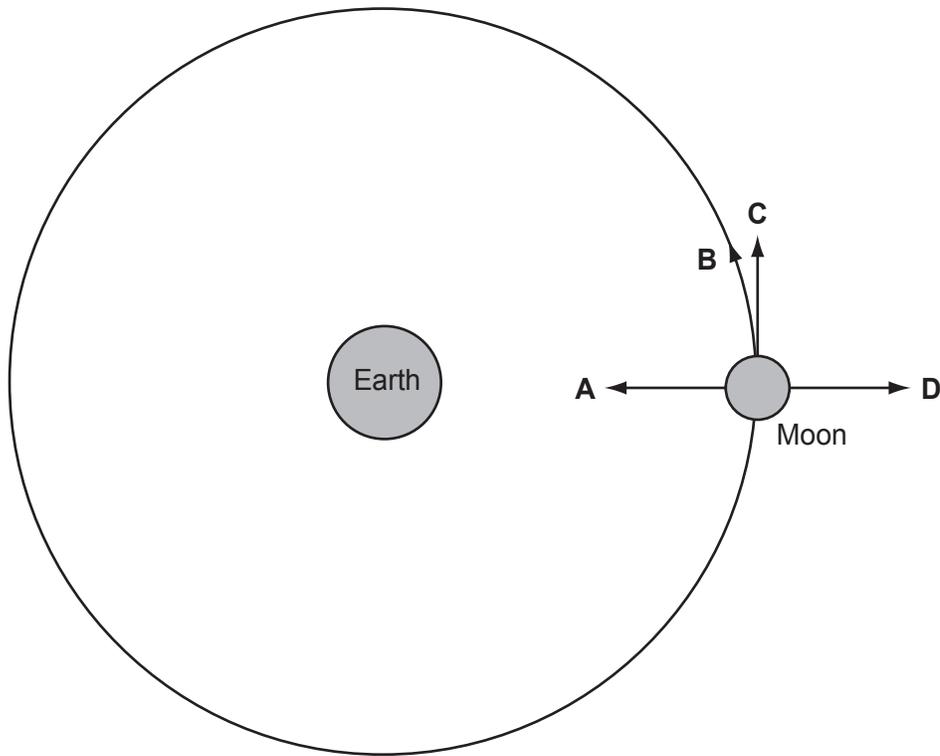
40 A skier is travelling downhill. The acceleration on hard snow is  $4 \text{ m/s}^2$  and on soft snow is  $2 \text{ m/s}^2$ .

Which graph shows the motion of the skier when moving from hard snow to soft snow?



41 The diagram represents the Moon in its orbit around the Earth.

Which arrow represents the direction of the resultant force acting on the Moon at the instant shown?

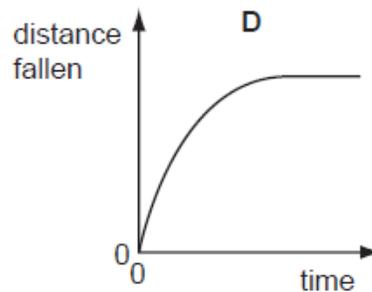
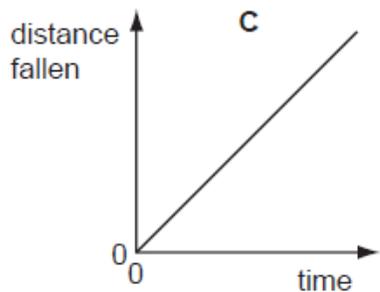
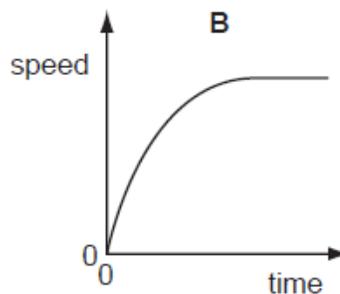
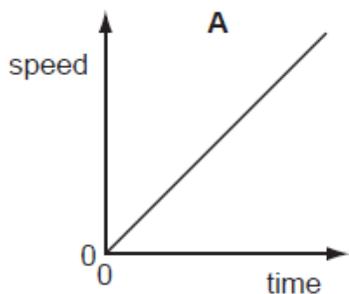


42 A car is brought to rest in 5 s from a speed of 10 m/s.

What is the average deceleration of the car?

- A**  $0.5\text{m/s}^2$       **B**  $2\text{m/s}^2$       **C**  $15\text{m/s}^2$       **D**  $50\text{m/s}^2$

43 Which graph shows the motion of a heavy, steel ball falling from a height of 2m?

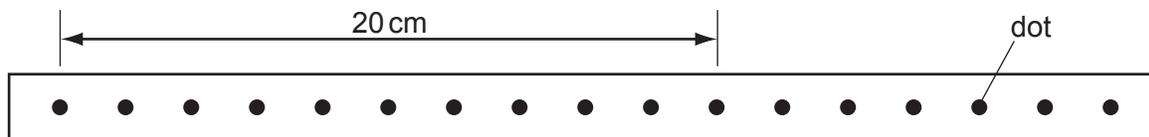


44 When a block of wood of mass 2 kg is pushed along the horizontal flat surface of a bench, the friction force is 4 N.

When the block is pushed along the bench with a force of 10 N, it moves with a constant

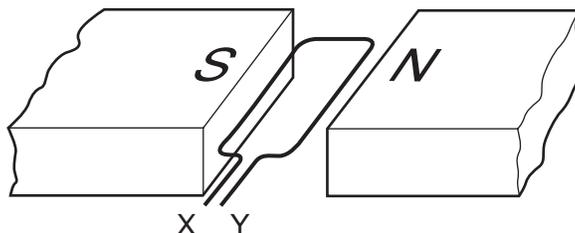
- A speed of 3 m/s.
- B speed of 5 m/s.
- C acceleration of 3 m/s<sup>2</sup>.
- D acceleration of 5 m/s<sup>2</sup>.

- 45 The diagram shows a strip of paper tape that has been pulled under a vibrating arm by an object moving at constant speed. The arm was vibrating regularly, making 50 dots per second.



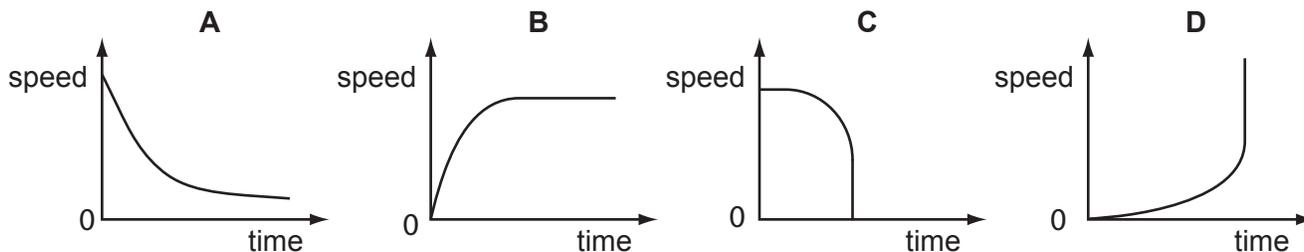
What was the speed of the object?

- A 2.0 cm/s      B 5.0 cm/s      C 100 cm/s      D 200 cm/s
- 46 The diagram shows a coil in a magnetic field.

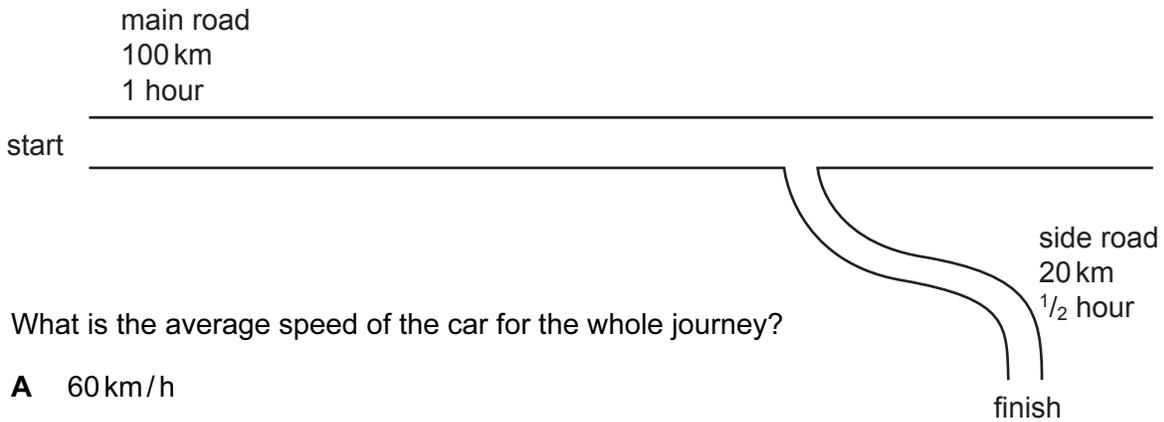


When the coil is part of a d.c. motor, what must be connected directly to X and Y?

- A d.c. supply  
 B slip rings  
 C soft-iron core  
 D split-ring commutator
- 47 Which graph represents the motion of a body falling vertically that reaches a terminal velocity?



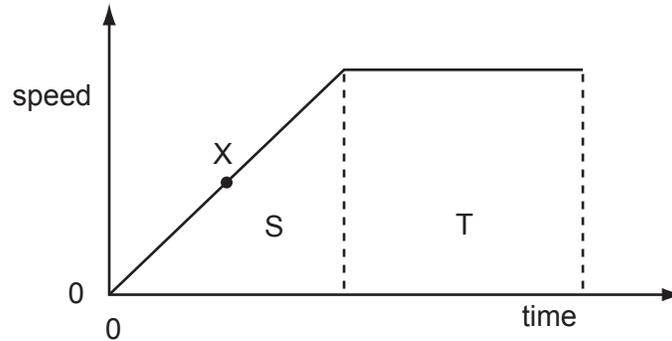
- 48 A car takes 1 hour to travel 100 km along a main road and then  $\frac{1}{2}$  hour to travel 20 km along a side road.



What is the average speed of the car for the whole journey?

- A 60 km/h
  - B 70 km/h
  - C 80 km/h
  - D 100 km/h
- 49 What **must** change when a body is accelerating?
- A the force acting on the body
  - B the mass of the body
  - C the speed of the body
  - D the velocity of the body

50 The graph illustrates the motion of an object.



Which feature of the graph represents the distance travelled by the object whilst moving at a constant speed?

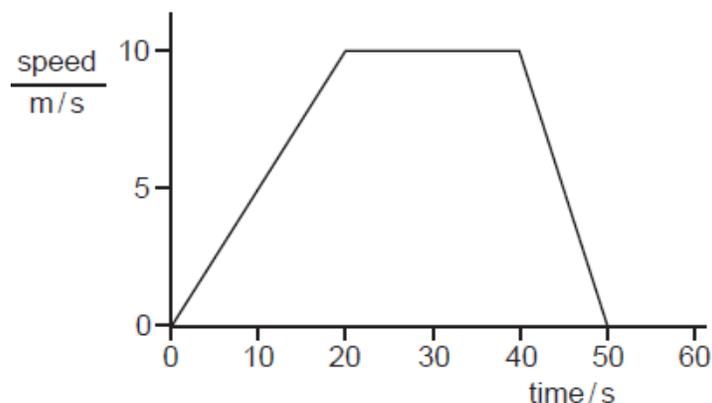
- A area S
- B area S + area T
- C area T
- D the gradient at point X

51 Which quantity  $X$  is calculated using this equation?

$$X = \frac{\text{change in velocity}}{\text{time taken}}$$

- A acceleration
- B average velocity
- C distance travelled
- D speed

52 The graph shows the movement of a car over a period of 50 s.



What was the distance travelled by the car while its speed was increasing?

- A 10 m                      B 20 m                      C 100 m                      D 200 m

53 An object is falling under gravity with terminal velocity.

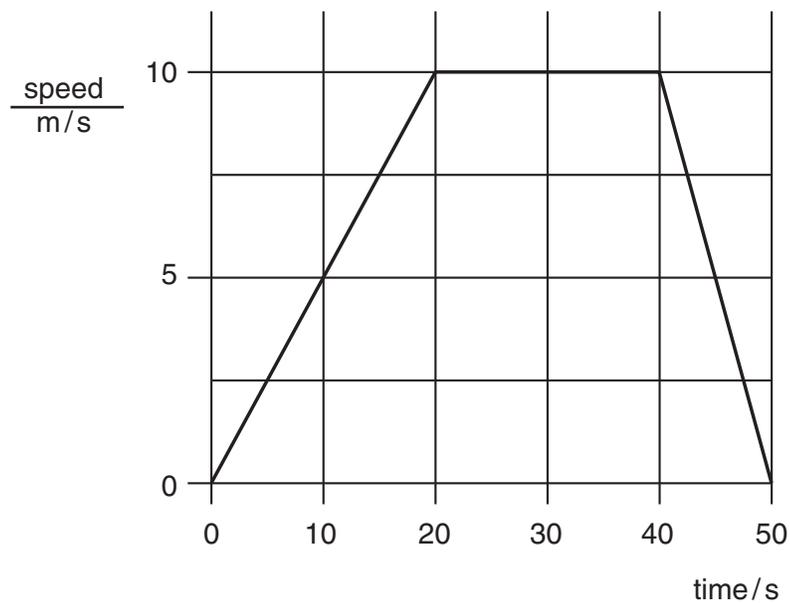
What is happening to its speed?

- A It is decreasing to a lower value.  
B It is decreasing to zero.  
C It is increasing.  
D It is staying constant.

54 Which of the following **defines** acceleration?

- A  $\frac{\text{change in velocity}}{\text{time taken}}$   
B  $\frac{\text{change in speed}}{\text{time taken}}$   
C  $\frac{\text{change in distance}}{\text{time taken}}$   
D  $\frac{\text{change in distance in a fixed direction}}{\text{time taken}}$

55 The graph shows the movement of a car over a period of 50 s.



What was the distance travelled by the car during the time when it was moving at a steady speed?

- A 10 m
- B 100 m
- C 200 m
- D 400 m