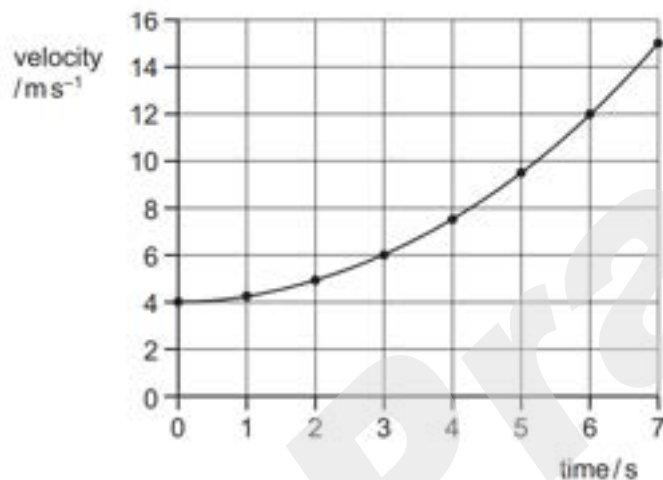


Kinematics

(Past Year Topical Questions 2010-2015)

May/June 2010 (11)

- 8 The diagram shows a velocity-time graph for a vehicle.

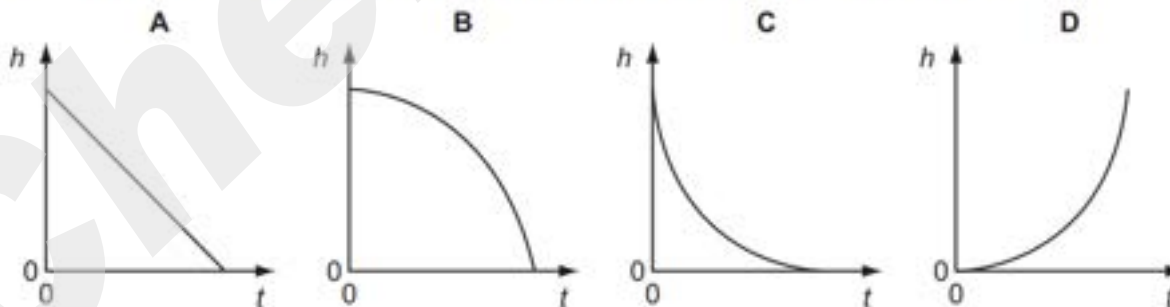


The vehicle, moving at 4.0 ms^{-1} , begins to accelerate at time = 0.

What is the vehicle's acceleration at time = 3.0 s?

- A 0.67 ms^{-2} B 1.0 ms^{-2} C 1.3 ms^{-2} D 2.0 ms^{-2}
- 9 A small steel ball falls freely under gravity after being released from rest.

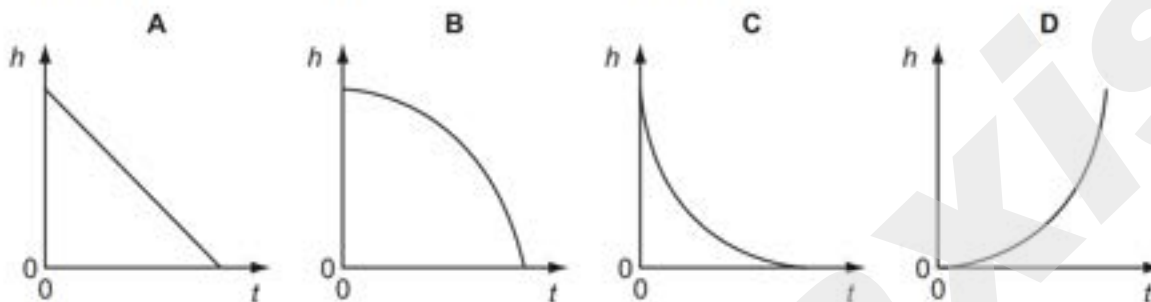
Which graph best represents the variation of the height h of the ball with time t ?



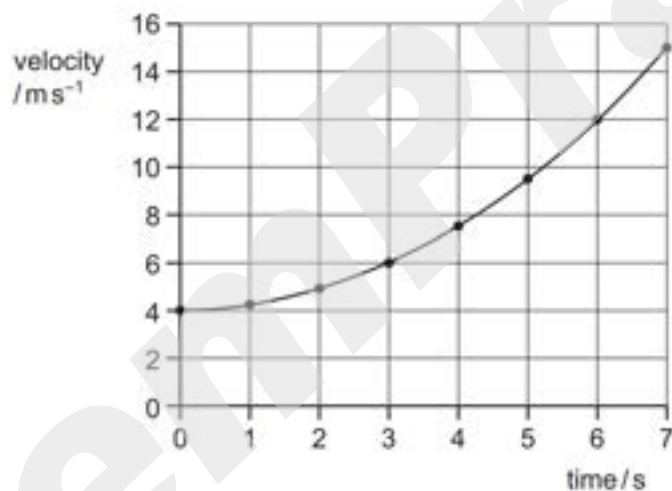
May/June 2010 (12)

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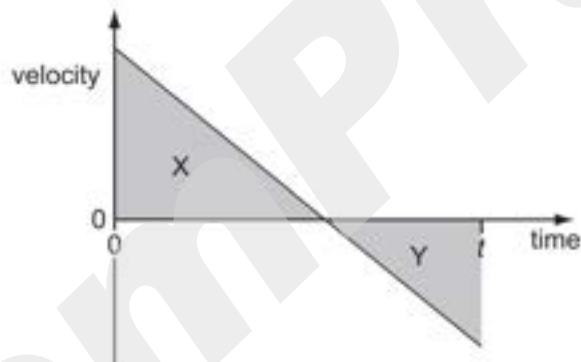
October/November 2010 (11)

- 7 A ball is thrown horizontally in still air from the top of a very tall building. The ball is affected by air resistance.

What happens to the horizontal and to the vertical components of the ball's velocity?

	horizontal component of velocity	vertical component of velocity
A	decreases to zero	increases at a constant rate
B	decreases to zero	increases to a constant value
C	remains constant	increases at a constant rate
D	remains constant	increases to a constant value

- 8 The velocity-time graph below is for a stone thrown vertically up into the air. Air resistance is negligible.



The stone is thrown up at time zero.

Area X represents a distance of 5 m. Area Y represents a distance of 3 m.

What is the displacement of the stone from its initial position at time t ?

- A** 2 m **B** 3 m **C** 5 m **D** 8 m

- 9 In order that a train can stop safely, it will always pass a signal showing a yellow light before it reaches a signal showing a red light. Drivers apply the brake at the yellow light and this results in a uniform deceleration to stop exactly at the red light.

The distance between the red and yellow lights is x .

What must be the minimum distance between the lights if the train speed is increased by 20 %, without changing the deceleration of the trains?

- A $1.20x$ B $1.25x$ C $1.44x$ D $1.56x$

October/November 2010 (12)

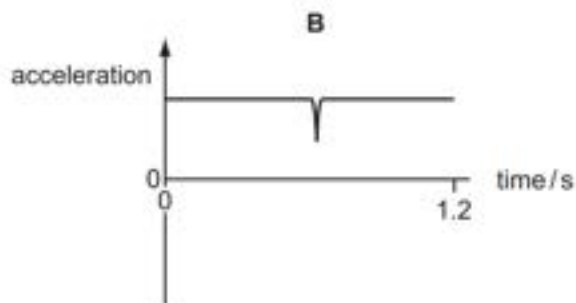
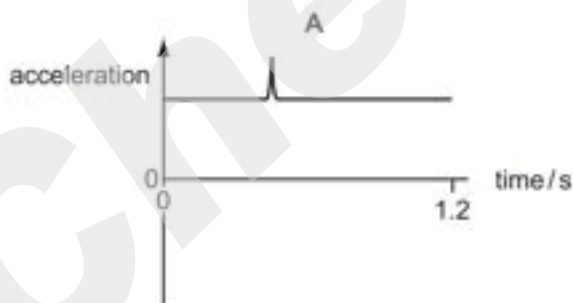
- 6 A football is dropped from the top of a three-storey building. It falls through air until it reaches the ground.

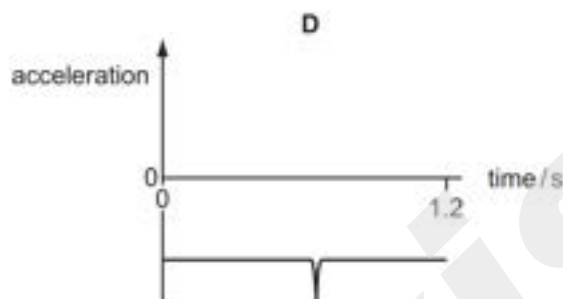
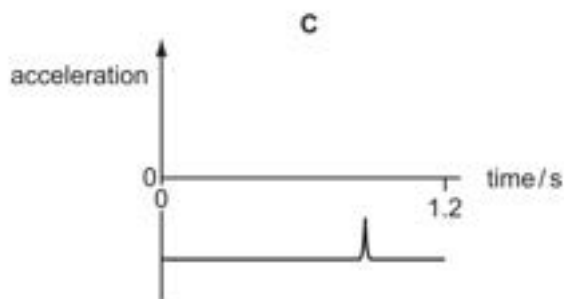
What remains constant throughout the fall?

- A acceleration of the football
 B air resistance on the football
 C velocity of the football
 D weight of the football
- 7 A student throws a ball in the positive direction vertically upwards.

The ball makes an elastic collision with the ceiling, rebounds and accelerates back to the student's hand in a time of 1.2 s.

Which graph best represents the acceleration of the ball from the moment it leaves the hand to the instant just before it returns to the hand?





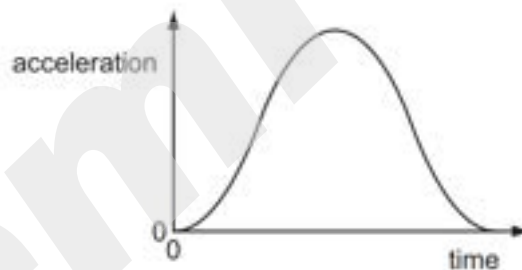
- 8** A moving body undergoes uniform acceleration while travelling in a straight line between points X, Y and Z. The distances XY and YZ are both 40 m. The time to travel from X to Y is 12 s and from Y to Z is 6.0 s.

What is the acceleration of the body?

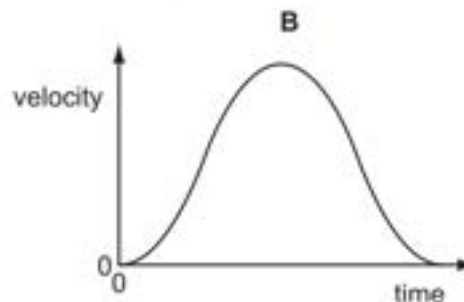
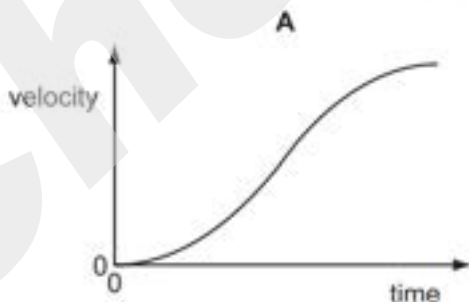
- A** 0.37 ms^{-2} **B** 0.49 ms^{-2} **C** 0.56 ms^{-2} **D** 1.1 ms^{-2}

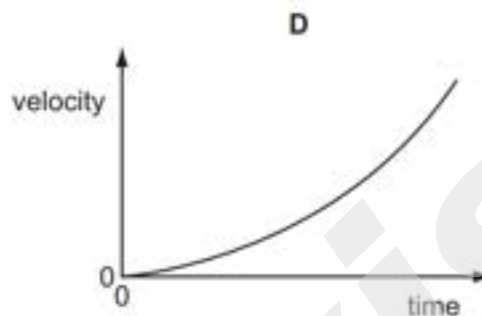
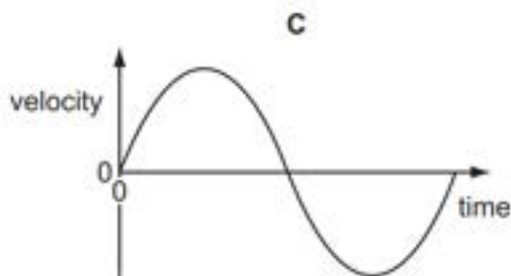
May/June 2011 (11)

- 6** The graph shows how the acceleration of an object moving in a straight line varies with time.

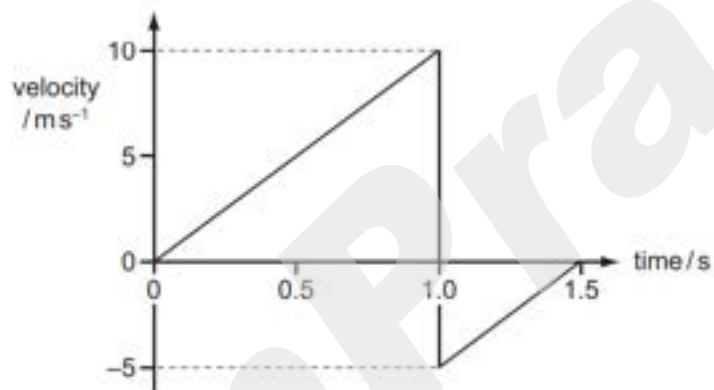


Which graph shows the variation with time of the velocity of the object?





- 7 A ball is released from rest at time zero. After 1.0 s it bounces inelastically from a horizontal surface and rebounds, reaching the top of its first bounce after 1.5 s.



What is the total displacement of the ball from its original position after 1.5 s?

- A** 1.25 m **B** 3.75 m **C** 5.00 m **D** 6.25 m

May/June 2011 (12)

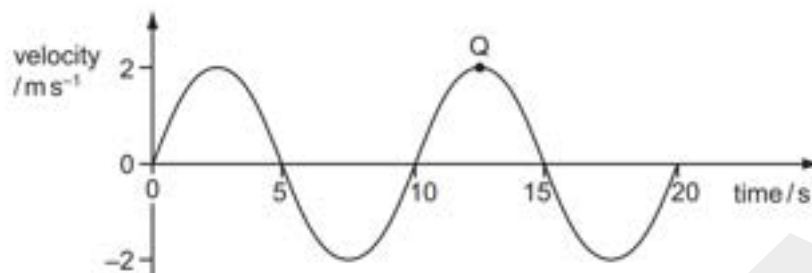
- 6 A bullet is fired horizontally with speed v from a rifle. For a short time t after leaving the rifle, the only force affecting its motion is gravity. The acceleration of free fall is g .

Which expression gives the value of $\frac{\text{the horizontal distance travelled in time } t}{\text{the vertical distance travelled in time } t}$?

- A** $\frac{vt}{g}$ **B** $\frac{v}{gt}$ **C** $\frac{2vt}{g}$ **D** $\frac{2v}{gt}$

- 7 A particle moves in the manner shown by the velocity-time graph.

The displacement of the particle has been measured so that it is zero at $t = 0$. Point Q refers to a point in its motion.

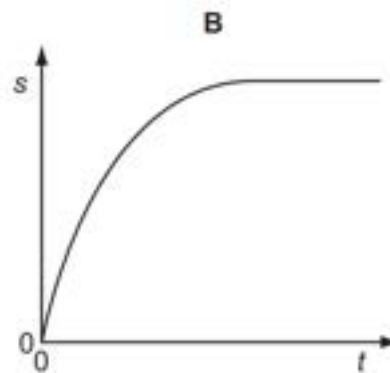


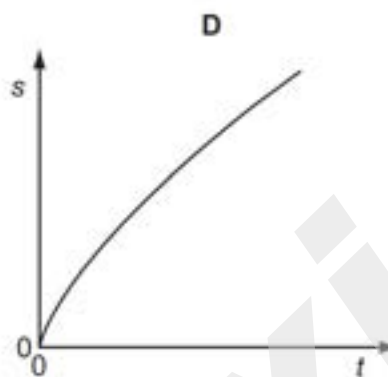
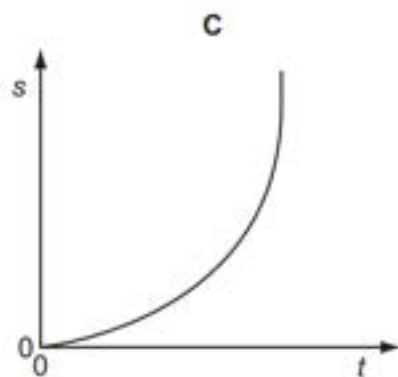
Which row of the table is correct?

	times for maximum displacement / s		acceleration at point Q / ms^{-2}
A	2.5	12.5	2
B	5	15	2
C	2.5	12.5	0
D	5	15	0

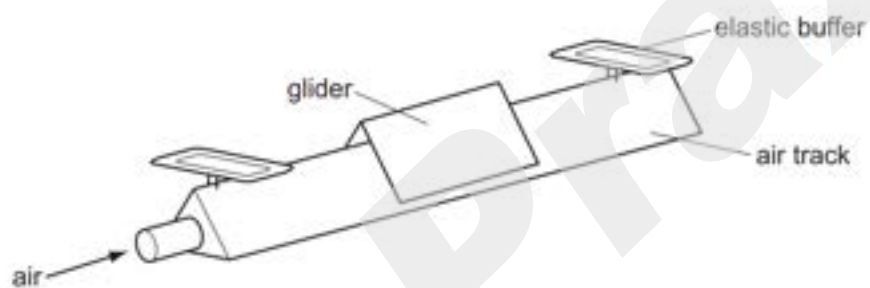
- 8 A tennis ball falls freely, in air, from the top of a tall building.

Which graph best represents the variation of distance s fallen with time t ?



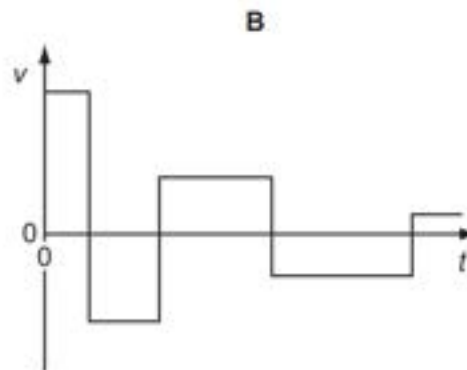
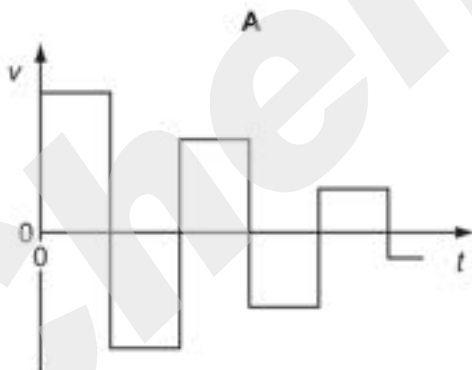


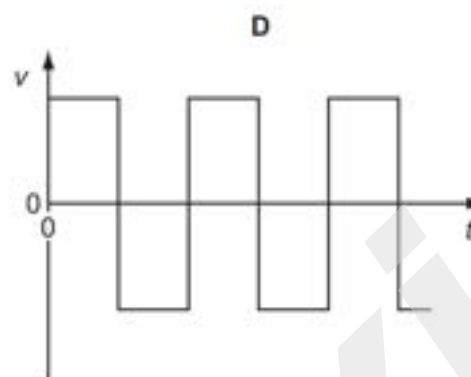
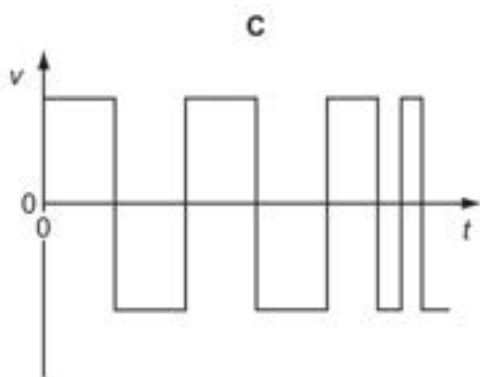
- 9 A small glider moves along a friction-free horizontal air track as shown below.



At each end of the air track there is a perfectly elastic buffer.

Which graph represents the variation with time t of the velocity v of the glider as it moves between the two buffers?





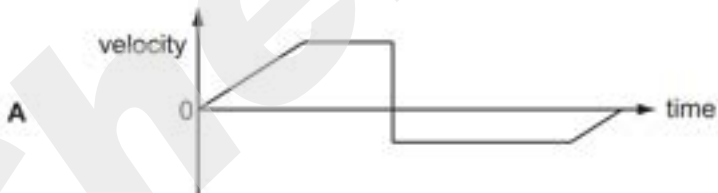
October/November 2011 (11)

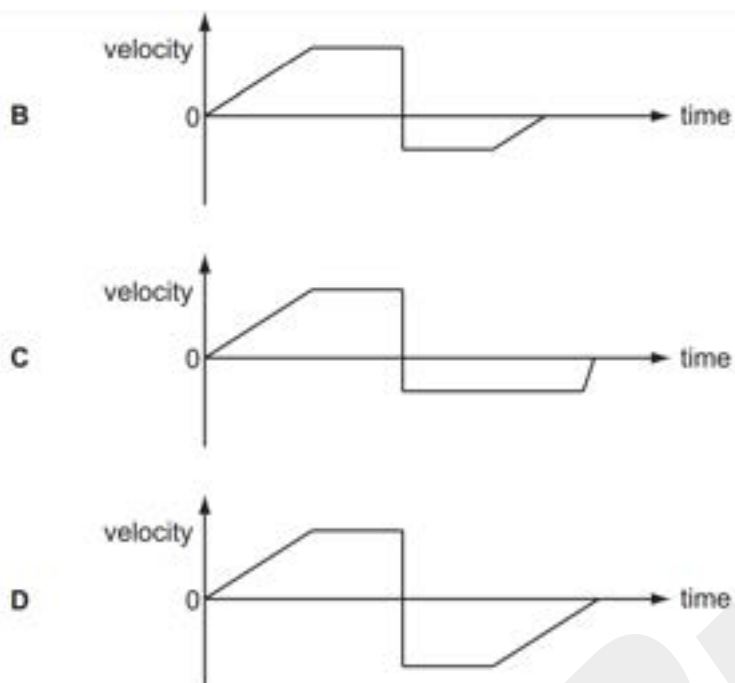
- 6** A ball is released from rest on a smooth slope XY.

It moves down the slope, along a smooth horizontal surface YZ and rebounds inelastically at Z. Then it moves back to Y and comes to rest momentarily somewhere on XY.



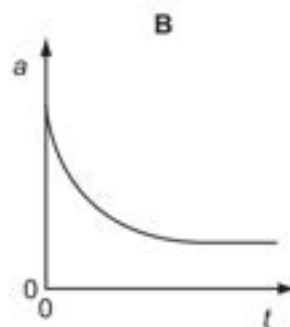
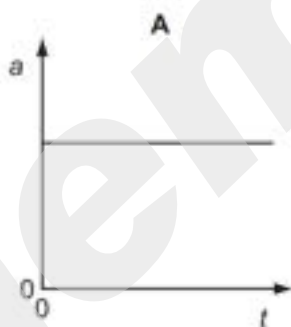
Which velocity-time graph represents the motion of the ball?

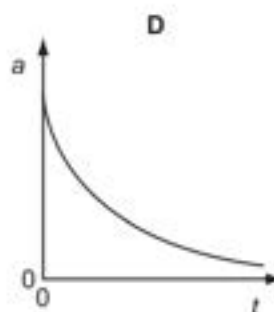
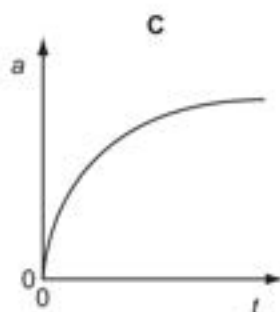




7 A tennis ball is released from rest at the top of a tall building.

Which graph best represents the variation with time t of the acceleration a of the ball as it falls, assuming that the effect of air resistance is **not** negligible?





- 8 A boy throws a ball vertically upwards. It rises to a maximum height, where it is momentarily at rest, and then falls back to his hands.

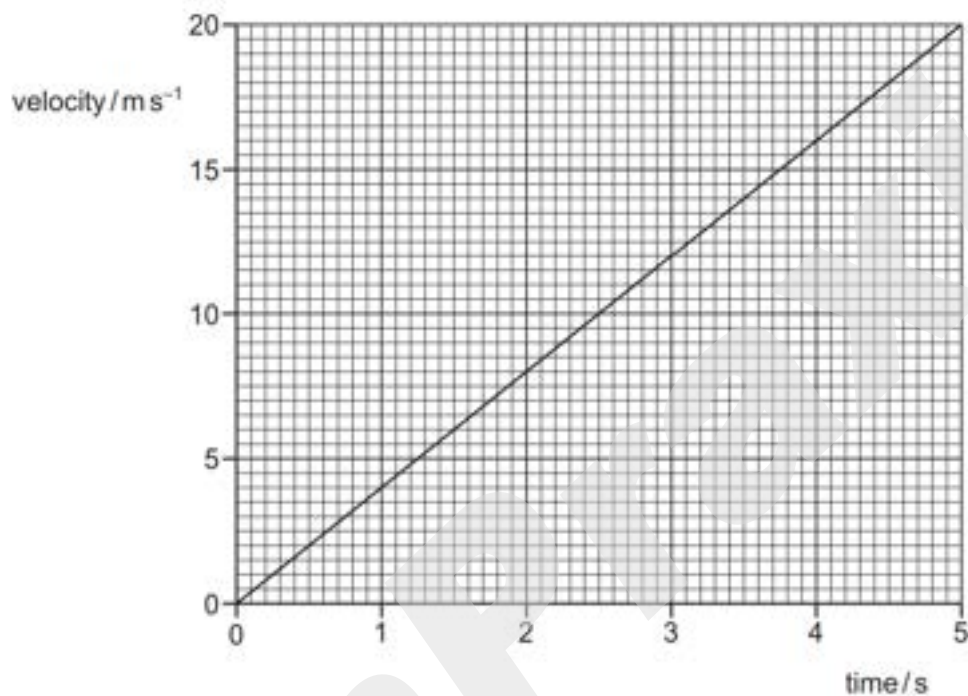
Which row gives the acceleration of the ball at various stages in its motion? (Take vertically upwards as positive. Ignore air resistance.)

	rising	at maximum height	falling
A	-9.81 ms^{-2}	0	$+9.81 \text{ ms}^{-2}$
B	-9.81 ms^{-2}	-9.81 ms^{-2}	-9.81 ms^{-2}
C	$+9.81 \text{ ms}^{-2}$	$+9.81 \text{ ms}^{-2}$	$+9.81 \text{ ms}^{-2}$
D	$+9.81 \text{ ms}^{-2}$	0	-9.81 ms^{-2}

- 10 What is the **definition** of the force on a body?
- A** the mass of the body multiplied by its acceleration
 - B** the power input to the body divided by its velocity
 - C** the rate of change of momentum of the body
 - D** the work done on the body divided by its displacement

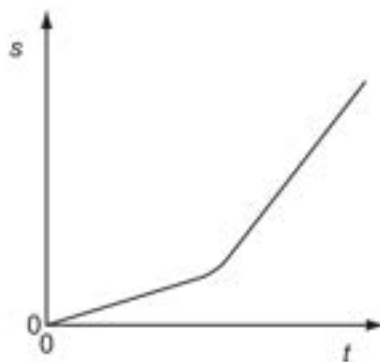
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- 6 The velocity of an object during the first five seconds of its motion is shown on the graph.



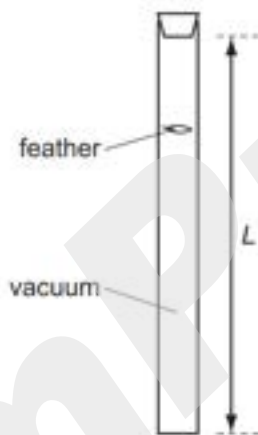
What is the distance travelled by the object in this time?

- A 4 m B 20 m C 50 m D 100 m
- 8 The variation with time t of the distance s moved by a body is shown below.



May/June 2012 (11)

- 7 Which feature of a graph allows acceleration to be determined?
- A the area under a displacement-time graph
 - B the area under a velocity-time graph
 - C the slope of a displacement-time graph
 - D the slope of a velocity-time graph
- 8 The diagram shows a laboratory experiment in which a feather falls from rest in a long evacuated vertical tube of length L .

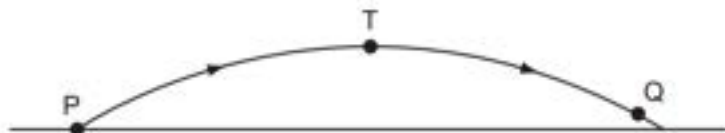


The feather takes time T to fall from the top to the bottom of the tube.

How far will the feather have fallen from the top of the tube in time $0.50 T$?

- A $0.13L$ B $0.25L$ C $0.38L$ D $0.50L$

- 9 In the absence of air resistance, a stone is thrown from P and follows a parabolic path in which the highest point reached is T. The stone reaches point Q just before landing.



The vertical component of acceleration of the stone is

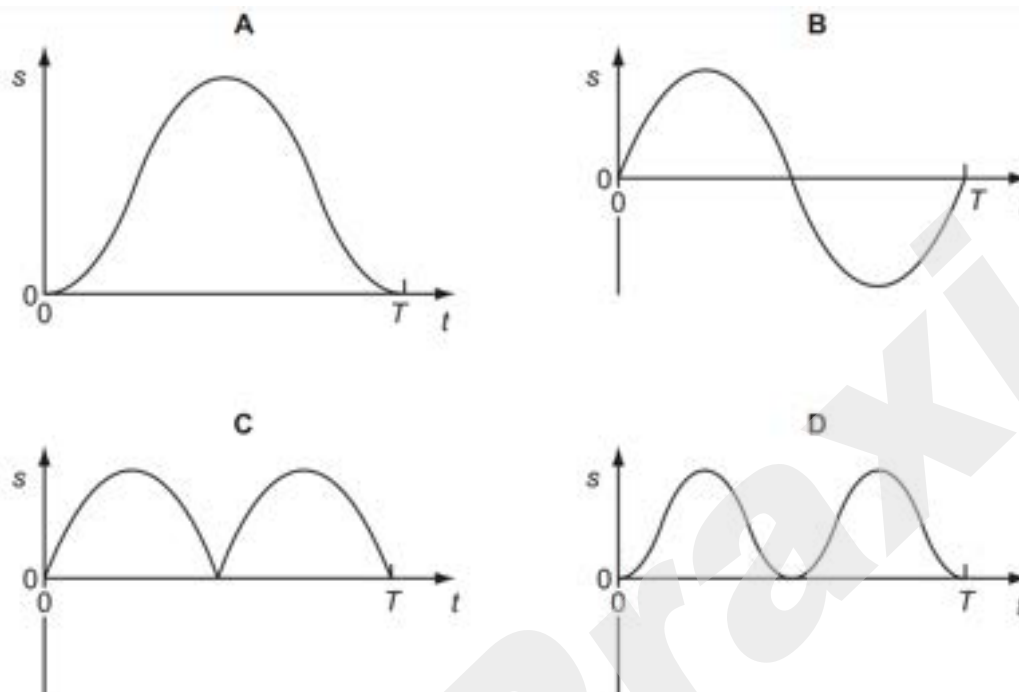
- A zero at T.
- B larger at T than at Q.
- C larger at Q than at T.
- D the same at Q as at T.

May/June 2012 (12)

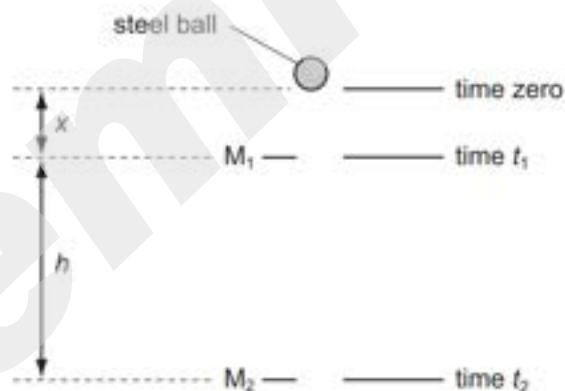
- 7 The graph shows how the velocity v of an object moving in a straight line varies over time $t = 0$ to $t = T$.



Which graph represents the displacement s of the object in the time $t = 0$ to $t = T$?



- 8 Two markers M_1 and M_2 are set up a vertical distance h apart.

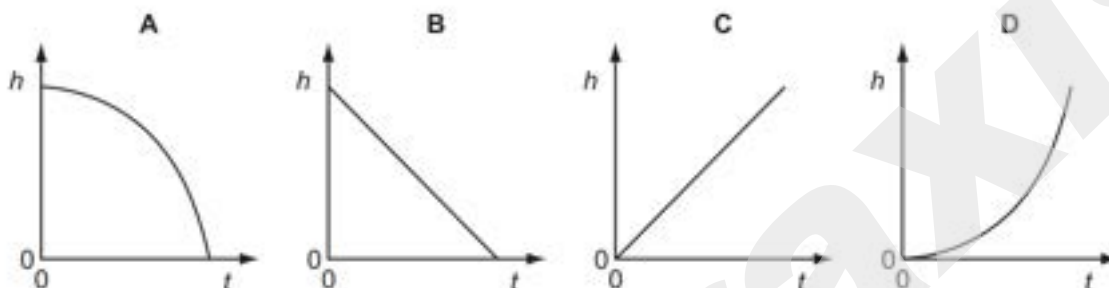


A steel ball is released at time zero from a point a distance x above M_1 . The ball reaches M_1 at time t_1 and reaches M_2 at time t_2 . The acceleration of the ball is constant.

A $\frac{2h}{t_2^2}$ B $\frac{2h}{(t_2 + t_1)}$ C $\frac{2h}{(t_2 - t_1)^2}$ D $\frac{2h}{(t_2^2 - t_1^2)}$

- 9 A brick is dislodged from a building and falls vertically under gravity.

Which graph best represents the variation of its height h above the ground with time t if air resistance is negligible?



- 10 A projectile is launched at point O and follows the path OPQRS, as shown. Air resistance may be neglected.

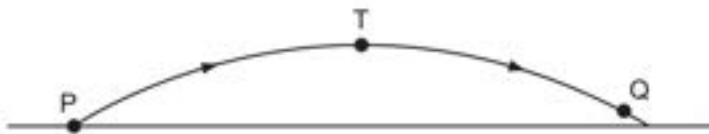


Which statement is true for the projectile when it is at the highest point Q of its path?

- A The horizontal component of the projectile's acceleration is zero.
 B The horizontal component of the projectile's velocity is zero.
 C The kinetic energy of the projectile is zero.
 D The momentum of the projectile is zero.

May/June 2012 (13)

- 8 In the absence of air resistance, a stone is thrown from P and follows a parabolic path in which the highest point reached is T. The stone reaches point Q just before landing.

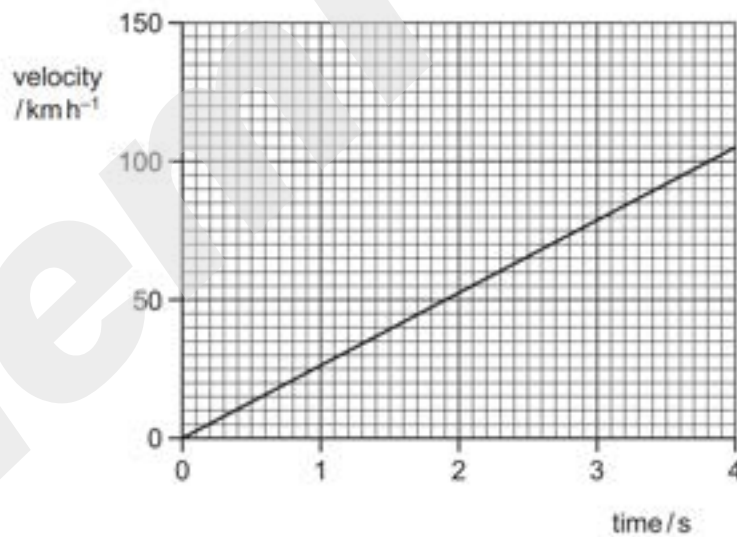


The vertical component of acceleration of the stone is

- A zero at T.
- B larger at T than at Q.
- C larger at Q than at T.
- D the same at Q as at T.

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- 8 The velocity of an electric car changes as shown.



What is the acceleration of the car?

- A 190ms^{-2}
- B 53ms^{-2}
- C 26ms^{-2}
- D 7.3ms^{-2}

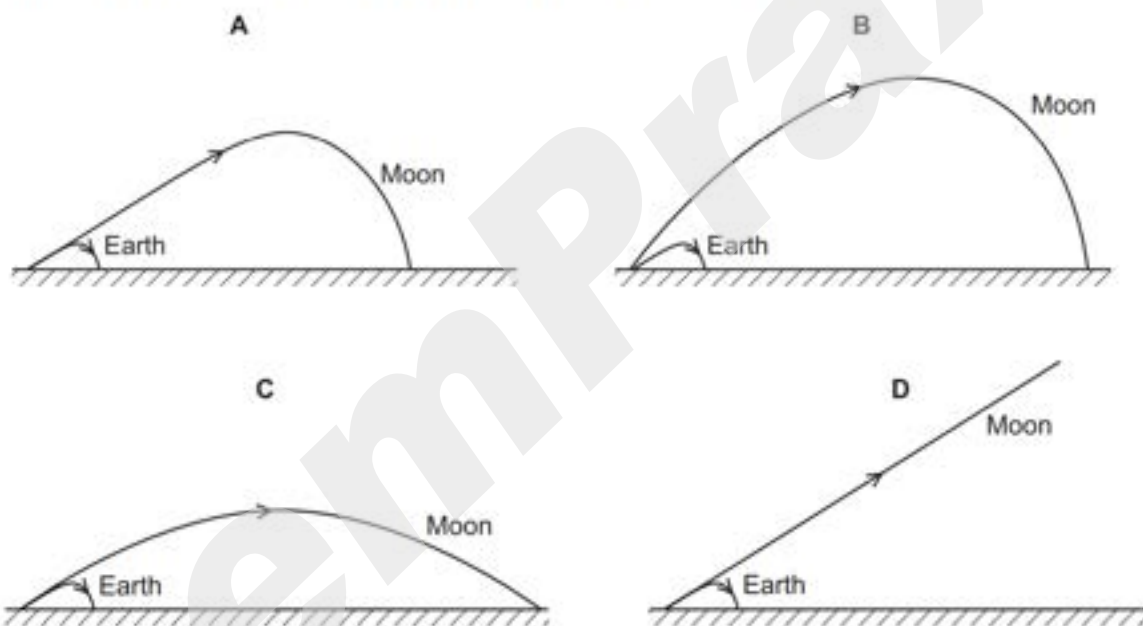
9 A ball is thrown vertically in air.

Neglecting air resistance, which property of the ball can **never** be zero at any time during the flight?

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

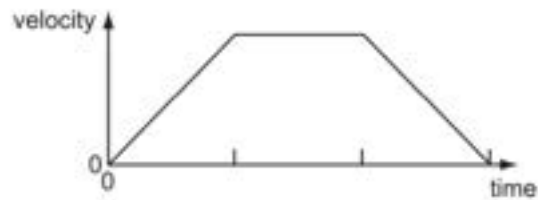
10 A golf ball is hit with the same force and direction on the Earth and on the Moon.

Which diagram best represents the shapes of the paths taken by the golf ball?

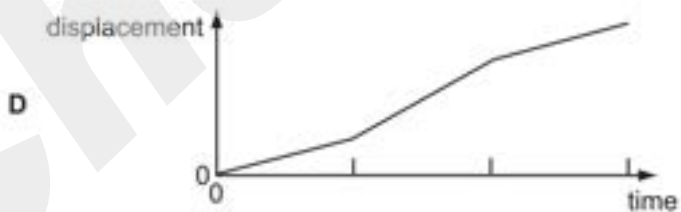
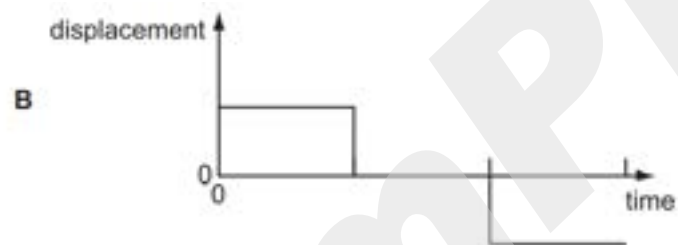
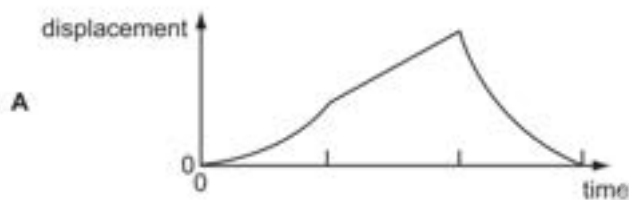


October/November 2012 (12)

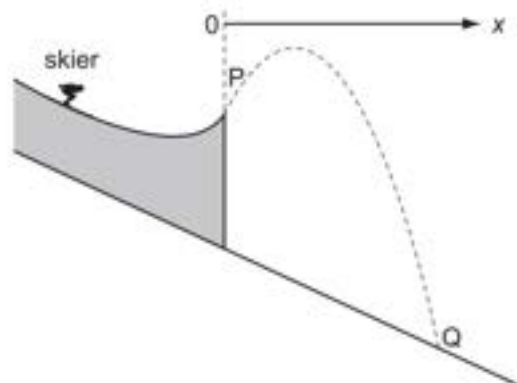
- 9 The graph of velocity against time for an object moving in a straight line is shown.



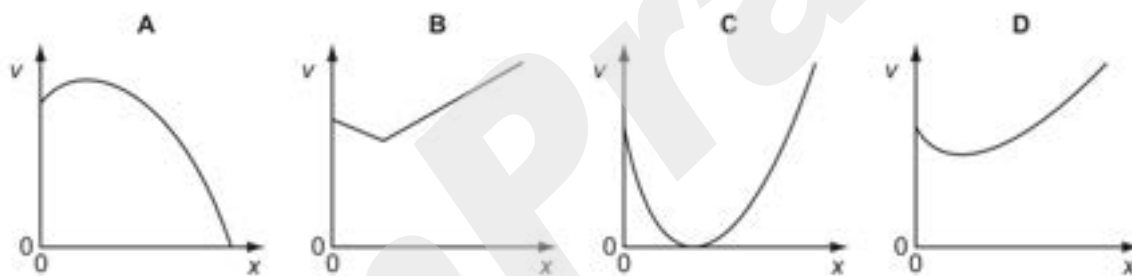
What is the corresponding graph of displacement against time?



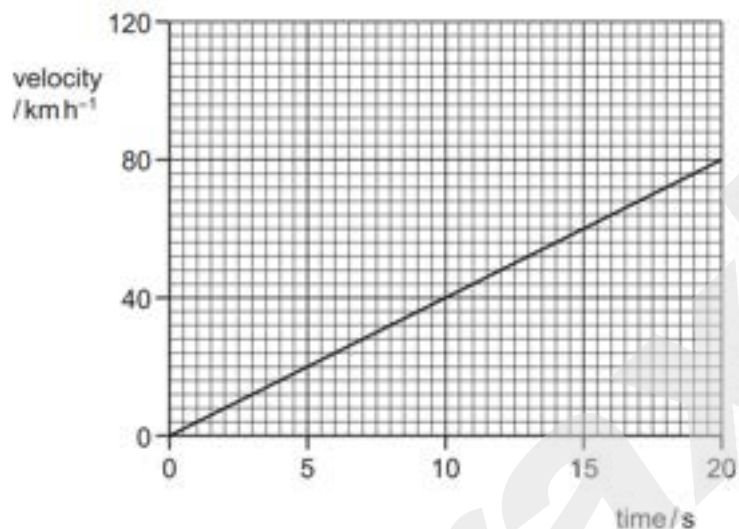
10 The dotted line shows the path of a competitor in a ski-jumping competition.



Ignoring air resistance, which graph best represents the variation of his speed v with the horizontal distance x covered from the start of his jump at P before landing at Q?



11 The velocity of a car changes as shown.



What is the acceleration of the car?

- A 1.1ms^{-2} B 4.0ms^{-2} C 224ms^{-2} D 800ms^{-2}

October/November 2012 (13)

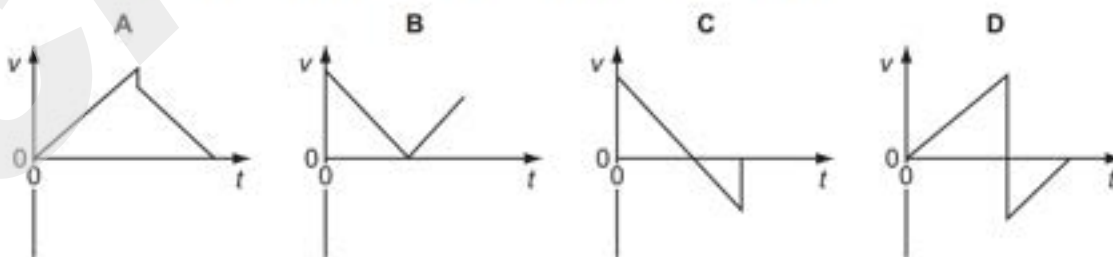
- 8 A bicycle brakes so that it undergoes uniform deceleration from a speed of 8ms^{-1} to 6ms^{-1} over a distance of 7 m.

If the deceleration of the bicycle remains constant, what further distance will it travel before coming to rest?

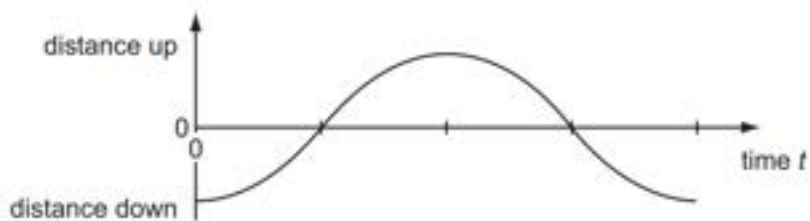
- A 7 m B 9 m C 16 m D 21 m

- 9 A ball is released from rest above a horizontal surface. It bounces once and is caught.

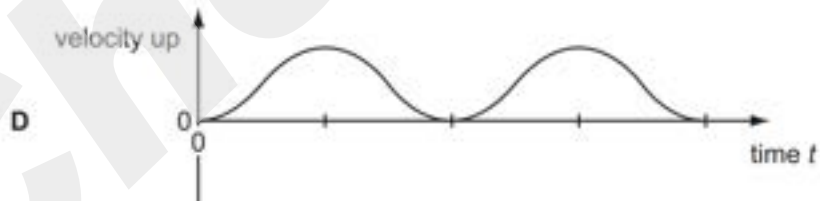
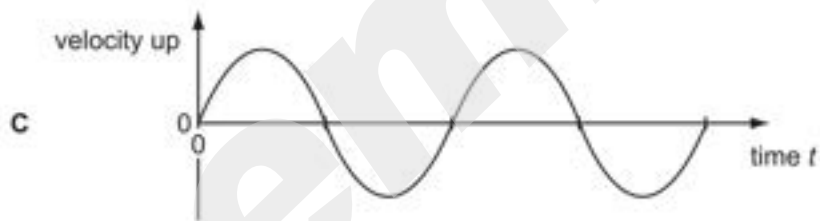
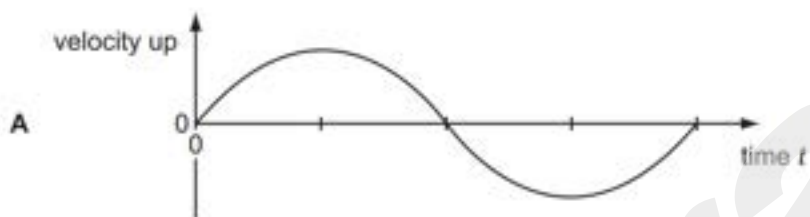
Which graph represents the variation with time t of the velocity v of the ball?



10 A mass on the end of a spring bounces up and down as shown, after being released at time $t = 0$.

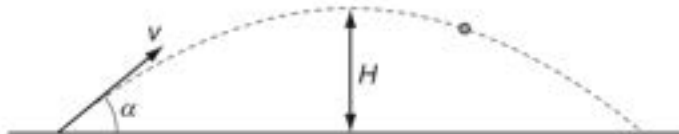


Which graph shows how the velocity varies with time?



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- 3 A cannon fires a cannonball with an initial speed v at an angle α to the horizontal.



Which equation is correct for the maximum height H reached?

A $H = \frac{v \sin \alpha}{2g}$ B $H = \frac{g \sin \alpha}{2v}$ C $H = \frac{(v \sin \alpha)^2}{2g}$ D $H = \frac{g^2 \sin \alpha}{2v}$

- 8 A goods train passes through a station at a steady speed of 10 m s^{-1} . An express train is at rest at the station. The express train leaves the station with a uniform acceleration of 0.5 m s^{-2} just as the goods train goes past. Both trains move in the same direction on straight, parallel tracks.

How much time passes before the express train overtakes the goods train?

- A 6 s B 10 s C 20 s D 40 s

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- 7 The diagram shows an arrangement to stop trains that are travelling too fast.



Trains coming from the left travel at a speed of 50 m s^{-1} . At marker 1, the driver must apply the brakes so that the train decelerates uniformly in order to pass marker 2 at no more than 10 m s^{-1} .

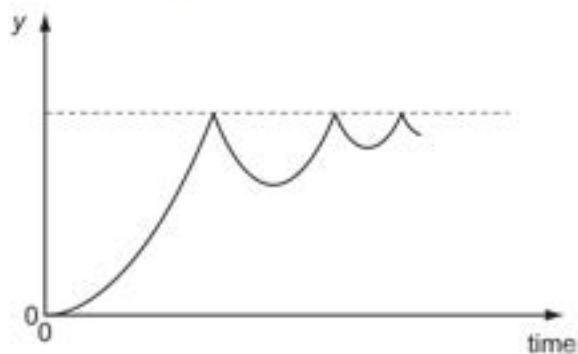
The train carries a detector that notes the times when the train passes each marker and will apply an emergency brake if the time between passing marker 1 and marker 2 is less than 20 s.

How far from marker 2 should marker 1 be placed?

- A 200 m B 400 m C 500 m D 600 m

- 8 A ball is released from rest above a horizontal surface and bounces several times.

The graph shows how, for this ball, a quantity y varies with time.

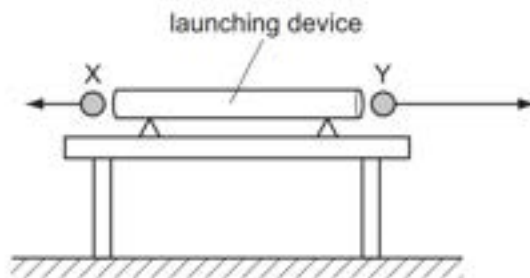


What is the quantity y ?

- A acceleration
- B displacement
- C kinetic energy
- D velocity

May/June 2013 (13)

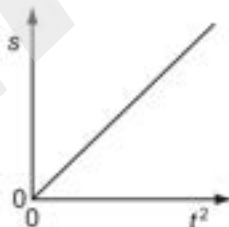
- 7 A double-ended launching device fires two identical steel balls X and Y at exactly the same time. The diagram shows the initial velocities of the balls. They are both launched horizontally, but Y has greater speed.



Which statement explains what an observer would see?

- A Both X and Y reach the ground simultaneously, because air resistance will cause both to have the same final speed.
- B Both X and Y reach the ground simultaneously, because gravitational acceleration is the same for both.
- C X reaches the ground before Y, because X lands nearer to the launcher.
- D Y reaches the ground before X, because Y has greater initial speed.
- 8 At time $t = 0$, a body moves from rest with constant acceleration in a straight line. At time t , the body is distance s from its rest position.

A graph is drawn of s against t^2 , as shown.

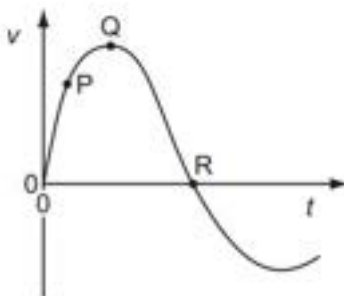


Which statement describes the acceleration of the body?

- A It is equal to half the value of the gradient of the graph.
- B It is equal to the value of the gradient of the graph.
- C It is equal to twice the value of the gradient of the graph.
- D It is equal to the reciprocal of the gradient of the graph.

October/November 2013 (11)

- 7 The graph shows how velocity v varies with time t for a bungee jumper.



At which point is the bungee jumper momentarily at rest and at which point does she have zero acceleration?

	jumper at rest	jumper with zero acceleration
A	Q	P
B	Q	R
C	R	Q
D	R	R

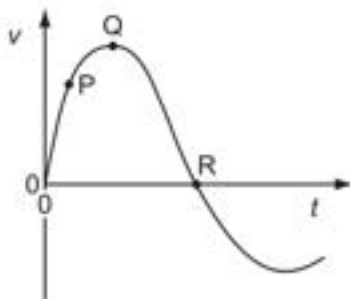
- 8 An aeroplane travels at an average speed of 600 km h^{-1} on an outward flight and at 400 km h^{-1} on the return flight over the same distance.

What is the average speed of the whole flight?

- A 111 m s^{-1} B 167 m s^{-1} C 480 km h^{-1} D 500 km h^{-1}

October/November 2013 (12)

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C	R	Q
D	R	R

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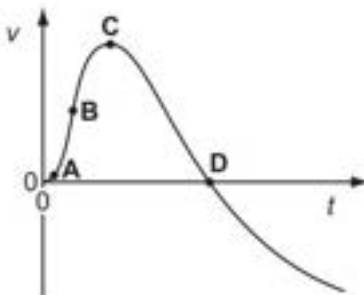
What is the average speed of the whole flight?

- A** 111 ms^{-1} **B** 167 ms^{-1} **C** 480 km h^{-1} **D** 500 km h^{-1}

October/November 2013 (13)

- 7 The graph shows how the velocity v of a firework rocket changes with time t .

At which point on the graph does the rocket have the greatest acceleration?



- 8 On a particular railway, a train driver applies the brake of the train at a yellow signal, a distance of 1.0 km from a red signal, where the train stops.

The maximum deceleration of the train is 0.20 m s^{-2} .

Assuming uniform deceleration, what is the maximum safe speed of the train at the yellow signal?

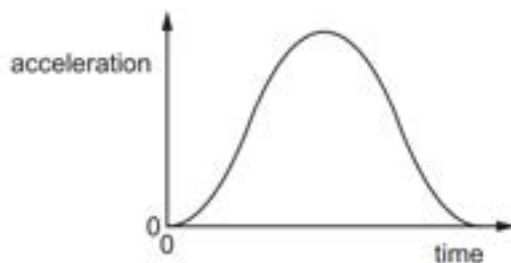
- A 14 m s^{-1} B 20 m s^{-1} C 40 m s^{-1} D 400 m s^{-1}
- 9 A person, travelling on a motorway a total distance of 200 km, travels the first 90 km at an average speed of 80 km h^{-1} .

Which average speed must be obtained for the rest of the journey if the person is to reach the destination in a total time of 2 hours 0 minutes?

- A 110 km h^{-1} B 120 km h^{-1} C 122 km h^{-1} D 126 km h^{-1}

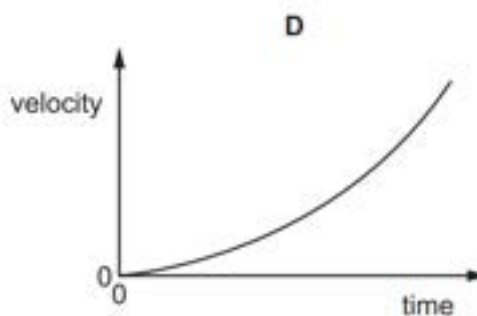
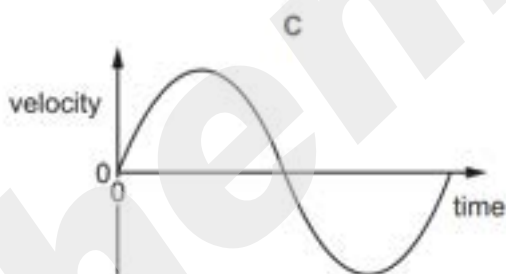
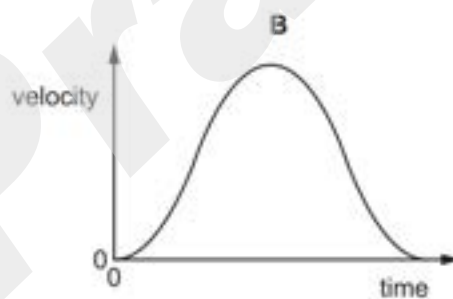
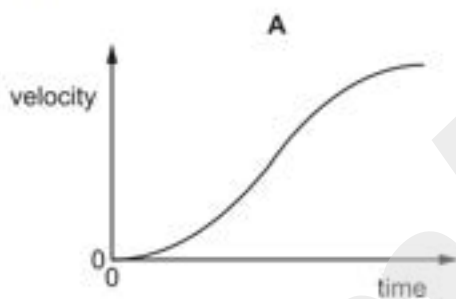
May/June 2014 (11)

- 8 The graph shows how the acceleration of an object moving in a straight line varies with time.



The object starts from rest.

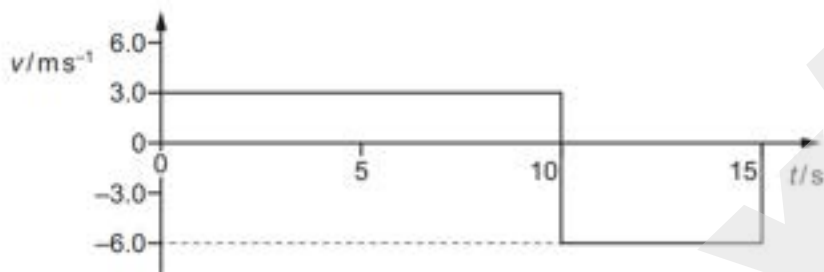
Which graph shows the variation with time of the velocity of the object over the same time interval?



May/June 2014 (12)

- 6 A radio-controlled toy car travels along a straight line for a time of 15 s.

The variation with time t of the velocity v of the car is shown below.



What is the average velocity of the toy car for the journey shown by the graph?

- A -1.5 ms^{-1} B 0.0 ms^{-1} C 4.0 ms^{-1} D 4.5 ms^{-1}

May/June 2014 (13)

- 7 An experiment is performed to measure the acceleration of free fall g . A body falls between two fixed points. The four measurements shown below are taken.

Which measurement is **not** required for the calculation of g ?

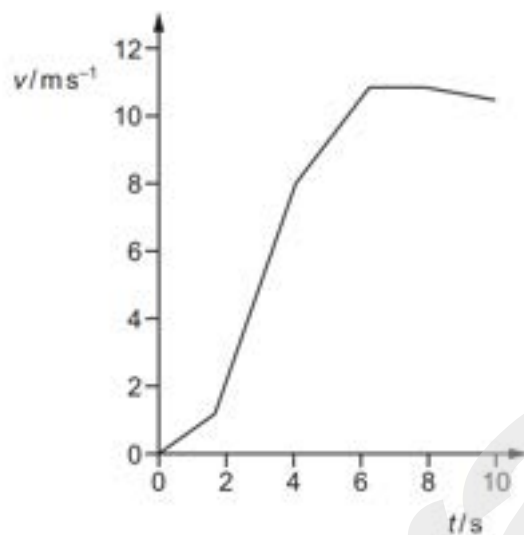
- A the distance fallen by the body
 B the initial velocity of the body
 C the mass of the body
 D the time taken for the body to fall

- 8 In a cathode-ray tube, an electron is accelerated uniformly in a straight line from a speed of $4 \times 10^3 \text{ ms}^{-1}$ to $2 \times 10^7 \text{ ms}^{-1}$ over a distance of 10 mm.

What is the acceleration of the electron?

- A $2 \times 10^3 \text{ ms}^{-2}$
 B $2 \times 10^6 \text{ ms}^{-2}$
 C $2 \times 10^{13} \text{ ms}^{-2}$
 D $2 \times 10^{16} \text{ ms}^{-2}$

- 9 The graph shows how the speed v of a sprinter changes with time t during a 100 m race.

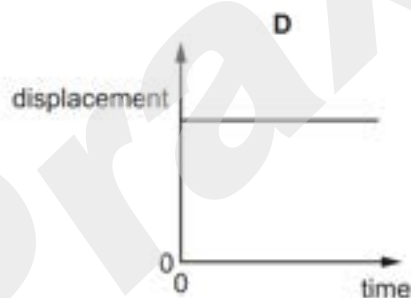
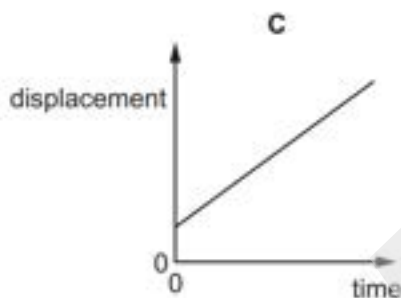
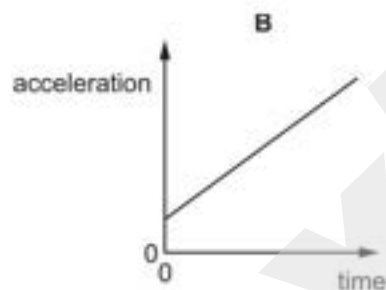
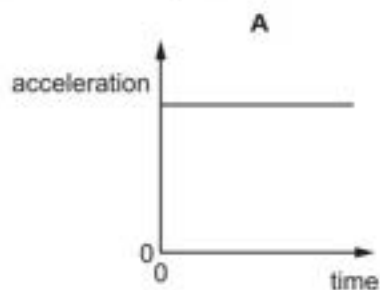


What is the best estimate of the maximum acceleration of the sprinter?

- A 0.5ms^{-2} B 1ms^{-2} C 3ms^{-2} D 10ms^{-2}

October/November 2014 (11) & October/November 2014 (12)

- 6 Which graph represents the motion of a car that is travelling along a straight road with a speed that increases uniformly with time?



October/November 2014 (13)

- 6 In an experiment to determine the acceleration of free fall g , a ball-bearing is held by an electromagnet. When the current to the electromagnet is switched off, a clock starts and the ball-bearing falls. After falling a distance h , the ball-bearing strikes a switch to stop the clock which measures the time t of the fall.

Which expression can be used to calculate the value of g ?

A $\frac{ht^2}{2}$

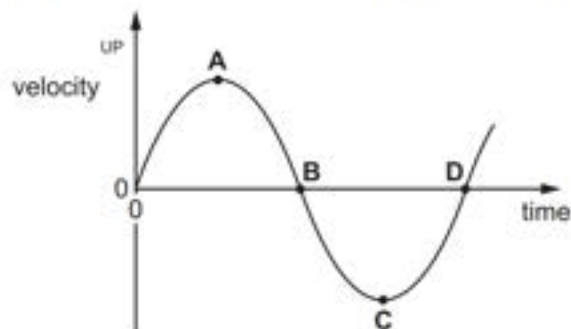
B $\frac{th^2}{2}$

C $\sqrt{\frac{2t}{h^2}}$

D $\frac{2h}{t^2}$

- 7 The diagram shows a velocity-time graph for a mass moving up and down on the end of a spring.

Which point represents the velocity of the mass when at the lowest point of its motion?

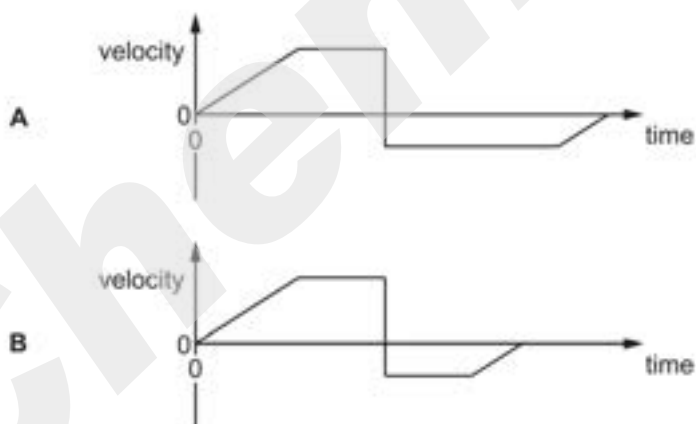


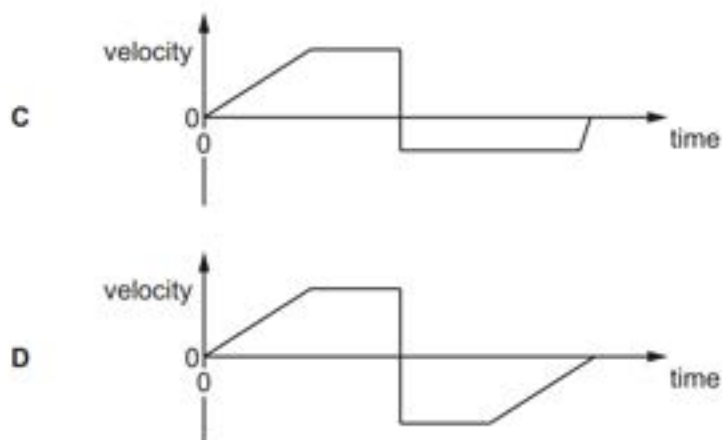
- 8 A ball is released from rest on a smooth slope XY.

It moves down the slope, along a smooth horizontal surface YZ and rebounds inelastically at Z. Then it moves back to Y and comes to rest momentarily somewhere on XY.



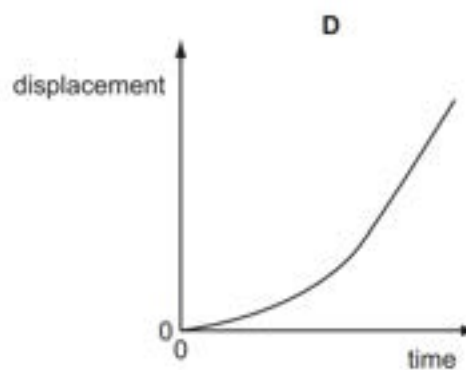
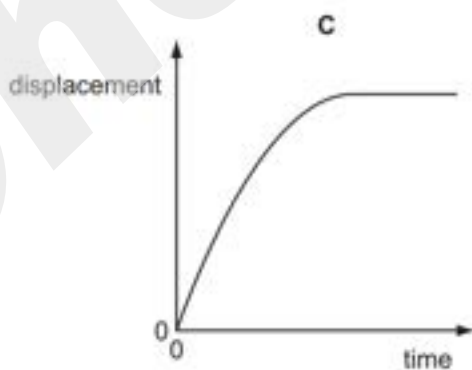
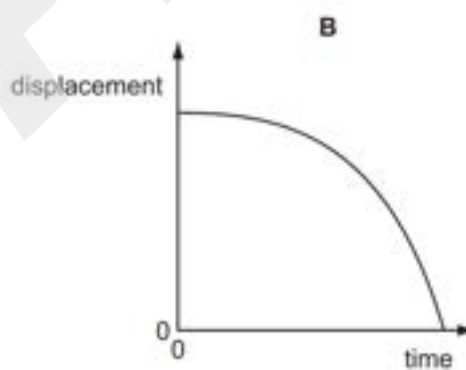
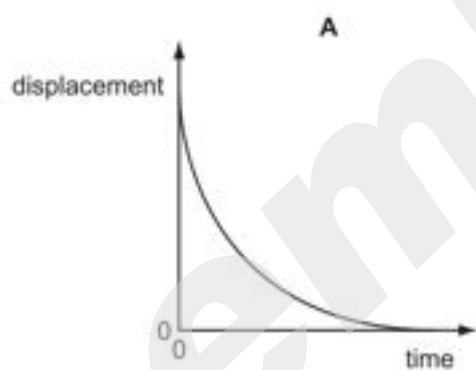
Which velocity-time graph represents the motion of the ball?





May/June 2015 (11)

- 7 A sphere is released and falls. Its initial acceleration reduces until it eventually begins to travel at constant terminal velocity. Which displacement-time graph best represents the motion of the sphere?



- 8 An insect jumps with an initial vertical velocity of 1.0ms^{-1} , reaching a maximum height of $3.5 \times 10^{-2}\text{m}$. Assume the deceleration is uniform.

What is the magnitude of the deceleration?

- A 3.6ms^{-2} B 9.8ms^{-2} C 14ms^{-2} D 29ms^{-2}

- 9 A body having uniform acceleration a increases its velocity from u to v in time t .

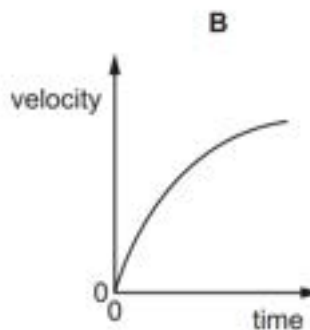
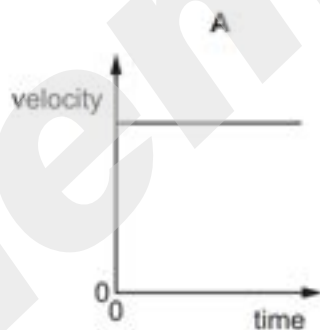
Which expression would **not** give a correct value for the body's displacement during time t ?

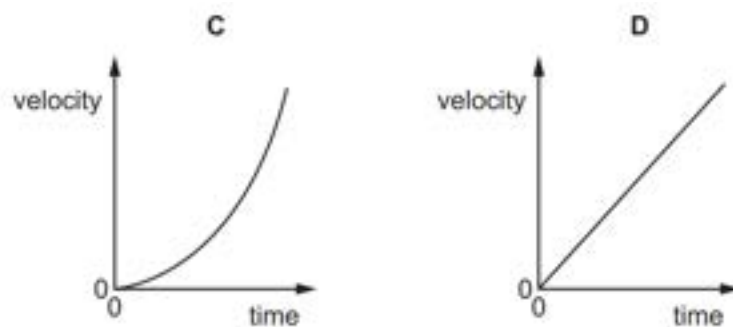
- A $ut + \frac{1}{2}at^2$
B $vt - \frac{1}{2}at^2$
C $\frac{(v+u)(v-u)}{2a}$
D $\frac{(v-u)t}{2}$

May/June 2015 (12)

- 8 A stone is thrown horizontally from the top of a cliff. Air resistance is negligible.

Which graph shows the variation with time of the vertical component of the stone's velocity?





- 9 A sprinter runs a 100m race in a straight line. He accelerates from the starting block at a constant acceleration of 2.5 m s^{-2} to reach his maximum speed of 10 m s^{-1} . He maintains this speed until he crosses the finish line.

Which time does it take the sprinter to run the race?

- A 4s B 10s C 12s D 20s

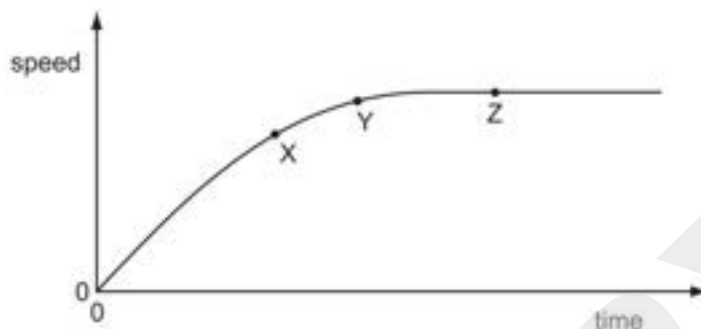
- 10 A firework rocket is fired vertically upwards. The fuel burns and produces a constant upwards force on the rocket. After 5 seconds there is no fuel left. Air resistance is negligible.

What is the acceleration before and after 5 seconds?

	before 5 seconds	after 5 seconds
A	constant	constant
B	constant	zero
C	increasing	constant
D	increasing	zero

May/June 2015 (13)

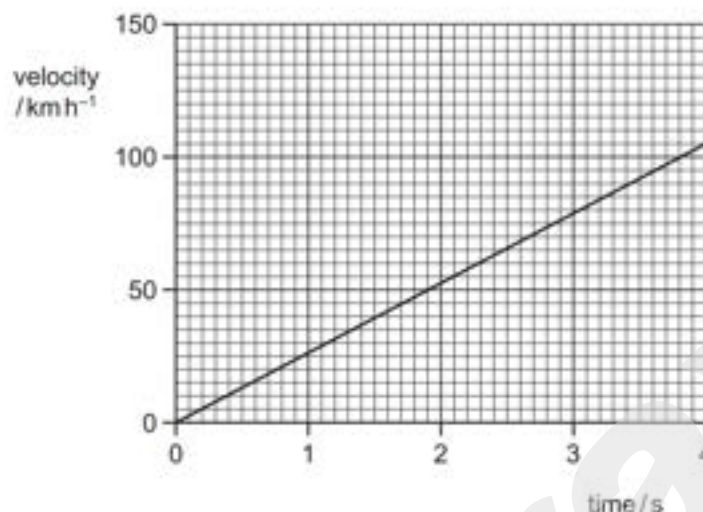
- 7 A raindrop falls vertically from rest in air. The variation with time of the speed of the raindrop is shown in the graph.



Which statement about the raindrop is correct?

- A At point X, the raindrop has an acceleration of 9.81 m s^{-2} .
- B At point Z, the force on the raindrop due to air resistance has reached its maximum value and so the acceleration of the raindrop has also reached its maximum value.
- C At point Z, the force due to air resistance is equal and opposite to the weight of the raindrop and so the speed of the raindrop is zero.
- D The resultant force on the raindrop at point Y is less than the resultant force on the raindrop at point X.

- 8 The velocity of an electric car changes as shown.



What is the acceleration of the car?

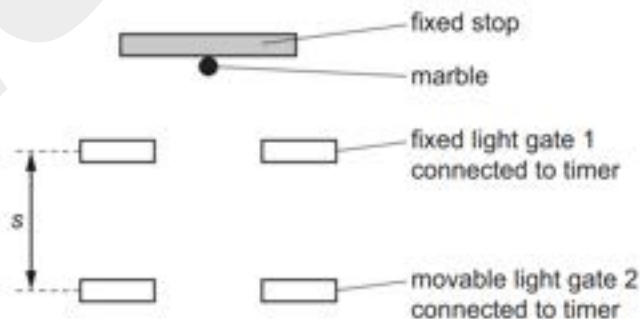
- A 210 ms^{-2} B 58 ms^{-2} C 26 ms^{-2} D 7.3 ms^{-2}

October/November 2015 (11)

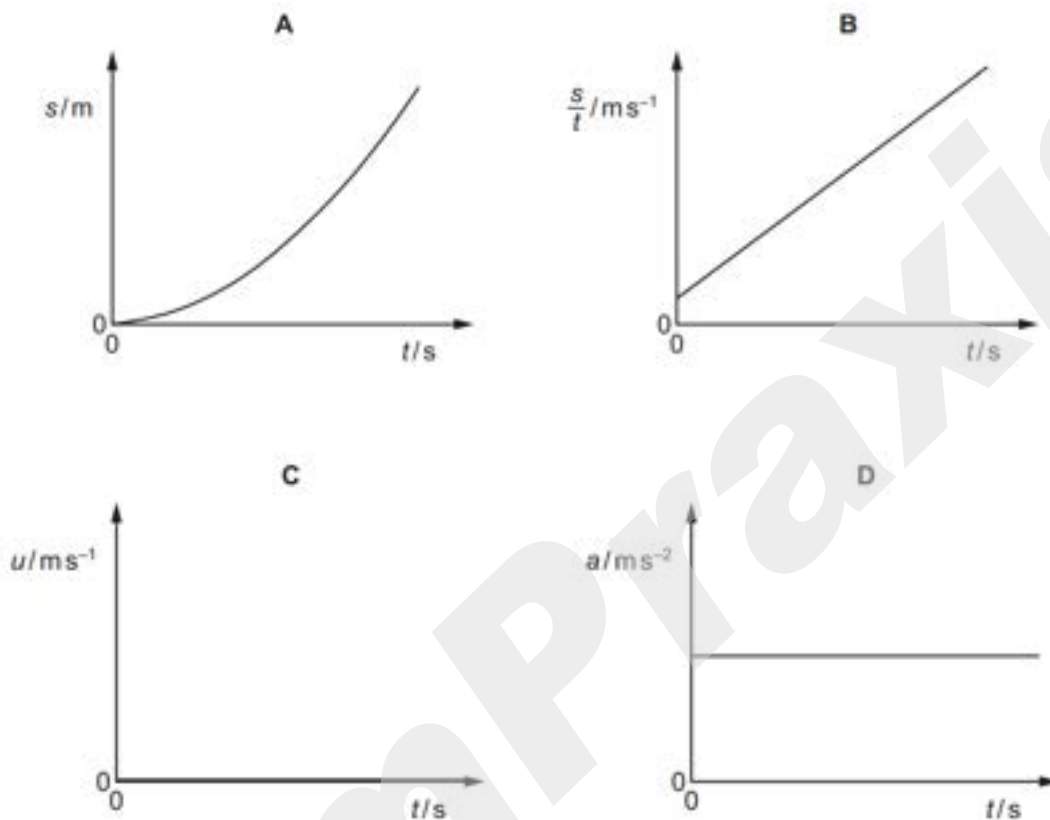
- 7 One of the equations of uniformly accelerated motion is shown.

$$s = ut + \frac{1}{2}at^2$$

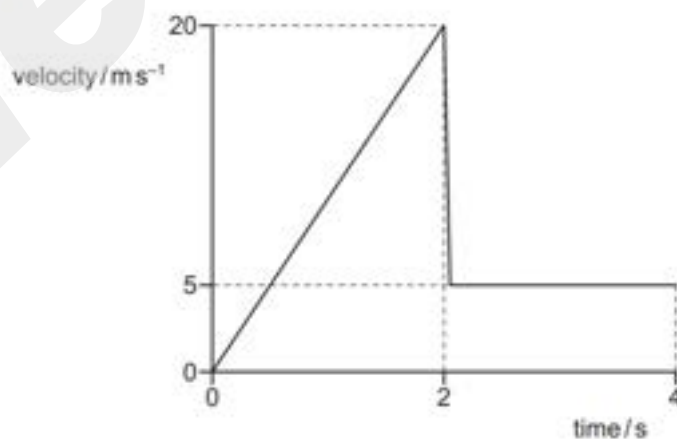
Apparatus is arranged to record the time t taken for a marble to fall between two light gates connected to timers. The marble touches the stop before it is released. The vertical distance s between the light gates is measured.



Which graph does **not** show a correct relationship when light gate 2 moves up to light gate 1 which is fixed?



- 8 A stone is dropped from a height of 20 m above water. The graph shows the variation with time of the velocity of the stone.



Which statement describes the approximate position of the stone four seconds after it is dropped?

- A It is at a distance of 10 m above the surface of the water.
- B It is at a distance of 10 m below the surface of the water.
- C It is at a distance of 20 m below the surface of the water.
- D It is at a distance of 30 m below the surface of the water.

- 9 The water surface in a deep well is 78.0 m below the top of the well. A person at the top of the well drops a heavy stone down the well.

Air resistance is negligible. The speed of sound in the air is 330 m s^{-1} .

What is the time interval between the person dropping the stone and hearing it hitting the water?

- A 3.75 s B 3.99 s C 4.19 s D 4.22 s

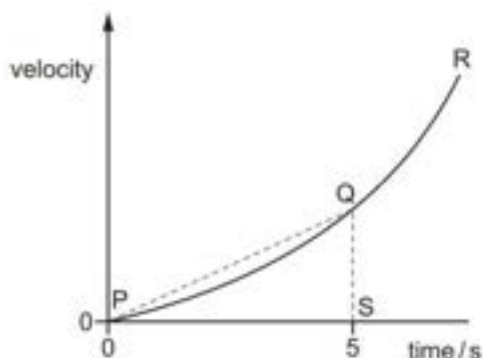
October/November 2015 (12)

- 7 A boy throws a ball vertically upwards. It rises to a maximum height, where it is momentarily at rest, and then falls back to his hands.

Which row gives the acceleration of the ball at various stages in its motion? (Take vertically upwards as positive. Ignore air resistance.)

	rising	at maximum height	falling
A	-9.81 m s^{-2}	0	$+9.81 \text{ m s}^{-2}$
B	-9.81 m s^{-2}	-9.81 m s^{-2}	-9.81 m s^{-2}
C	$+9.81 \text{ m s}^{-2}$	$+9.81 \text{ m s}^{-2}$	$+9.81 \text{ m s}^{-2}$
D	$+9.81 \text{ m s}^{-2}$	0	-9.81 m s^{-2}

- 8 The curved line PQR is the velocity-time graph for a car starting from rest.



What is the average acceleration of the car over the first 5 s?

- A the area below the curve PQ
 - B the area of the triangle PQS
 - C the gradient of the straight line PQ
 - D the gradient of the tangent at Q
- 9 A ball is released from rest above a horizontal surface. It strikes the surface and bounces several times.

The velocity-time graph for the first two bounces is shown.

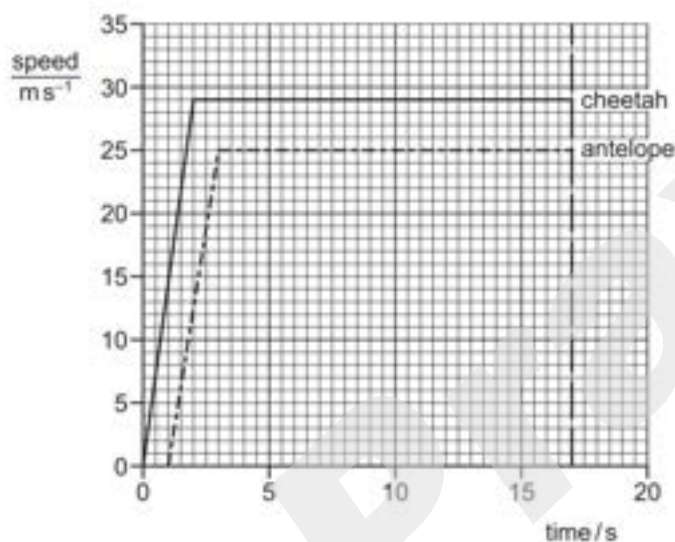


What is the maximum height of the ball after the first bounce?

- A 0.20 m
- B 0.25 m
- C 0.45 m
- D 0.65 m

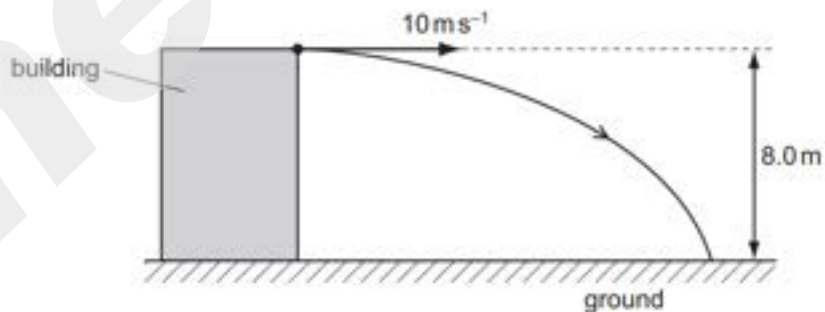
October/November 2015 (13)

- 8 A cheetah and an antelope are 100 m apart. The cheetah spots the antelope and runs towards it. The antelope reacts to the cheetah after one second and runs directly away from the cheetah. Both animals take 2 seconds to reach their top speeds. The graph shows how the speeds of the two animals vary with time.



How far apart are the animals, 17 seconds after the cheetah began running?

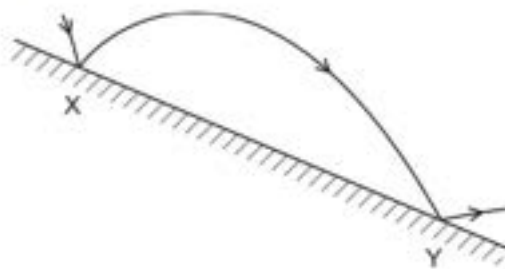
- A 4 m B 11 m C 54 m D 89 m
- 9 A boy throws a stone with a horizontal velocity of 10 ms^{-1} from the top of a building. The height of the building is 8.0 m. The stone travels along a curved path until it hits the ground, as shown in the diagram.



How long does it take the stone to reach the ground? (Air resistance can be neglected.)

- A 0.61 s B 0.80 s C 1.3 s D 1.6 s

- 10 A football is released above a plane, sloping surface and bounces several times. The diagram shows its path between its bounces at X and at Y. Assume that there is no air resistance.



Which graph correctly shows the variation with time t of the horizontal component of its velocity v_h between X and Y?

